METHODS OF DELIVERY

Blended Training Mode consisting of

- Theory and Practical Face to Face class at Suite 57/330 Wattle Street , Ultimo NSW2007
- Online Learning Support Portal www.iqytechnicalcollege.com/el.htm
- Real time live lesson at www.iqytechnicalcollege.com/GoogleMeetingLink.htm
- RPL Assessment
  Student's Study Evidence
- E Profiling to record the students

are to be applied in all courses delivered by IQY Technical College

UEECD0003 Apply industry and community standards to engineering activities

ELEMENTS PERFORMANCE CRITERIA

Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Review ethical and community standards**	**1.1**	Ethical standards are reviewed and applied in accordance with relevant industry standards	Q & A related to Lesson Powerpoint slides
		1.2	Advice on the application processes for applying ethical community and relevant industry standards is obtained from relevant person/s	Assignment Task
		1.3	Contributions to periodic revision of relevant industry standards is conducted through formal discussions with relevant person/s and submissions documented for public review in accordance with relevant community standards	To perform online research on periodic revision of relevant industry standards as provided examples.
2	**Apply ethical and community standards**	**2.1**	Ethical standards are applied to all formal interactions and activities	Q & A and discussion on • Engineers Australia Code of Ethics 2020.pdf • Practice Standard for Professional Engineers _ NSW Fair Trading.pdf
		2.2	Work is planned and managed in accordance with relevant community and industry standards	Assignment Task
		2.3	Quality of work is monitored in accordance with relevant community and industry standards	Assignment Task
		2.4	Advice on engineering issues and adoption of technologies is sought from relevant person/s in accordance with relevant industry standards	Assignment Task

Lesson

Read Engineering Ethics-Community Standards.pdf Slides

Reference Books

- Engineering Ethics_Fleddermann.pdf
- Exposure draft_ National competency standard for engineering 2025.p
- Naagarazan-Professional ethics and humanvalues.pdf
- Practice Standard for Professional Engineers _ NSW Fair Trading.pdf
- Engineers Australia Code of Ethics 2020.pdf
- Industry codes _ eSafety Commissioner.pdf (periodic revision of relevant industry standards example)
- Development-of-Phase-2-Industry-Codes-under-the-Online-Safety-Act-eSafety-position-paper_0.pdf ((periodic revision of relevant industry standards example)

ASSIGNMENT

Read the following story

Original Source

https://safework.sa.gov.au/news-and-alerts/news/news/2024/apprentice-death-leads-to-record-work-safety-fine

19 November 2024

A Riverland manufacturing business has been fined a record $840,000 following the death of an apprentice in 2021.

SafeWork SA prosecuted JMA Engineering Pty Ltd after an investigation found the company was reckless in its failure to protect its workers from the risk of death or serious injury as prescribed under the Work Health and Safety Act 2012.

The incident took place in February 2021 when the cable on a gantry crane failed, causing a stainless steel tank weighing more than three tonnes to fall on a worker, crushing him to death.

JMA Engineering was sentenced in the South Australian Employment Court on 15 November 2024.

A SafeWork SA investigation found the gantry crane, and others operated by the company, had not been subjected to regular maintenance.

Where maintenance had occurred, it did not comply with the relevant codes of practice. An offer by another company to include the crane in a servicing run scheduled for the Riverland two months before the incident was not taken up by JMA Engineering.

JMA Engineering conducts a fabrication business from its Berri premises where it manufactures stainless steel tanks including for use in wineries.

Part of the tank construction process requires the tanks to be suspended from an overhead crane while the welding was undertaken inside and outside of the tank frame. The tanks are large structures weighing several tonnes.

A ramp was set up to provide workers access to a basement under the floor of the shed to allow access to the tanks via a trapdoor to avoid exposure directly under a suspended tank.

However, the SafeWork SA investigation found that it was common practice for workers to take a shorter route by going under the suspended tank to gain access, placing them directly beneath and in the path of the tank should it fall.

In sentencing, the Court accepted that this practice had become so common that the tribunal found it had become the system of work at JMA Engineering.

On 23 February 2021, an apprentice boilermaker was under a suspended tank when the crane's cable failed and the tank fell on him.
Damage to the crane's cable had been identified and repaired twice in the four weeks before the incident.

The company was charged with a Category 1 offence against section 19 of the Work Health and Safety Act 2012. The production manager David Pahl was also charged with a Category 2 offence against section 32 of the Act.

Both pleaded guilty and convictions were recorded.

The company was fined $840,000, which is a record amount for an offence under the South Australian WHS legislation. The Court also imposed mandatory training on all the company's directors, managers and staff responsible for safety.

Through its guilty plea, JMA Engineering admitted that it was reckless as to the risk of death or serious injury.
The company was aware:
* Of the risk of workers moving under the suspended tanks and condoned a system of work which permitted if not encouraged such a practice.
* Of issues with the cable to the crane. It was aware, at least after the second cable repair, that questions of the safety of the use of the crane remained.
* It was not routinely maintaining or servicing their cranes.

Pahl was fined $12,000. It was found that Pahl:

* Was in a significant level of authority, leading and managing a production team of approximately 25 workers.
* Took no action to address the unsafe system of moving under suspended loads notwithstanding his knowledge of the practice.
* Made no adequate response to the identified repeated problem of the fraying cable.
* Gave the direction for the repairs the second time the cable frayed, without reference to the maintenance manager or initiating enquiries as to the cause.

In his sentencing remarks, Deputy President Judge Crawley said there were “a number of troubling aspects to the facts of this case”.
Judge Crawley said unlike a number other WHS cases he had presided over, the practices giving rise to the fatality were an integral part of the JMA Engineering business.

‘The defendants had prior warning of the potential for the tragedy which unfolded to occur,’ Judge Crawley said.

‘The unsafe practice of avoiding the use of the ramp and trapdoor to access the interior of the tanks was well known and had become the system of work.

‘The problems with the cable to the crane had been identified and not resolved.’

Quotes attributable to SafeWork SA Executive Director Glenn Farrell

This is a significant outcome and the first of its type under South Australian WHS legislation where a defendant has been sentenced for a Category 1 offence where the risk of death manifested from reckless conduct.

This is identified in the judgement by the imposition of a record fine that should send a strong message that reckless behaviour that exposes workers to the risk of death will be punished accordingly.

This was a case where the business activities were so well known and the culture of the workplace had become complacent to the risk of harm, that a life was unnecessarily lost. A lost life that could very easily have been avoided had the safety of workers been a priority to the business.

I urge all those who have a responsibility toward ensuring the safety of workers to stop and reflect on what they must and could do better to prevent the tragic consequences of poor safety practices.

It should not take a serious incident or death to trigger improvements being made to protect workers from harm.

Your task

Discuss how Industry and Community Standards to be applied to avoid the similar incidence in the project work managed by you and how they will be justified, whom to be consulted with.

Grading Rubric for Written Assignments

Levels of Assessment

Criteria	Inadequate=D (Below Standard)	Adequate=C (Meets Standard)	Above Average=B (Exceeds Standard)	Exemplary=A (Far Exceeds Standard)
Organization	Writing lacks logical organization. It shows some coherence but ideas lack unity. Serious errors.	Writing is coherent and logically organized. Some points remain misplaced and stray from the topic. Transitions evident	Writing is coherent and logically organized with transitions used between ideas and paragraphs to create coherence. Overall	Writing shows high degree of attention to logic and reasoning of points. Unity clearly leads the reader to the conclusion and stirs thought regarding the topic.

		but not used throughout essay.	unity of ideas is present.	
Level of Content	Shows some thinking and reasoning but most ideas are underdeveloped and unoriginal.	Content indicates thinking and reasoning applied with original thought on a few ideas.	Content indicates original thinking and develops ideas with sufficient and firm evidence.	Content indicates synthesis of ideas, in- depth analysis and evidences original thought and support for the topic.
Development	Main points lack detailed development. Ideas are vague with little evidence of critical thinking.	Main points are present with limited detail and development. Some critical thinking is present.	Main points well developed with quality supporting details and quantity. Critical thinking is weaved into points	Main points well developed with high quality and quantity support. Reveals high degree of critical thinking.
Grammar & Mechanics	Spelling, punctuation, and grammatical errors create distraction, making reading difficult; fragments, comma splices, run-ons evident. Errors are frequent.	Most spelling, punctuation, and grammar correct allowing reader to progress though essay. Some errors remain.	Essay has few spelling, punctuation, and grammatical errors allowing reader to follow ideas clearly. Very few fragments or run-ons.	Essay is free of distracting spelling, punctuation, and grammatical errors; absent of fragments, comma splices, and run-ons.
Style	Mostly in elementary form with little or no variety in sentence structure, diction, rhetorical devices or emphasis.	Approaches college level usage of some variety in sentence patterns, diction, and rhetorical devices.	Attains college level style; tone is appropriate and rhetorical devices used to enhance content; sentence variety used effectively.	Shows outstanding style going beyond usual college level; rhetorical devices and tone used effectively; creative use of sentence structure and coordination
Format	Fails to follow format and assignment requirements; incorrect margins, spacing and indentation; neatness of essay needs attention.	Meets format and assignment requirements; generally correct margins, spacing, and indentations; essay is neat but may have some assembly errors.	Meets format and assignment requirements; margins, spacing, and indentations are correct; essay is neat and correctly assembled.	Meets all formal and assignment requirements and evidences attention to detail; all margins, spacing and indentations are correct; essay is neat and correctly assembled with professional look.

The candidate must achieve Minimum of “C” Grade to achieve Competent in this unit.

UEECD0004 Apply material science to solving electrotechnology engineering problem

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Identify electrotechnology problem/s**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	OHS Process and procedures for Electrolysis Practical & Materials Thermal expansion practical UEEEL0008- TSP01.2.pdf UEE-CD0046 TSP 5.2 .pdf
		1.2	WHS/OHS risk control work preparation measures and workplace procedures are followed	OHS Risk Control for Electrolysis Practical & Materials Thermal expansion practical UEEEL0008- TSP01.2.pdf UEE-CD0046 TSP 5.2 .pdf
		1.3	Scope of electrotechnology problem and material for the environment are obtained and applied from documentation and/or work supervisor	CLASS LESSON Engineering Materials Class Lesson.pdf READERS Properties of materials/metals/polymers/thermoplastics/ceramics/chemical

Elements		Performance criteria		
				bonding/ionic bond/metallic bond/covalent bond/ production/ strength/electrical properties/ thermal properties/ durability/ corrosion resistance force extension diagram/carbon steel/brinell hardness test/fatgue testing/safety factor/ casting/carbon state change diagram,nickel copper equilibrium diagram /smelting/steel manufacturing electric arc furnacing/heat treatment/alloying/induction hardening/polyethylene/ polyvinyl chloride/hardness test/ceramic/glass/mortar/matrix materials/welding/service requirement Problem Calculation Engineering Materials Problem Calculations Video Lessons.pdf
		1.4	Tools, equipment and testing devices required for work are obtained and checked for correct operation and safety	Set up tools and materials for Electrolysis Practical & Materials Thermal expansion practical UEEEL0008- TSP01.2.pdf UEE-CD0046 TSP 5.2 .pdf

Elements		Performance criteria		
2	**Apply material science to developing solutions**	**2.1**	WHS/OHS risk control work measures and workplace procedures are followed	OHS Risk Assessment for Electrolysis Practical & Materials Thermal expansion practical UEEEL0008- TSP01.2.pdf UEE-CD0046 TSP 5.2 .pdf
		2.2	Tests and measurements are undertaken in accordance with WHS/OHS requirements and workplace procedures	OHS Risk Assessment for Electrolysis Practical & Materials Thermal expansion practical UEEEL0008- TSP01.2.pdf UEE-CD0046 TSP 5.2 .pdf
		2.3	Tests, measurements and results are used to identify material science solutions to electrotechnology problems	1/Electrolysis Practical for Chemical Properties 2/Thermal Relay Practical for materials expansion properties
		2.4	Effects on environments, materials and health risks are considered in resolving electrotechnology problems	Saley disposal of chemicals used in Electrolysis Practical UEE-CD0046 TSP 5.2 .pdf

Elements		Performance criteria		
		2.5	Unplanned situations are dealt with in accordance with WHS/OHS and approval of relevant person/s	Prepare the plan to clean up the electrolyte in the case of chemical spill.
3	**Report solution/s**	**3.1**	Proposed solutions to electrotechnology problems are documented with justification for the solutions	Prepare the report for Electrolysis Practical & Materials Thermal expansion practical UEEEL0008- TSP01.2.pdf UEE-CD0046 TSP 5.2 .pdf
		3.2	Identified health risks exposed by a material and/or application is documented in workplace report	Chemical hazards identification and protection for chemicals used in Electrolysis Practical UEE-CD0046 TSP 5.2 .pdf
		3.3	Proposed solution report is forwarded to relevant person/s in accordance with workplace procedures	Submit the report for Electrolysis Practical & Materials Thermal expansion practical UEEEL0008- TSP01.2.pdf UEE-CD0046 TSP 5.2 .pdf And submit it to assessor Feedback Session

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:	
• applying material science to developing solutions to electrotechnology problems • applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • considering environment and health risks in resolving electrotechnology problems • dealing with unplanned situations in accordance with WHS/OHS and approval from relevant person/s • documenting proposed solutions and justification • obtaining the scope of electrotechnology problem and materials to be used • obtaining tools, equipment and testing devices • interpreting results to identify material science solutions to electrotechnology problems • using testing devices • using test and measurement results to identify material science solutions.	Practical Tasks Chemical hazards identification and protection for chemicals used in Electrolysis Practical UEE-CD0046 TSP 5.2 .pdf Problem Solving Tasks Engineering Materials Problem Calculations Video Lessons.pdf Exercise Assignments UEECD0004 Engineering Materials Exercises Assignment

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

• problem-solving techniques • relevant classification, nature and physical properties of materials used in electrotechnology • relevant environment and health issues • relevant job safety assessments or risk mitigation processes • relevant manufacturer specifications and operating instructions • relevant material processing and manufacturing • relevant material science • relevant tests and measurement • relevant tools, equipment and testing devices • relevant WHS/OHS legislated requirements • relevant workplace documentation, including ○ solution report	CLASS LESSON Engineering Materials Class Lesson.pdf READERS Properties of materials/metals/polymers/thermoplastics /ceramics/chemical bonding/ionic bond/metallic bond/covalent bond/ production/ strength/electrical properties/ thermal properties/ durability/ corrosion resistance force extension diagram/carbon steel/brinell hardness test/fatgue testing/safety factor/ casting/carbon state change diagram,nickel copper equilibrium diagram /smelting/steel manufacturing electric arc furnacing/heat treatment/alloying/induction hardening/polyethylene/ polyvinyl chloride/hardness test/ceramic/glass/mortar/matrix materials/welding/service requirement Problem Calculation

• relevant workplace instruction, policies and procedures.	Engineering Materials Problem Calculations Video Lessons.pdf ASSESSMENT UEECD0004 Engineering Materials Exercises Assignment

Textbooks

- Materials-for-engineers-and-technicians

Practical Instruction and Worksheet

- UEEEL0008- TSP01.2.pdf
- UEE-CD0046 TSP 5.2 .pdf
- Engineering Materials Online Simulated Practical

Class Lesson Notes

- Engineering Materials
- Engineering Materials Class Lesson

Class Lesson Video Links

- Engineering Materials Problem Calculations Video Lessons

Exercises

- UEECD0004 Engineering Materials Exercises Assignment

UEECD0024 Implement and monitor energy sector WHS

policies and procedures

MAPPING STRATEGY

This unit is relevant to UEECD0016 unit of UEE30820. By comparing the Competencies in both units, the resources for UEECD0016 of Energy Spacecan be used and any Gap can be identified and provided the training and assessment

Those highlighted with Yellow are the same performance criteria common to UEECD0016

Those are not highlighted will need GAP TRAINING.

UEECD0016	
ELEMENTS	**PERFORMANCE CRITERIA**
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1.1	Hazards are identified and documented by undertaking a job analysis and worksite inspection in consultation with relevant person/s and in accordance with workplace procedures
1.2	Risks associated with identified hazards are assessed in consultation with relevant person/s, taking into account existing control measures and documented in accordance with workplace procedures
2.1	Level of risk is assessed and prioritised for each identified hazard in consultation with relevant/s persons and in accordance with regulations and WHS/OHS workplace compliance procedures
2.2	Control measures for identified hazards are determined by applying the hierarchy of control and activities to eliminate and/or mitigate the risk
2.3	Level of risk is re-assessed to confirm the required control measures reduce the risk level to as low as reasonably practicable
2.4	Hazards risk level and control measures are agreed to in consultation with relevant stakeholders and documented in accordance with workplace procedures
3.1	Documented control measures are recorded in workplace risk register and made available for reference by relevant person/s

3.2	Control measures are reviewed and modified, as required, in consultation with relevant person/s in accordance with workplace procedures
3.3	Document and apply measures to control WHS/OHS risks associated with electrotechnology work
3.4	Changes and updates are made to relevant documentation, risk register as additional hazards are identified
3.5	Documentation of hazards, risks control measures and their application are filed in accordance with workplace procedures

UEECD0024

Elements and Performance Criteria

ELEMENTS		**PERFORMANCE CRITERIA**		**UEECD0016**
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Provide WHS/OHS information to the work group**	**1.1**	Relevant WHS/OHS legislation and codes of practice are explained to work group	2.1+3.1
		1.2	Relevant WHS/OHS workplace policies, procedures and programs are available in a readily accessible manner and explained to work group	2.1+3.1
		1.3	Identified hazards, risk assessments and risk control measures are identified, supplied and explained to the work group	1.1

2	**Implement and monitor participative arrangements for management of WHS/OHS**	**2.1**	Workplace procedures for consultation of WHS/OHS issues are implemented, monitored and communicated to work group	1.2
		2.2	Issues raised through consultation are dealt with and resolved promptly or referred to relevant person/s for resolution in accordance with workplace procedures	3.2
		2.3	Outcomes of WHS/OHS consultation issues are communicated to the work group	2.4
3	**Implement and monitor procedures for identifying hazards, assessing risk and controlling risks**	**3.1**	Hazards are identified, risks are assessed and control measures are implemented	2.3
		3.2	Risks control measures are implemented and adherence by work group is monitored in accordance with workplace procedures	2.2
		3.3	Inadequacies in existing risk control measures are identified in accordance with hierarchy of risk control and reported to relevant person/s	
		3.4	Inadequacies in resource allocation for implementation of risk control measures are identified and reported to relevant person/s	
4	**Implement procedures for dealing with hazardous events**	**4.1**	Workplace procedures for responding to hazardous events are implemented to ensure prompt control action is taken	2.1+_3.1

		4.2	Hazardous events are investigated to identify their cause in accordance with workplace procedures	1.1+1.2
		4.3	Control measures to minimise risks of hazardous events based on the hierarchy of risk control are implemented or referred to relevant person/s	3.2
5	**Implement and monitor procedures for WHS/OHS training**	**5.1**	WHS/OHS training needs analysis of work group is performed to identify competency gaps	
		5.2	Identified WHS/OHS training gaps are fulfilled by training programs in consultation with relevant person/s	
6	**Implement and monitor procedures for maintaining WHS/OHS records**	**6.1**	WHS/OHS records for work area are completed in accordance with workplace procedures and relevant legislative requirements	3.5
		6.2	Aggregate information from work area WHS/OHS records are used to identify hazards and monitor risk control procedures in accordance with workplace procedures	3.3

IDENTIFIED GAP in UEECD0024

3	**Implement and monitor procedures for identifying hazards, assessing risk and controlling risks**	**3.3**	Inadequacies in existing risk control measures are identified in accordance with hierarchy of risk control and reported to relevant person/s	
		3.4	Inadequacies in resource allocation for implementation of risk control measures are identified and reported to relevant person/s	
5	**Implement and monitor procedures for WHS/OHS training**	**5.1**	WHS/OHS training needs analysis of work group is performed to identify competency gaps	
		5.2	Identified WHS/OHS training gaps are fulfilled by training programs in consultation with relevant person/s	

Delivery and Assessment Strategy

- Scenario related to incidence due to insufficient current WHS policies and procedures is developed and find out the way to improve it.
- Scenario related to incidence due to insufficient current WHS Training and Competencies of the employee is identified and provided with WHS Training

Performance Evidence Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:	Element 1 to 5

• applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements in the energy sector, including: • communicating WHS/OHS issues with relevant person/s, and providing and explaining WHS/OHS information to a work group • implementing and monitoring participative arrangements for management of WHS/OHS • implementing and monitoring procedures for identifying hazards, and assessing and controlling risks • implementing and monitoring workplace procedures for WHS/OHS and maintaining records, including existing hazard register • implementing risk control measures using hierarchy of risk control • investigating hazardous events to identify causes • dealing with unplanned events/situations in accordance with workplace procedures in a manner that minimises risk to personnel and equipment • implementing procedures for dealing with hazardous events • performing training needs analysis and identifying training gaps • resolving WHS/OHS issues raised.	
Knowledge Evidence Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of: • provisions of relevant WHS/OHS legislation • principles and practice of effective WHS/OHS management • workplace hazards, range and selection of control measures • organisational WHS/OHS management systems and policies and procedures needed for legislative compliance • impact of characteristics and composition of the workforce on WHS/OHS management • relevance of WHS/OHS management to other organisational management policies, procedures and systems	Identified gap in Element 1 to 5 Literature, and Assessment Tasks related to identified gap 3.3,3.4,5.1,5.2

• analysis of entire work environment and judge WHS/OHS interventions • analysis of relevant workplace data • ability to assess resources needed for risk control • communication techniques • relevant WHS/OHS legislation, including: • resources needed for risk control • hierarchy of risk control measures • relevant safe work method statements (SWMS)/job safety assessments or risk mitigation processes • workplace hazards, range and selection of risk control measures • relevant workplace documentation • relevant workplace policies and procedures • training needs analysis.	

Instruction to students

Read the provided literatures

Reader 1

Identify_and_report_inadequacies_in_exis.pdf

(Reference Source- Identify and report inadequacies in existing risk controls according to hierarchy of control and WHS legislative requirements and monitor outcomes of reports on inadequacies, where appropriate, to ensure prompt organisational response (Originally published in Academia)

By Sarah Keating

Reader 2

Record_of_action_taken-WHS-concern.pdf

Reader 3

Review and revise risk controls _ SafeWork NSW.pdf

Reader 4

5 Best Risk Assessment Control Measures With Examples - HASpod.pdf

Reader 5

3 Questions Every Health & Safety Manager Should Ask To Control Risks.pdf

Assessment tasks.

Watch the following video and story

https://www.abc.net.au/news/2024-02-13/callide-power-station-explosion-report-released/103459626

An explosion at a central Queensland power station that left nearly half a million people without power could not have been anticipated, according to a report into the incident.

State-owned operator CS Energy released findings into the Callide Power Station's C4 unit today, which found the incident had been caused by failing electrical equipment and system back-ups.

"Some of the contributing factors can be traced back to the original design of the power station which, while tested and compliant with connection standards, we now realise could have been more robust," chief executive Darren Busine said.

"This was an extraordinary chain of events that we could never have anticipated."

Mr Busine said the event was not caused by a lack of maintenance.

Unstoppable sequence'

There are two types of power used at power stations, including alternating current (AC), which is what the station produces and sends to the market, and a direct current (DC) system, which is used for protection systems such as emergency back-up power.

The report found that on May 25, 2021, a new DC system with a battery charger had been commissioned and was being connected to the C4 unit.

"Voltage unexpectedly dropped to zero, causing a trip in the AC system," Mr Busine said.

"The loss of the AC system then prevented the recovery of the DC system."

This meant the power station unit could not disconnect from the grid or shut down safely.

"Ultimately the turbine generator went from generating electricity to consuming electricity," Mr Busine said.

"It became an unstoppable sequence of events which led to the emergency evacuation of the site ahead of the destruction of the generator."

The turbine generator spun, and this, alongside the loss of other critical systems like lubrication oil pumps, caused the explosion.

Mr Busine thanked staff for their handling of the incident.

No-one was injured.

"All this happened within seconds — what's important to understand also is that the control room went black," Mr Busine said.

"The ability for our staff in the control room to understand what was happening was not possible at the time."

'Cannot happen again'

CS Energy said it had already implemented several design changes to prevent similar incidents from happening.

It will install an extra switchboard, battery and battery charger before the C4 unit returns to service.

The unit is expected to be online by the end of July.

"The improvements that we've now made into the system will mean that this incident cannot happen again," Mr Busine said.

CS Energy said it had made changes at other plants, including Kogan Creek and Callide B and C.

It has also hired more operators, a safety team and an engineering team to focus on standards and quality assurance.

Critics had been sceptical of the time it was taking CS Energy to release its report, but chair Adam Aspinall said information was shared with the public as soon as it was possible to do so.

He said the design of the unit was typical of recently built power stations, including Kogan Creek, Tarong North, and others built in New South Wales

Your task

Outline the followings

1/ Inadequacies in existing risk control measures are identified in accordance with hierarchy of risk control and reported to relevant person/s (3.3)

Online research

Do online research on “Voltage unexpectedly dropped to zero, causing a trip in the AC system,"

Do online research on failing electrical equipment and system back-ups

2/ Inadequacies in resource allocation for implementation of risk control measures are identified and reported to relevant person/s (3.4)

Do online research on the power station unit could not disconnect from the grid or shut down safely

Write

Action Plan 1-Record_of_action_taken-WHS-concern.pdf

Action Plan 2- Suggest the training to be provided to the staff

Grading Rubric for Written Assignments

Levels of Assessment

Criteria	**Inadequate=D (Below Standard)**	**Adequate=C (Meets Standard)**	**Above Average=B (Exceeds Standard)**	**Exemplary=A (Far Exceeds Standard)**
Organization	Writing lacks logical organization. It shows some coherence but ideas lack unity. Serious errors.	Writing is coherent and logically organized. Some points remain misplaced and stray from the topic. Transitions evident but not used throughout essay.	Writing is coherent and logically organized with transitions used between ideas and paragraphs to create coherence. Overall unity of ideas is present.	Writing shows high degree of attention to logic and reasoning of points. Unity clearly leads the reader to the conclusion and stirs thought regarding the topic.
Level of Content	Shows some thinking and reasoning but most ideas are underdeveloped and unoriginal.	Content indicates thinking and reasoning applied with original thought on a few ideas.	Content indicates original thinking and develops ideas with sufficient and firm evidence.	Content indicates synthesis of ideas, in-depth analysis and evidences original thought and support for the topic.
Development	Main points lack detailed development. Ideas are vague with little evidence of critical thinking.	Main points are present with limited detail and development. Some critical thinking is present.	Main points well developed with quality supporting details and quantity. Critical thinking is weaved into points	Main points well developed with high quality and quantity support. Reveals high degree of critical thinking.

Grammar & Mechanics	Spelling, punctuation, and grammatical errors create distraction, making reading difficult; fragments, comma splices, run-ons evident. Errors are frequent.	Most spelling, punctuation, and grammar correct allowing reader to progress though essay. Some errors remain.	Essay has few spelling, punctuation, and grammatical errors allowing reader to follow ideas clearly. Very few fragments or run-ons.	Essay is free of distracting spelling, punctuation, and grammatical errors; absent of fragments, comma splices, and run-ons.
Style	Mostly in elementary form with little or no variety in sentence structure, diction, rhetorical devices or emphasis.	Approaches college level usage of some variety in sentence patterns, diction, and rhetorical devices.	Attains college level style; tone is appropriate and rhetorical devices used to enhance content; sentence variety used effectively.	Shows outstanding style going beyond usual college level; rhetorical devices and tone used effectively; creative use of sentence structure and coordination
Format	Fails to follow format and assignment requirements; incorrect margins, spacing and indentation; neatness of essay needs attention.	Meets format and assignment requirements; generally correct margins, spacing, and indentations; essay is neat but may have some assembly errors.	Meets format and assignment requirements; margins, spacing, and indentations are correct; essay is neat and correctly assembled.	Meets all formal and assignment requirements and evidences attention to detail; all margins, spacing and indentations are correct; essay is neat and correctly assembled with professional look.

The candidate must achieve Minimum of “C” Grade to achieve Competent in this unit.

UEECD0036 Provide engineering solutions for problems in complex multiple path circuits

Elements and performance criteria

Elements		**Performance criteria**		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare tools, equipment and materials for problem solving**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	
		1.2	WHS/OHS risk control work preparation measures and workplace procedures are followed	
		1.3	Scope of circuit/s problems are obtained from documentation and/or work instructions to determine the work	

Elements		Performance criteria		
		1.4	Advice is sought from the work supervisor to ensure the work is coordinated with others	
		1.5	Materials required for work are identified and accessed in accordance with workplace procedures	
		1.6	Tools, equipment and testing devices required for work are obtained and checked for correct operation and safety	
2	**Provide solutions for complex multiple path circuits**	**2.1**	WHS/OHS risk control work measures and workplace procedures are followed	
		2.2	Inspect and test live work is conducted in accordance with WHS/OHS requirements and workplace procedures	

Elements		Performance criteria		
		2.3	Circuits are checked and isolated as required in accordance with WHS/OHS requirements and workplace procedures	
		2.4	Methods used to solve circuit problems are used from measured and calculated values as they apply to complex multiple path circuits	
		2.5	Unplanned situations are dealt with in accordance with WHS/OHS and approval of a relevant person	
		2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment and/or services using sustainable energy practices	

Elements		Performance criteria		
3	**Complete work and documentation**	**3.1**	WHS/OHS work completion risk control measures and workplace procedures are followed	
		3.2	Worksite is cleaned and made safe in accordance with workplace procedures	
		3.3	Justification for solutions used to solve circuit problems is documented	
		3.4	Work completion is documented and relevant person/s notified in accordance with workplace procedures	

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:

• analysing complex multiple path circuits • applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • completing work and documenting problem-solving activities • completing written justification of solutions • coordinating work with others • dealing with unplanned events in accordance with problem-solving techniques and workplace procedures • determining the operating parameters of existing circuits • inspecting and testing active systems • obtaining and following work instructions • obtaining and using tools, equipment and products • preparing to solve problems in complex multiple path circuits • providing effective solutions to circuit problems from measurements and calculations • providing solutions for problems in complex multiple path circuits	• UEECD0036 Provide engineering solutions for problems in complex multiple path circuits EXERCISES.pdf • Hayt Engineering Circuit Analysis 8th • G048.pdf • E026.pdf • UEECD0036 Class Lessons.pdf • UEECD0036-Provide engineering solutions for problems in complex multiple path circuits. VIDEO LESSONS

• using sustainable energy practices in accordance with workplace procedures • using testing devices.	

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

• complex alternating current (a.c.) power and maximum power transfer theorem	Q21
• complex impedance	Q25+Q26
• mesh and nodal analysis for a.c. linear circuits	Q16+Q17
• mesh and nodal analysis for direct current (d.c.) linear circuits	
• Norton's principles for d.c. linear circuits	
• phasors	Q15 Phasor Revise (UEEEL0020)
• problem-solving techniques	Q10+11
• relevant complex multiple path circuits	
• relevant industry standards	
• relevant job safety assessments or risk mitigation processes	
• relevant manufacturer specifications and operating instructions	
• relevant materials, tools, equipment, product and testing devices	

• relevant sustainable energy principles • relevant tools, equipment and products • relevant WHS/OHS legislated requirements • relevant workplace documentation • relevant workplace instructions, policies and procedures	
• series and parallel a.c. linear circuits	Q29+Q30
• star-delta conversions	Q12+13+14
• superposition principles and Kirchhoff's law applied to a.c. linear circuits	Q16+17+Q7+8
• superposition principles for d.c. linear circuits	
• Thévenin and Norton theorems applied to a.c. linear circuits	Q19+20
• Thévenin's principles for d.c. linear circuits	
• transients	Q31+32+33
• voltage/current sources and Kirchhoff's law for d.c. linear circuits.	Q1+2+3+4+5+6

Class Lesson Slide

- E025.pdf
- G048.pdf

Class Lesson Written Notes

- UEECD0036 Class Lessons.pdf

Video Lesson Lessons

- UEECD0036-Provide engineering solutions for problems in complex multiple path circuits. VIDEO LESSONS

Reference Textbooks

- Hayt Engineering Circuit Analysis 8th.pdf
- Concepts-in-electric-circuits.pdf

Exercises

- UEECD0036 Provide engineering solutions for problems in complex multiple path circuits EXERCISES.pdf

UEECD0039 Provide solutions to basic engineering computational problems

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Provide computational solutions to engineering problems**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	
		1.2	Scope of problem/s is obtained from documentation and/or from work instructions to determine work	
		1.3	Problems are documented and/or diagrammatic form and appropriate methods identified to resolve them	
		1.4	Constants and variables to the problem are obtained from measured values and/or problem documentation	
		1.5	Alternative methods for resolving the problem are considered and, as required, discussed with relevant person/s	

Elements		Performance criteria		
		1.6	Problems are resolved using mathematical processes in accordance with workplace procedures	
2	**Complete work and documentation**	**2.1**	Justification for solutions used to solve engineering problems is documented in work records in accordance with workplace procedures and relevant industry standards	
		2.2	Work completion is documented and relevant person/s notified in accordance with workplace procedures	

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:	
• applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • completing work and documenting problem-solving activities • dealing with unplanned events in accordance with problem-solving techniques and workplace	•

procedures • documenting justification of solutions provided • obtaining known constants and variables • solving problems using appropriate mathematical processes • stating problems in documented and diagrammatic form.	

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:	
• algebraic manipulation • complex numbers • estimations, errors and approximations • exponential and logarithmic functions • graphs of linear functions • graphs of trigonometric functions • laws of indices • matrices • plane figures - quadrilaterals and circles • plane figures – triangles and basic trigonometry • problem-solving techniques • quadratic functions • rational, irrational numbers and algebra • relevant manufacturer specifications • relevant job safety assessments or risk mitigation processes • relevant WHS/OHS legislated requirements • relevant workplace documentation • relevant workplace instruction, policies and procedures • simultaneous equations	All exercises and assessment tasks in E050 Lesson 1 Polynomials E050 Lesson 2 Non linear equations E050 Lesson 3 Logarithmic equation E050 Lesson 4 Circular function E050 Lesson 5 Trigonometric identities E050 Lesson 6 Vector E050 Lesson 7 Mensuration+Area E050 Lesson 8 Differentiation E050 Lesson 9 Integration E050 Lesson 10 Integration of trigo functions E050 Lesson 11 Definite integral+Electrical application E050 Lesson 11 Exercises

• vectors and phasors.	

UEECD0049 Use advanced computational processes to provide solutions to energy sector engineering problems

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Provide solutions to engineering problems**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	
		1.2	Scope of problems are obtained from documentation and/or work instruction to solve problems	
		1.3	Problems are documented and/or provided in diagrammatic form and appropriate methods identified to resolve them	
		1.4	Constants and variables to problems are obtained from measured values and/or problem documentation	
		1.5	Alternative methods for resolving problems are	

Elements		Performance criteria		
			reviewed and, as required, discussed with relevant person/s	
		1.6	Problems are resolved using mathematical processes in accordance with workplace procedures	
2	**Complete work and documentation**	**2.1**	Justification for solutions used to solve engineering problems is documented in work records in accordance with workplace procedures and relevant industry standards	
		2.2	Work completion is documented and relevant person/s notified in accordance with workplace procedures	

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:	
• applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • completing work and documenting problem-solving activities	•

• dealing with unplanned events in accordance with problem-solving techniques and workplace procedures • documenting justification of solutions provided • obtaining known constants and variables • providing computational solutions to energy sector engineering problems • solving problems using appropriate mathematical processes • stating problems in written and diagrammatic form.	

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

• problem-solving techniques
• relevant advanced engineering mathematics, including:
  ○ differential calculus
  ○ differential equations
  ○ integral calculus
  ○ linear algebra
  ○ number
  ○ sequences and series
  ○ statistics
  ○ variables
  ○ vectors
• relevant constants and variables
• relevant diagrammatic form
• relevant industry standards
• relevant manufacturer specifications
• relevant job safety assessments or risk mitigation processes
• relevant WHS/OHS legislated requirements
• relevant workplace documentation
	All exercises and assessment tasks in
	
	E026 Lesson 1-Fourier
	
	E026 Lesson 2-Differential equation
	
	E026 Lesson 3-Gamma+Beta Function
	
	E026 Lesson 4-Vector analysis
	
	E026-Lesson 5-Laplace Transform
	
	E026 Harmonic Exercises
	
	E026 Definite Integral
	
	E026 Harmonics
	
	E026 Multiple Integral

• relevant workplace instruction, policies and procedures.	

REFERENCE
Engineering Mathematics
TEXTBOOKS
introductory-finite-difference-methods-for-pdes.pdf
www.iqytechnicalcollege.com/introductory-finite-difference-methods-for-pdes.pdf

Maths 101 Engineering Mathematics.pdf
www.iqytechnicalcollege.com/Maths 101 Engineering Mathematics.pdf

Maths 301 Introductory-finite-difference-methods-for-pdes.pdf
www.iqytechnicalcollege.com/Maths 301 Introductory-finite-difference-methods-for-pdes.pdf

Maths 301-an-introduction-to-the-theory-of-complex-variables.pdf
www.iqytechnicalcollege.com/Maths 301-an-introduction-to-the-theory-of-complex-variables.pdf

Maths 302 elementary-linear-algebra.pdf
www.iqytechnicalcollege.com/Maths 302 elementary-linear-algebra.pdf

Maths 303 essential-engineering-mathematics.pdf
www.iqytechnicalcollege.com/Maths 303 essential-engineering-mathematics.pdf

Maths 303 Introductory-finite-volume-methods-for-pdes.pdf
www.iqytechnicalcollege.com/Maths 303 Introductory-finite-volume-methods-for-pdes.pdf

Maths 304 integration-and-differential-equations.pdf
www.iqytechnicalcollege.com/Maths 304 integration-and-differential-equations.pdf

Maths 401 continuous-distributions.pdf
www.iqytechnicalcollege.com/Maths 401 continuous-distributions.pdf

Maths 402 discrete-distributions.pdf
www.iqytechnicalcollege.com/Maths 402 discrete-distributions.pdf

Maths 403 engineering-mathematics-youtube-workbook.pdf
www.iqytechnicalcollege.com/Maths 403 engineering-mathematics-youtube-workbook.pdf

Maths 403 second-order-ordinary-differential-equations.pdf
www.iqytechnicalcollege.com/Maths 403 second-order-ordinary-differential-equations.pdf

Maths 501 introduction-to-probability.pdf
www.iqytechnicalcollege.com/Maths 501 introduction-to-probability.pdf

Maths 501 linear-algebra-c-1.pdf
www.iqytechnicalcollege.com/Maths 501 linear-algebra-c-1.pdf

Maths 501 linear-algebra-c-1.pdf

www.iqytechnicalcollege.com/Maths 501 linear-algebra-c-1.pdf

Maths 501 linear-algebra-c-2.pdf
www.iqytechnicalcollege.com/Maths 501 linear-algebra-c-2.pdf

Maths 501 linear-algebra-i-matrices-and-row-operations.pdf
www.iqytechnicalcollege.com/Maths 501 linear-algebra-i-matrices-and-row-operations.pdf

Maths 502 introductory-finite-difference-methods-for-pdes.pdf
www.iqytechnicalcollege.com/Maths 502 introductory-finite-difference-methods-for-pdes.pdf
Maths 502 mathematical-modeling-i-preliminary.pdf
www.iqytechnicalcollege.com/Maths 502 mathematical-modeling-i-preliminary.pdf

Maths 601 random-variables-i.pdf
www.iqytechnicalcollege.com/Maths 601 random-variables-i.pdf
http://www.iqytechnicalcollege.com/Passwordprotect/2-john-bird-higher-engineering-mathematics.pdf
For the units

UEECD0039	Provide solutions to basic engineering computational problems*
UEECD0049	Use advanced computational processes to provide solutions to energy sector engineering problems*

Class Lessons
E126+127

www.highlightcomputer.com/Maths1E050G047Mod.zip

www.iqytechnicalcollege.com/Maths 2-E026 Mod.zip

VIDEO LESSONS

Engineering Mathematics I

E126	Engineering Mathematics

E050/E126
Page 87 to 101

www.highlightcomputer.com/Video Lessons.pdf

Mathematics
E050Part1.zip
Lesson 1
http://youtu.be/67MNuPQMiKw
http://youtu.be/GMrOtiVGcSg
Lesson 2
http://youtu.be/GMrOtiVGcSg
Lesson 3
http://youtu.be/3MnPK4HC0oc
Lesson 4

http://youtu.be/4Qiv5gvcxG0
Lesson 5
http://youtu.be/NJFYPLXjNDM
Lesson 6
http://youtu.be/Ejr9Genn5ZM
E050 Lesson 7 Mensuration+Area.zip
http://youtu.be/PSdB3--AHZM

E050 Lesson 8 Differentiation.zip
http://youtu.be/rLmLY8fj2l8
http://youtu.be/VLhQD_wrWY8

E050 Lesson 9 Integration.zip
http://youtu.be/ax_k2-qvhpA

E050 Lesson 10 Integration of trigo functions.zip
http://youtu.be/Xp6RiXES0qs

E050 Lesson 11 Definite integral+Electrical application.zip
http://youtu.be/GS26UxVilPA
http://youtu.be/AYXFn88n4yM

E050 Lesson 11 Exercises.zip

The links contain the following lessons
E050 Lesson 1 Polynomials
E050 Lesson 2 Non linear equations
E050 Lesson 3 Logarithmic equation
E050 Lesson 4 Circular function
E050 Lesson 5 Trigonometric identities
E050 Lesson 6 Vector
E050 Lesson 7 Mensuration+Area
E050 Lesson 8 Differentiation
E050 Lesson 9 Integration
E050 Lesson 10 Integration of trigo functions
E050 Lesson 11 Definite integral+Electrical application
E050 Lesson 11 Exercises

Engineering Mathematics II

E127	Advanced Engineering Mathematics

E026/E127
Page 26 to 50 of
www.highlightcomputer.com/Video Lessons.pdf
Engineering Mathematics
E026 Lesson 1 to 5
The links contain the following lessons
E026 Lesson 1-Fourier
https://www.youtube.com/watch?v=QzYO2qCJGNg

http://youtu.be/fGL7VYtEBV4

E026 Lesson 2-Differential equation
http://youtu.be/RjhgggxG2p0

E026 Lesson 3-Gamma+Beta Function
http://youtu.be/D-bUQ1UyI_Y
http://youtu.be/6rNFJbbqzyI

E026 Lesson 4-Vector analysis
http://youtu.be/T9OYT8RpqbA

E026-Lesson 5-Laplace Transform
Links
E026 Harmonic Exercises
https://www.youtube.com/watch?v=VSdug1mECDE
E026 Definite Integral
https://www.youtube.com/watch?v=oaI27HPNvhA
E026 Harmonics
https://www.youtube.com/watch?v=yFM7ajxKnXw
http://youtu.be/d5drjXEZKv0
http://youtu.be/NDUvNSO6il8
http://youtu.be/d5drjXEZKv0

E026 Multiple Integral
http://youtu.be/amV5KiBi0jk
http://youtu.be/IAKJvYUTPiI

E026-Lesson 6-Inverse Laplace+ Differential equation solution
http://youtu.be/yXulBJeI_2w
http://youtu.be/SPGeFn2icU0
http://youtu.be/4VLHZp6joYg
http://youtu.be/bYkyLGd17PU
http://youtu.be/GrYCm8FzAMY
E026-Lesson 7-Matrices
http://youtu.be/99cNSVx4hgU
http://youtu.be/ztHu2UYwA5c
http://youtu.be/m_7oVlLNSsI
http://youtu.be/5hq-ZfZdCRI

E026-Lesson 8 Legendre Function
http://youtu.be/VWyysJQ1grs
E026-Lesson 9 Binomial Theorem+ Partial Differential equation
http://youtu.be/jNj4dWucl50
E026-Lesson 10 Multiple Integral
http://youtu.be/amV5KiBi0jk

UEECD0056 Apply methods to maintain currency of industry developments

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Identify currency of industry developments**	**1.1**	Work activities are identified and reviewed for currency of methods in accordance with relevant industry standards	Professional Development Activities Matrix for Electrical Engineering Associates.xls stage-1-competency-standard-engineering-associate-may-25.pdf Engineers Australia Writing Engineering Competency Claims.pdf stage-1-competency-standard-engineering-associate-may-25.pdf engineering-associate-stage2-competency-v2.pdf
		1.2	Information and advice are sought for relevant legislated requirements on work outcomes	Discussion with Registered Professional Engineer (The trainers) and implement the tasks as per advice
		1.3	Technical information is reviewed in	Information review task on

Elements		Performance criteria		
			accordance with relevant industry standards	stage-1-competency-standard-engineering-associate-may-25.pdf Engineers Australia Writing Engineering Competency Claims.pdf stage-1-competency-standard-engineering-associate-may-25.pdf engineering-associate-stage2-competency-v2.pdf
2	**Maintain currency of methods and practices**	**2.1**	Methods are maintained in accordance with work health and safety (WHS)/occupational health and safety (OHS) requirements	Professional Development Activities Matrix for Electrical Engineering Associates.xls Entering the relevant information in OHS Columns of the Excel sheet PLUS Recordkeeping in Digital Folders
		2.2	Methods are maintained in accordance with relevant industry standards	Professional Development Activities Matrix for Electrical Engineering Associates.xls Entering the relevant information in Compliance Professional/Columns of the Excel sheet PLUS

Elements		Performance criteria		
				Recordkeeping in Digital Folders
		2.3	Methods are maintained in accordance with relevant legislation and workplace procedures	Professional Development Activities Matrix for Electrical Engineering Associates.xls Entering the relevant information in Compliance Legislation/Law/Government Columns of the Excel sheet PLUS Recordkeeping in Digital Folders
		2.4	Methods for maintaining currency of relevant industry developments are identified and applied in accordance with workplace procedures	Record in Industrial Development Information and Knowledge column of Professional Development Activities Matrix for Electrical Engineering Associates.xls
		2.5	Maintenance of current methods and practices for work is documented in accordance with workplace procedures	Record in current practice and method column of Professional Development Activities Matrix for Electrical Engineering Associates.xls

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:

• applying methods to maintain currency in accordance with relevant industry standards • applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • dealing with unplanned events in accordance with problem-solving techniques and workplace procedures • documenting maintenance of current knowledge and practices in accordance with relevant industry standards • identifying and reviewing areas of work activities for currency • preparing to apply methods to maintain currency of industry developments • using methods to ensure managerial aspects of work in accordance with relevant industry standards • using methods to ensure technical aspects of work are current in accordance with relevant industry standards.	Information review task on stage-1-competency-standard-engineering-associate-may-25.pdf Engineers Australia Writing Engineering Competency Claims.pdf stage-1-competency-standard-engineering-associate-may-25.pdf engineering-associate-stage2-competency-v2.pdf Professional Development Activities Matrix for Electrical Engineering Associates.xls Entering the relevant information in OHS Columns of the Excel sheet PLUS Recordkeeping in Digital Folders Professional Development Activities Matrix for Electrical Engineering Associates.xls Entering the relevant information in Compliance

	Professional/Columns of the Excel sheet PLUS Recordkeeping in Digital Folders Professional Development Activities Matrix for Electrical Engineering Associates.xls Entering the relevant information in Compliance Legislation/Law/Government Columns of the Excel sheet PLUS Recordkeeping in Digital Folders Record in Industrial Development Information and Knowledge column of Professional Development Activities Matrix for Electrical Engineering Associates.xls Record in current practice and method column of Professional Development Activities Matrix for Electrical Engineering Associates.xls

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

• currency of technology, machinery, equipment and tools, applications and uses • relevant codes of practice and industry standards • relevant manufacturer specifications and instruction manuals • relevant methods of formally maintaining currency • relevant regulatory and industry standards • relevant requirements to maintain currency in industry practices and products • relevant job safety assessments or risk mitigation processes • relevant sources of information in industry changes and new developments • relevant technical information • relevant WHS/OHS legislated requirements • relevant workplace documentation, including: ○ industry journals • relevant workplace policies and procedures.	Reference construction-engineer-learning-development-guide.pdf engineering-associate-stage2-competency-v2.pdf professional-engineer-stage-2-2012_0.pdf professional-standards-framework-v1-2023.pdf stage-1-competency-standard-engineering-associate-may-25 Writing Engineering Competency Claims.pdf

Lesson Slides

- Engineering Competency Development Lesson

Reference

- construction-engineer-learning-development-guide.pdf
- engineering-associate-stage2-competency-v2.pdf
- professional-engineer-stage-2-2012_0.pdf
- professional-standards-framework-v1-2023.pdf
- stage-1-competency-standard-engineering-associate-may-25
- Writing Engineering Competency Claims.pdf

Assessment

Submission of Skill-Matrix-Template-powered-by-Skills-Base.xlsx filled with Competency Development Activities and future plan for the period of two years that includes both past and future activities.

UEEEL0043 Develop engineering solutions for induction machine and control problems

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to develop engineering solution for induction machine problems**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	OHS Safety Assessment Appropriate OHS Procedures in motor practical
		1.2	WHS/OHS risk control measures and workplace procedures in preparation for the work are followed	Risk Assessment in motor practical
		1.3	Scope of induction machine problem is determined from performance specifications and/or documentation and in	(1) AC Machine introduction (3) Motor equivalent circuit. (4) Wound rotor motor (5) Torque +Motor test (7) Motor starters

Elements		Performance criteria		
			consultation with relevant person/s	(8) Three phase motor equivalent circuit (9) Reduced voltage starting methods (16) Single phase motor (18) Single phase motor problems. (19) Force on motor
		1.4	Activities are planned to meet scheduled timelines in consultation with others involved in the work	Planning of motor control system
		1.5	Strategies are formed to ensure solution development and implementation is carried out efficiently	Problem solving in the topics (1) AC Machine introduction (3) Motor equivalent circuit. (4) Wound rotor motor (5) Torque +Motor test (7) Motor starters (8) Three phase motor equivalent circuit (9) Reduced voltage starting methods

Elements		Performance criteria		
				(16) Single phase motor (18) Single phase motor problems. (19) Force on motor
2	**Develop engineering solution**	**2.1**	WHS/OHS risk control measures and workplace procedures for carrying out the work are followed	Risk control procedures
		2.2	Induction machine construction, operation, characteristics and applications are applied to developing solutions to induction machine problems	Theory study, assessment and Problem solving in the topics (1) AC Machine introduction (3) Motor equivalent circuit. (4) Wound rotor motor (5) Torque +Motor test (7) Motor starters (8) Three phase motor equivalent circuit (9) Reduced voltage starting methods (16) Single phase motor (18) Single phase motor problems.

Elements		Performance criteria		
				(19) Force on motor
		2.3	Parameters tested, data taken, specifications and performance requirements to each machine problem are obtained in accordance with workplace procedures	Do the practicals • Induction motor load test • Dynamic Braking • Star / Delta Starter • Motor control virctual lab • DOL Starter • Jogging • Speed Control
		2.4	Approaches to resolving induction machine problems are analysed to provide most effective solutions	Determining the problem solution steps in calculations
		2.5	Unplanned events are dealt with safely and effectively in accordance with relevant industry standards and workplace procedures	Simulation for over load, under voltage , wrong connection, starter fault. Motor fault finding

Elements		Performance criteria		
		2.6	Quality of work is monitored in accordance with relevant industry standards and workplace procedures	
3	**Implement engineering solution and complete documentation**	**3.1**	Solutions to machine problems are tested to determine their effectiveness and modified as required	Motor tests, operation, determining the characteristics
		3.2	Adopted solutions are documented, including instruction for implementation with risk control measures	Risk control processes in practical
		3.3	Relevant person/s required to implement solutions to induction machine problems is coordinated in accordance with relevant industry standards and workplace procedures	Authorisation by trainer to energize in the practical

Elements		Performance criteria		
		3.4	Justification for solutions used to solve induction machine problems is documented in work/project records in accordance with relevant industry standards	Verifying of the answers in solved problems

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least one occasion and include:

• understanding the extent of the machine problem • forming effective strategies for solution development and implementation • obtaining machine parameters, specifications and performance requirements appropriate to each problem • testing and solutions to machine problems • documenting instruction for implementation of solutions that incorporate risk control measure to be followed	Do the practicals • Induction motor load test • Dynamic Braking • Star / Delta Starter • Motor control virctual lab • DOL Starter • Jogging • Speed Control • OHS Safety Assessment • Appropriate OHS Procedures

• documenting justification of solutions implemented in accordance with professional standards • dealing with unplanned events • analysing approaches to solutions • applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures • determining the scope of induction machine problems • monitoring quality of work • planning activities to meet timelines.	

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

• induction machines diagnostics and engineering solutions for induction motor problems, including:
  ○ operating principles of polyphase induction motors encompassing:
  ▪ rotating magnetic field torque slip
	(1) AC Machine introduction
	Q1 to 5

▪ MMF relationships ▪ leakage fluxes ○ construction of polyphase induction motors encompassing: ▪ squirrel cage motors ▪ slip-ring motors ▪ construction considerations in minimisation of tooth locking ○ speed-torque relationships in induction motors encompassing: ▪ maximum torque ▪ torque – slip relationships ▪ squirrel cage rotor types ▪ power flow in the motors ▪ power distribution ▪ torque units ▪ slip ring rotors	(2) Induction motor Q6 to Q8 +(3) Motor equivalent circuit. Q12 Q9 to Q11 Q20 to Q27

○ induction motor performance testing encompassing: ▪ no-load tests ▪ locked rotor tests ▪ development of motor equivalent circuit from test results ▪ analysis of motor performance using circle diagrams ○ induction motor starters encompassing: ▪ starting requirements ▪ type of starters ▪ starting torque ▪ starting dynamics ▪ static friction ▪ mechanical loads ▪ starting duration ○ reduced voltage starting encompassing: ▪ starting dynamics ▪ change over conditions ▪ starting duration	(7) Motor starters Q13+Q31+Q32 Q46,47, Q50 to 58

▪ acceleration curves	
○ speed control of induction motors encompassing:	Q60 ,61
▪ constant torque, constant power concepts	
▪ torque-flux-voltage relationships	
▪ rotor resistance control	
▪ stator impedance control	
▪ variable frequency control (e.g. PAM, PWM and flux vector control)	
○ braking of induction motors encompassing:	Q62,63 Q51 to 57
▪ electrical braking systems (plugging, direct current (d.c.) dynamic, regenerative and capacitor-magnetic)	
▪ mechanical braking systems (mechanical	

drum, demag and eddy current) ○ motor protection encompassing: ▪ overload ▪ earth fault ▪ phase failure ○ motor selection criteria and RMS rating ○ induction motor maintenance/repair encompassing: ▪ routine maintenance schedules ▪ type of repairs (mechanical and electrical) ○ single phase induction motors encompassing: ▪ operating principles (especially RMF) ▪ construction types ▪ speed-torque relationships ▪ testing • relevant induction machine construction, operation,	Q45 Q105,106

characteristics and applications, including driven load and duty cycle • relevant machine parameters, specifications and performance requirements • relevant manufacturer specifications and operating instructions/manuals • relevant job safety assessments or risk mitigation processes • relevant WHS/OHS legislated requirements • relevant workplace documentation • relevant workplace quality, instructions, policies and procedures.	

Textbook

- Electrical Machines Drive and Power System Chapter 13+14+15
- Motor Control Electronics.pdf
- AC MachinesClass Lesson
- AC Machines Video Lessons

Practical-Virtual Lab

Virtual Lab

- Speed control of slipring Induction Motor.

Physical Lab

- UEE-EL0024 TSP07.2.2.pdf

- UEE-EL00TSP03.2.pdf
- Motor Control Practical-Physical

Exercises

- UEEEL0043 Exercises

UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to develop engineering solutions in complex polyphase power circuit problems**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	OHS Procedures in Polyphase Power Circuit Practical
		1.2	WHS/OHS risk control work preparation measures and workplace procedures are followed	OHS Risk Control in Polyphase Power Circuit Practical
		1.3	Scope of complex polyphase power circuit problems is identified from documentation and/or work instructions	Solving the problems in UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits Exercises
		1.4	Advice is sought from the work supervisor to ensure	Advice from trainer

Elements		Performance criteria		
			the work is coordinated effectively with others	
		1.5	Sources of materials required for work are identified in accordance with workplace procedures	Three phase circuit practical equipment
		1.6	Tools, equipment and testing devices required for work are obtained and checked for correct operation and safety	Three phase circuit practical equipment
2	**Provide engineering solutions to problems**	**2.1**	WHS/OHS risk control work measures and procedures are followed	OHS Risk Control in Polyphase Power Circuit Practical
		2.2	The need to test and measure live electrical work is determined in accordance with WHS/OHS requirements and workplace procedures	Three phase circuit practical testing and OHS Aspects
		2.3	Circuits are checked and isolated in accordance with WHS/OHS requirements and workplace procedures	Three phase circuit practical circuit set up and checking
		2.4	Complex polyphase power circuit problems are solved	Solving the problems in UEEEL0062 Provide

Elements		Performance criteria		
			from interpreting measurements and calculated values in accordance with workplace procedures	engineering solutions to problems in complex polyphase power circuits Exercises
		2.5	Unplanned situations are dealt with safely and with the approval of relevant person/s	Out of phase, open neutral emergency procedures
		2.6	Problems are solved without damage to apparatus, circuits, the environment and/or services using sustainable energy practices	Solving the problems in UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits Exercises
3	**Complete work and document solutions**	**3.1**	WHS/OHS work completion risk control measures and workplace procedures are followed	OHS Risk Control in Polyphase Power Circuit Practical
		3.2	Worksite is cleaned and made safe in accordance with workplace procedures	Housekeeping tasks after completion of Polyphase Power Circuit Practical
		3.3	Justification for solutions used to solve complex polyphase power circuit problems is documented	Checking the practical results with calculated values

Elements		Performance criteria		
		3.4	Work completion is documented and relevant person/s notified in accordance with workplace procedures	Submission of practical report and assignment exercises to trainer for assessment and evalution.

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least one occasion and include:	
• determining the operating parameters of existing circuit • using established problem-solving methods • taking relevant measurements accurately • interpreting measured values appropriately • providing effective solutions to circuit problems from measurements and calculations • giving written justification of solutions provided • dealing with unplanned events	Measurement of voltage, current , power and phase sequence in three phase circuits practical Solving three phase circuit problems Measurement of voltage, current , power and phase sequence in three phase circuits practical Solving the problems in UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits Exercises Out of phase, open neutral emergency procedures

• applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures • checking and isolating circuits • documenting completed work and notifying relevant person/s • identifying sources of materials required for work • identifying the scope of the complex polyphase power circuit problems • preparing for problems in complex polyphase power circuits • testing and measuring live work • using tools, equipment and testing equipment.	OHS Procedures in Polyphase Power Circuit Practical Circuit isolation practice in three phase circuit practical. UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits Exercises UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits Exercises

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

• polyphase power circuit analysis, including:	

○ polyphase supply system encompassing: ▪ advantage of three phase system compared to single phase systems ▪ double subscript notation ▪ phase sequence ▪ 120 degree operator ▪ given circuit component parameters, solve practically-based problems using: ▪ equivalent circuits of transformers, lines and loads ▪ component values using rectangular and polar notation ▪ current divider and potential divider rules using complex impedances	Q21 to 23 Q25 Q19+20 Q16

▪ the "per unit" values of voltage, current and impedance to a common VA base	Q24
○ types of three phase system connections encompassing:	
▪ supply to balanced star, three and four wire loads ▪ supply to delta connected loads ▪ effects of phase reversal ▪ representation of currents and voltages as complex phasors for three phase, and three phase and neutral quantities ▪ calculation of the values of, and drawing labelled phasor diagrams, not to scale, to represent complex values of current and voltage for balanced and unbalanced loads	Q2 to 11

for star and delta systems ▪ calculation of values of P, Q and S for balanced and unbalanced systems ▪ draw and label single phase diagrams to represent one phase of a complex three phase system ▪ represent unbalanced voltages or currents as symmetrical components ▪ phase-to-phase currents ▪ phase-to-neutral/earth currents ○ balanced three phase loads encompassing: ▪ calculations of balanced loads connected in star ▪ calculations of balanced loads connected in delta ▪ calculation of steady state values of fault	Q2 to 11

current for various configurations ▪ evaluation of the symmetrical component impedances for the various distribution system components, transformers (earthed neutral case) and generators (high impedance earth) ▪ calculation of fault currents using the per unit approach ▪ calculation using the "worst case" values based on transformer impedance only (i.e. a short circuit fault) ▪ estimation of peak values using accepted multipliers ▪ effects of the direct current (d.c.) component on the instantaneous magnitudes of fault currents in transformers and generators	

○ unbalanced three phase loads encompassing: ▪ star – four wire systems ▪ delta systems ▪ star – three wire systems ▪ star - four wire with neutral impedance ○ power in three phase circuits encompassing: ▪ summation of phase powers and power in balanced loads ▪ measurement of power in balanced loads – two Wattmeter methods ○ reactive three phase power encompassing: ▪ power triangle calculation ▪ measurement of VAR ▪ power factor correction ○ fault currents encompassing: ▪ symmetrical components	Q2+3+10+16 Q24+25

▪ positive, negative and zero sequence impedance ▪ fault current breaking and let-through energy capacities of circuit breakers and fuses ▪ importance of fault/arc impedance ▪ calculation of fault currents - phase-to-earth faults ▪ calculation of fault currents - phase-to-phase faults ▪ analysis of asymmetrical fault currents ○ harmonics in three phase systems encompassing: ▪ presence of triple in harmonics in three phase systems ▪ effects of three phase harmonics for different star and delta connections ▪ methods for reducing harmonics in three phase systems	Harmonics Problems All

• problem-solving techniques • relevant checks and isolation of circuits • relevant manufacturer specifications and operating instructions • relevant materials, tools, equipment and testing devices • relevant job safety assessments or risk mitigation processes • relevant WHS/OHS legislated requirements • relevant workplace documentation • relevant workplace instructions, policies and procedures.	Isolation practice in Three Phase Circuit Practical Operation instruction of Watt meters and circuit testing set OHS and Risk Assessment in three phase circuit practical

Resources

- UEEEL0062 Study Guide.pdf
- UEEEL0062 Provide engineering solutions to problems in complex polyphase power circuits Exercises
- Harmonics Problems
- UEEEL0062 Class Lessons

Power Electronics

*UEEIC0040 Solve problems in polyphase electronic power control circuits**
*UEEIC0042 Solve problems in single phase electronic power control circuits**

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Identify problems in single phase electronic power control system**	**1.1**	WHS/OHS requirements and workplace procedures are identified and applied	OHS practice in power electronics practical tasks
		1.2	Hazards are identified, risks are assessed and control measures implemented	Hazard Identification in power electronics practical tasks
		1.3	Extent of single phase electronic power control problems are determined from performance specifications, situation reports and consultations with relevant person/s	Single phase electronic power control problems solution and exercises
		1.4	Activities are planned to meet scheduled timelines in consultation with relevant person/s	Power electronics practical tasks schedule
		1.5	Tools, equipment and testing devices needed for the work are obtained in accordance with workplace procedures and checked for correct operation and safety	Power electronics practical tasks equipment arrangement
2	**Solve problems in single phase electronic power**	**2.1**	WHS/OHS risk control measures and workplace procedures for carrying out the work are followed	OHS Risk assessment and control in in power electronics practical tasks

Elements		Performance criteria		
	control system			
		2.2	Single phase electronic power control devices, circuit operation characteristics and applications are used to develop solutions for control problems	Power electronics practical tasks practical work procedure and data collection
		2.3	Parameters, specifications and performance requirements in relation to each single phase electronic power control problem are obtained in accordance with workplace procedures	Determining the characteristics of power electronic circuits under test.
		2.4	Approaches to resolving single phase electronic power control problems are evaluated to provide most effective solutions	Problem solution and verification of the results in of power electronic circuits practical
		2.5	Unplanned situations are responded to in accordance with workplace procedures in a manner that minimises risk to personnel and equipment	Risk assessment and protection plan for unplanned events
		2.6	Problems are solved efficiently using sustainable energy practices without waste of materials, damaging apparatus, the surrounding environment or services in accordance with workplace procedures	Minimizing the use of energy and waste to set up and test the power electronics practical circuits.
3	**Test and document solutions to single phase electronic power control**	**3.1**	WHS/OHS risk control measures and workplace procedures for carrying out the work are followed	OHS and risk control tasks in power electronics practical
		3.2	Solutions to single phase electronic power control problems are tested to determine effectiveness and modified as necessary	Modify the power electronics circuits to acquire the needed result and function.
		3.3	Adopted solutions are documented, including instructions for implementation, incorporating risk control measures	Practical data record, plotting the characteristics graph and data

Elements		Performance criteria		
		3.4	Justification for solutions used to solve single phase electronic power control problems are documented in accordance with workplace procedures	Data integrity and verification of the results.

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:	
• *applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including implementing risk control measures* • *applying sustainable energy principles and practices* • *evaluating problem resolutions, testing for effectiveness and modifying as required* • *meeting scheduled timelines* • *preparing and solving problems in single phase electronic power control systems* • *using tools, equipment and testing devices* • *obtaining and checking tools and equipment* • *dealing with unplanned events/situations in accordance with workplace procedures in a manner that minimises risk to personnel and equipment.*	Element 1 to 3 above

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the eleme

• *introduction to power control, including:*
  ○ *advantages and benefits of power control*
  ○ *need for power control and typical applications*
  ○ *power control methods*
  ○ *types of solid-state switches*
  ○ *block diagram of a power converter*
  ○ *power control terminology*
  ○ *modes of operation*
• *single phase power rectifiers, including:*
  ○ *single phase rectifier circuit configurations*
  ○ *resistive/inductive loads*
  ○ *output voltages/waveforms*
  ○ *ripple voltage frequency*
  ○ *peak reverse voltages*
  ○ *freewheeling diodes*
• *silicon controlled rectifiers (SCRs), including:*
  ○ *construction and symbol*
  ○ *basic operating principles*
  ○ *characteristics*
  ○ *gate requirements*
	Lesson and Assessment Tasks in the following topics
	
	H011 Lesson 1 DC Power supply principle
	H011 Lesson 2 Load regulation
	H011 Lesson 3 Current limiter
	H013 Lesson 1 Amplifier model
	H013 Lesson 2 Amplifier biasing
	H013 Lesson 3 Amplifier configuration
	H013 Lesson 4 Amplifier parameters
	H013 Lesson 5 JFET
	H025 Lesson 1-Differential Amplifier
	H025 Lesson 2-Comparator
	H025 Lesson 3-Timer IC
	H025 Lesson 4-Op Amp Circuit 1 & 2
	H025 Lesson 5-Op amp characteristics+ Band width compensation
	H025 Lesson 6-Op amp diode characteristics
	H025 Lesson 7-Sine & square wave

○ *commutation* ○ *electrical ratings* ○ *testing SCRs* ○ *applications* • *triacs and gate turn off (GTO) thyristors, including:* ○ *triac construction and symbol* ○ *triac basic operating principles* ○ *triac characteristics* ○ *triac triggering modes* ○ *triac electrical ratings* ○ *triac testing* ○ *GTO construction and symbol* ○ *GTO basic operating principles* ○ *GTO characteristics* ○ *GTO electrical ratings* ○ *applications for triac and GTOs* • *power transistors bipolar junction transistor (BJT), including:* ○ *BJT construction and symbol* ○ *BJT basic operating principles* ○ *BJT characteristics* ○ *BJT electrical ratings* ○ *BJT testing* ○ *applications for BJTs* • *power field effect transistors (FET), including:* ○ *types of FETs used for power control* ○ *power FETs construction and symbol* ○ *FET basic operating principles and characteristics* ○ *insulated gate bipolar transistor (IGBT) basic operating principles and characteristics* ○ *power FET electrical ratings* ○ *power FET Testing* ○ *applications for power FETs* • *triggering devices diac, including:* ○ *construction and symbol* ○ *operating principles* ○ *breakover voltage* ○ *unijunction transistors (UJTs)* ○ *construction and symbol* ○ *operating principles* ○ *intrinsic stand-off ratio and peak point voltage* • *programmable unijunction transistors (PUTs) including:* ○ *construction and symbol* ○ *operating principles* ○ *programmable standoff ratio* ○ *peak point voltage* • *triggering circuits, including:* ○ *R-C time constant circuits* ○ *diac trigger circuit operation* ○ *UJT relaxation oscillator circuit operation* ○ *PUT relaxation oscillator circuit* • *half wave-controlled rectification, including:* ○ *phase shift control*	oscillators H025 Lesson 8-Op amp ckt-Integrator+ Differentiator H025 Lesson 9-Active filter H025 Lesson 10-Multistage Op amp ckt H025 Lesson 11-Transducers H025 Lesson 12-Introduction to control

○ *controlled rectifiers* ○ *controlled rectifier power output control* ○ *single phase half wave-controlled rectifier* ○ *circuit configuration* ○ *circuit operation* ○ *waveforms* ○ *load voltage* ○ *applications and limitations* ○ *problems associated with phase shift control* • *full wave-controlled bridge rectification including:* ○ *single phase full wave-controlled bridge rectifier circuit* ○ *output voltage* ○ *output waveforms* ○ *applications and limitations* ○ *advantages and disadvantages* • *fully controlled bridge rectification, including:* ○ *single phase fully controlled rectifier bridge circuit* ○ *output voltage* ○ *output waveforms* ○ *applications and limitations* ○ *advantages and disadvantages* • *single phase alternating current (a.c.) voltage control, including:* ○ *phase control of a.c. power* ○ *circuit configurations - half and full control circuits* ○ *triggering circuits* ○ *circuit performance and operation on resistive and inductive loads* ○ *output voltage and waveform, determination of output voltage using circuit characteristics* ○ *range of control with inductive loads* ○ *triggering problems associated with inductive loads* ○ *applications and limitations* • *zero voltage switching (ZVS), including:* ○ *operating principles* ○ *circuit configuration, including trigger circuits* ○ *circuit operation and waveforms resistive loads only* ○ *relationship between load power and conduction time* ○ *solid state relays: types and ratings* ○ *applications and limitations* • *fault finding of power control circuits, including:* ○ *fault-finding procedures* ○ *typical faults power and trigger circuits* ○ *characteristics displayed by common faults* ○ *comparison of test data with*	

expected data (voltage/current waveforms) ○ *location and replacement of faulty components* • *job safety assessments or risk mitigation processes, including risk control measures* • *relevant manufacturer specifications* • *relevant tools, equipment and testing devices* • *relevant WHS/OHS legislated requirements* • *relevant workplace documentation* • *relevant workplace policies and procedures* • *single phase electronic power control circuits* • *solutions to single phase electronic power control problems* *sustainable energy principles and practices.*	

UEEIC0040 Unit Description

This unit involves the skills and knowledge required to solve problems in polyphase electronic power control circuits.

It includes preparing and solving problems in polyphase electronic power control circuits. It also includes testing and documenting solutions.

Typical polyphase electronic power control problems are those encountered in meeting performance requirements and industry compliance standards, revising control operating parameters and dealing with control malfunctions.

The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c.).

Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, is required.

Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

Elements and performance criteria

Elements		Performance criteria	
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
1	**Identify problems in polyphase electronic power control circuits**	**1.1**	WHS/OHS requirements and workplace procedures are identified and applied
		1.2	Hazards are identified, risks are assessed and control measures implemented
		1.3	Extent of polyphase electronic power control problems are determined from performance specifications, situation

			reports and consultations with relevant person/s
		1.4	Work activities are planned to meet scheduled timelines in consultation with relevant person/s
		1.5	Tools, equipment and testing devices needed for work are obtained in accordance with workplace procedures and checked for correct operation and safety
2	**Solve problems in polyphase electronic power control circuits**	**2.1**	WHS/OHS risk control measures and workplace procedures for carrying out the work are followed
		2.2	Polyphase electronic power control devices, circuit operation characteristics and applications are applied to developing solutions to control problems
		2.3	Parameters, specifications and performance requirements in relation to each polyphase electronic power control problem are obtained in accordance with workplace procedures
		2.4	Solutions to polyphase electronic power control problems are evaluated to determine most effective resolution
		2.5	Unplanned situations are responded to in accordance with workplace procedures in a manner that minimises risk to personnel and equipment

		2.6	Problems are resolved using sustainable energy practices and principles without wasting materials, damaging apparatus, the surrounding environment or services in accordance with workplace procedures
3	**Test and document solutions to polyphase electronic power control problems**	**3.1**	WHS/OHS risk control measures and procedures for carrying out the work are followed
		3.2	Solutions to polyphase electronic power control problems are tested to determine effectiveness and modified, as required
		3.3	Solutions are documented, including instructions for implementation, incorporating risk control measures
		3.4	Solutions used to solve polyphase electronic power control problems are justified and documented in accordance with workplace procedures

Foundation skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of conditions

Range is restricted to essential operating conditions and any other variables essential to the wo

Non-essential conditions may be found in the UEE Electrotechnology Training Package Compa

Solving electrical problems in polyphase electronic power control circuits must include at least f following:

Assessment requirements

Modification history

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of range of conditions on at least two separate occasions and include:

- applying relevant work health and safety (WHS)/occupational health and safety (OHS) re
- applying sustainable energy principles and practices
- dealing with unplanned events/situations in accordance with workplace procedures in a m
- determining the extent of the polyphase electronic power control problem
- developing, evaluating and testing solutions to polyphase electronic power control proble
- documenting justification of solutions implemented in accordance with workplace procedu
- following scheduled timeframes
- obtaining electronic device and circuit parameters, specifications and performance requir
- resolving problems in polyphase electronic power control circuits
- testing and documenting solutions to polyphase electronic power control circuits.

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of range of conditions and include knowledge of:

- job safety assessments or risk mitigation processes, including risk control measures
- three phase rectifier circuits, including:
    - three phase circuit configurations
    - resistive/inductive loads
    - output voltages/waveforms
    - ripple voltage/frequency
    - peak reverse voltages
    - freewheeling diodes
    - measurement of rectifier output parameters
- three phase half wave-controlled rectifiers, including:
    - phase control
    - purpose/operation of half wave-controlled rectifiers
    - circuit configuration

    - rectifier performance and operation - resistive loads
    - output voltage resistive load
    - rectifier performance and operation - inductive loads
    - rectifier output waveforms
    - applications and limitations
    - advantages and disadvantages three phase half wave-controlled rectifiers
- three phase half-controlled bridge rectifier, including:
    - purpose/operation of a half-controlled bridge rectifiers
    - circuit configuration and connections
    - rectifier output - resistive loads
    - output voltage resistive loads
    - rectifier output - inductive loads
    - output voltage - inductive loads
    - flywheel diode
    - output voltage calculations
    - applications and limitations
    - advantages and disadvantages three phase half-controlled bridge rectifiers
- three phase fully controlled bridge rectifier, including:
    - purpose/operation of a fully controlled bridge rectifiers
    - circuit configuration and connections
    - rectifier output - resistive loads
    - output voltage resistive loads
    - rectifier output - inductive loads
    - output voltage - inductive loads
    - flywheel diode
    - output voltage calculations
    - applications and limitations
    - advantages and disadvantages three phase fully controlled bridge rectifiers
- three phase alternating current (a.c.) controllers, including:
    - circuit configurations
    - circuit operation
    - triacs and silicon controlled rectifier (SCR) circuits
    - triggering requirements
    - output voltage and waveforms

    - determination of output voltage
    - applications
    - advantages and disadvantages
- direct current (d.c.) converters, including:
    - purpose and operation of d.c. converters
    - circuit configurations
    - voltage control methods
    - forced commutation methods
    - calculation of load voltage
    - output voltage/waveforms
    - applications
    - advantages and disadvantages
- cyclo-converters, including:
    - purpose/operation of a cyclo-converter
    - basic circuit configurations
    - measurement of output voltage
    - calculation of load voltage
    - output voltage/waveforms
    - applications and limitations
    - advantages and disadvantages
- inverters, including:
    - purpose/operation of an inverter
    - basic circuit configurations
    - measurement of inverter outputs
    - output voltage
    - applications and limitations
    - advantages and disadvantages
- thyristor protection, including:
    - power control devices failure
    - protection techniques
    - snubber networks
    - series inductors
    - amp trap high rupturing capacity (HRC) fuses
    - gate pulse suppression

- installation of thyristor devices and circuits, including:
    - need for heat sinking of power thyristor devices
    - heat sink features and types
    - installation methods for all types of thyristor packages
    - basic thermal model, only to demonstrate the effect of different heat sink
    - types and profiles and installation methods on thyristor junction temperature
- series and parallel thyristor connections, including:
    - purpose of series/parallel connection
    - series connections
    - reasons
    - operational problems
    - parallel connections
    - reasons
    - operational problems
- fault finding three phase thyristor circuits, including:
    - fault finding procedures
    - typical faults power and trigger circuits
    - characteristics displayed by common faults
    - comparison of test data with expected data (voltage/current waveforms)
    - location and replacement of faulty components
- problem-solving techniques
- relevant manufacturer specifications
- relevant tools, equipment and testing devices
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace policies and procedures
- sustainable energy principles and practices.

General Assessment Information

Assessment Tasks

Name	Weighting	Hurdle	Due
Pre-Class Quiz (Lectorials)	10%	No	Week 2, 3, 4, 5, 6
Assignments (PC Labs)	20%	No	Week 2, 3, 4, 5, 6, 7
Class Quiz (Lectorials)	20%	No	Week 8
Assessment (Project)	50%	No	Week 13, 14

Pre-Class Quiz (Lectorials)

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Week 2, 3, 4, 5, 6**
Weighting: **10%**

Students are expected to go through the iLearn content, understand the theory and attempt the online quiz each week prior to attending the class activities of that week.

On successful completion you will be able to:

- Describe the relationship between physical structure and performance characteristics of passive electrical components and active semiconductor power electronic devices;
- Analyse and simulate power electronic circuits and derive accepted performance parameters, including power quality metrics;
- Design and critically assess key aspects of power converters such as AC-DC, DC-DC and DC-AC converters;

Assignments (PC Labs)

Assessment Type [1]: Problem set
Indicative Time on Task [2]: 12 hours
Due: **Week 2, 3, 4, 5, 6, 7**
Weighting: **20%**

Evaluation of Lab activity during first part of the semester. This evaluation focuses on students ability to perform modelling, design and implementation of power electronics systems using PLECS.

On successful completion you will be able to:

- Analyse and simulate power electronic circuits and derive accepted performance parameters, including power quality metrics;
- Design and critically assess key aspects of power converters such as AC-DC, DC-DC and DC-AC converters;
- Design, model/build and analyse a complete power converter application based on a set of user specifications;

Class Quiz (Lectorials)

Assessment Type [1]: Quiz/Test
Indicative Time on Task [2]: 5 hours
Due: **Week 8**
Weighting: **20%**

A quiz is scheduled right after the mid-semester break. The quiz will assess both factual knowledge and problem solving.

On successful completion you will be able to:

- Describe the relationship between physical structure and performance characteristics of passive electrical components and active semiconductor power electronic devices;
- Design and critically assess key aspects of power converters such as AC-DC, DC-DC and DC-AC converters;
- Demonstrate knowledge of emerging applications of power electronics in the renewable energy systems, energy storage systems and micro-grids;

Assessment (Project)

Assessment Type [1]: Project
Indicative Time on Task [2]: 20 hours
Due: **Week 13, 14**
Weighting: **50%**

This is the major assessment of this Unit. It will consist of 3 individual assessments and 1 team assessment, as follows: - Individual assessments: ◦ Oral presentation and demonstration of the project; ◦ Peer assessment regarding the actual contribution of each team member; ◦ Evaluation of project log book of each team member. - Team assessment: ◦ Project report to be submitted in iLearn by each team.

On successful completion you will be able to:

- Describe the relationship between physical structure and performance characteristics of passive electrical components and active semiconductor power electronic devices;
- Analyse and simulate power electronic circuits and derive accepted performance parameters, including power quality metrics;
- Design and critically assess key aspects of power converters such as AC-DC, DC-DC and DC-AC converters;
- Design, model/build and analyse a complete power converter application based on a set of user specifications;
- Demonstrate knowledge of emerging applications of power electronics in the renewable energy systems, energy storage systems and micro-grids;

[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

METHODS OF COMMUNICATIONS

UNIT WEBSITE

- The iLearn website for this unit can be found at: www.iqytechnicalcollege.com/weeklylesson.htm
-
    - *Note! All information and communications relevant to this Unit will be via the iLearn website.*

TEXTBOOK

- Power Electronics: A First Course, November 2011, Ned Mohan, Wiley, ISBN: 9781118215265 (Digital version recommended).
    - *Note! Links will be provided to specific sections of the Digital version in iLearn for each Lectorial.*
- *Remark: This textbook is used extensively as a reference in all activities of this Unit. All students are expected to have access to this textbook.*
- Support Website: http://www.wileydigitalsolutions.com.au/support/article/student/ – link to the Wiley's digital solutions support page and live chat for students.

LECTORIALS

- There will be a Lectorial (3 hours) for every week in the first part of the semester (Weeks 1-7). The Lectorial will comprise of: - discussion session on fundamental knowledge;

- practical examples; - interactive problem solving involving students.

- Lectorials are a combination of traditional lecture and practice-based teaching modes, and are designed to improve student engagement inside/outside classes.
- The Lectorials are organised in a flipped classroom fashion, students are expected to go thorugh the recommneded weekly contents before each lectorial takes place.
- Outside class
    - links to E-Text specific sections, brief videos and/or lecture notes are posted in iLearn each week.
    - students are expected to read these E-Text sections, try to solve any given examples, and watch any videos and/or read any posted notes prior to attending the Lectorials.
- Inside class
    - brief discussion sessions on fundamental principles.
    - practical examples.
    - interactive problem solving involving students.

LABORATORIES

- PC Lab activities start from Week 1 and take place once a week (Weeks 1-7) according to the Unit schedule.
    - *Note! Students must enrol in one of the available weekly Lab sessions.*
- Interactive PC Labs use PLECS software platform to assist with the modelling and design of power electronics converters.

On-campus activities commence in Week 1. Students should contact the Unit convenor as soon as possible if they are unable to get back to campus in time.

PROJECTS

- Project activities take place once a week (Weeks 8-13) according to the Unit schedule.
    - *Note! Teams must enrol in one of the two available weekly Project sessions.*
- The team Project is the core component of this Unit. The Projects cover design and practical aspects of power electronics to be used in future Electrical, Electronics and Mechatronics units.
- Students are required to form teams.
    - *Note! When forming teams, students should agree in which weekly Project session they want to enrol.*
    - *All Project activities are performed in teams;*

TECHNOLOGY

- The laboratory work will rely on the use of PLECS software platform.
- PLECS Standalone software can be downloaded for free from Plexim website and/or or can be used on dedicated Lab PCs.
    - *Note! The PLECS server license will cover only PCs connected to MQ online network.*
    - *Students are encouraged to dowload and install PLECS in their own computer. Licensing instructions on how to obtain a 1-year free version of PLECS will be released by the teaching staff at the start of semester.*
- Each team will be given a hardware kit for the second half of the semester to perform experimental activities.

WEB RESOURCES

- **PLECS support:**
    - https://plexim.com/support
        - PLECS videos
        - Application examples
        - Technical solutions
        - Installation help

LEARNING PORTAL RESOURCES AND VIDEO LINK

UEEIC0040	Solve problems in polyphase electronic power control circuits*	60
UEEIC0042	Solve problems in single phase electronic power control circuits*	

http://highlightcomputergroup4.zoomshare.com/files/Power_Electronics_H025H026_Mod.zip

Power Electronics H025+H026

H025 Operational Amplifier.pdf

H unit **Analogue Electronics**

Analog 1

Analog 2
Power Control Electronics 1

Power Control Electronics 2

Power Control Electronics 3

Power Control Electronics 4

DC Power supplies
H011 Lesson 1 DC Power supply principle.zip

http://youtu.be/S1no7ZshUwA

H011 Lesson 2 Load regulation.zip

http://youtu.be/9yCpkrbJdtQ

H011 Lesson 3 Current limiter.zip

http://youtu.be/fV2cEqYot74

http://youtu.be/qy9TXslvE1E

The links contain the following lessons
H011 Lesson 1 DC Power supply principle
H011 Lesson 2 Load regulation
H011 Lesson 3 Current limiter

H013
Page 378 to 386 of
www.highlightcomputer.com/Video Lessons.pdf
Amplifier
H013 Lesson 1 Amplifier model.zip

http://youtu.be/3kZUZrXytwo

H013 Lesson 2 Amplifier biasing.zip

http://youtu.be/Xk34pnOIgZ4

http://youtu.be/QGGw2_K38BY

H013 Lesson 3 Amplifier configuration.zip

http://youtu.be/PmGrqK94xks

H013 Lesson 4 Amplifier parameters.zip

http://youtu.be/6CivoozCPu4

http://youtu.be/R8TouJvv6OA

H013 Lesson 5 JFET.zip

http://youtu.be/XW1bcn99zZ0

http://youtu.be/yb-qM5jE0Oc

The links contain the following lessons
H013 Lesson 1 Amplifier model
H013 Lesson 2 Amplifier biasing
H013 Lesson 3 Amplifier configuration
H013 Lesson 4 Amplifier parameters
H013 Lesson 5 JFET

Power Electronics I

Page 387 to 403 of
www.highlightcomputer.com/Video_Lessons.pdf
Operational amplifier+ single phase power control equipments
H025 Lesson 1-Differential Amplifier.zip

http://youtu.be/ad_3bdF0zds

http://youtu.be/O5in0xvrnPQ

H025_Lesson_2-Comparator.zip

http://youtu.be/pePuim3kqKQ

H025 Lesson 3-Timer IC.zip

http://youtu.be/KMaFIzaoUm4

http://youtu.be/CbUWCd6fP9A

H025 Lesson 4-Op Amp Circuit 1 & 2.zip

http://youtu.be/wl-jVz30LSc

http://youtu.be/b8pjTG9Om_w

H025 Lesson 5-Op amp characteristics+Band widthe compensation.zip

http://youtu.be/1t6fdXK5i_0

http://youtu.be/Htq19FqAxSA

H025 Lesson 6-Op amp diode characteristics.zip

http://youtu.be/uHkiUpemhPs

H025 Lesson 7-Sine & square wave oscillators.zip

http://youtu.be/lOWhEW2THxw

H025 Lesson 8-Op amp ckt-Integrator+Differentiator.zip

http://youtu.be/3GFksg5MYUU

H025 Lesson 9-Active filter.zip

http://youtu.be/VedHWINE60Q

H025 Lesson 10-Multistage Op amp ckt.zip

http://youtu.be/SpHOroXrQf0

http://youtu.be/_GQzAZw15oM

http://youtu.be/TAwRmz298iM

H025 Lesson 11-Transducers.zip

http://youtu.be/ojsZNBOoX3U

http://youtu.be/7vAOB8pNXhQ

H025 Lesson 12-Introduction to control.zip

http://youtu.be/dr1kfNW0TFc

The links contain the following lessons
H025 Lesson 1-Differential Amplifier
H025 Lesson 2-Comparator
H025 Lesson 3-Timer IC
H025 Lesson 4-Op Amp Circuit 1 & 2
H025 Lesson 5-Op amp characteristics+ Band width compensation
H025 Lesson 6-Op amp diode characteristics
H025 Lesson 7-Sine & square wave oscillators

H025 Lesson 8-Op amp ckt-Integrator+ Differentiator
H025 Lesson 9-Active filter
H025 Lesson 10-Multistage Op amp ckt
H025 Lesson 11-Transducers
H025 Lesson 12-Introduction to control

Power Electronics II

	Electro-mechanical Control

H026+ H & I units in UEE11
Page 404 to 415 of
www.highlightcomputer.com/Video Lessons.pdf
Three phase power control equipments
H026 Lesson 1-Single &Three phase power control.zip

http://youtu.be/fUOIOe4Tdr4

http://youtu.be/J6Ba7ZPFn90

http://youtu.be/fI-3zOB9V7k

H026 Lesson 2-Solid state switching devices.zip

http://youtu.be/FTqNg42TLLw

H026 Lesson 3-Inverter Converter.zip

http://youtu.be/pLbgreYVlsY

http://youtu.be/DfmCM7ZwWFg

H026 Lesson 4-Power Diodes.zip

http://youtu.be/64tr-u8R3Ok

H026 Lesson 5-AC Motor speed control.zip

http://youtu.be/CcNiMMiGpRI

H026 Lesson 6-Current fed inverter.zip

http://youtu.be/3eJSleyBf7w

http://youtu.be/98GMaawtYME

The links contain the following lessons

H026 Lesson 1-Single &Three phase power control
H026 Lesson 2-Solid state switching devices
H026 Lesson 3-Inverter Converter
H026 Lesson 4-Power Diodes
H026 Lesson 5-AC Motor speed control
H026 Lesson 6-Current fed inverter

Analogue Electronics

	Analogue Electronics

H045+ H & I units in UEE11

UEENEEH114A		Troubleshoot resonance circuits in an electronic apparatus
UEENEEH147A		Assess electronic apparatus compliance

Page 416 to 428 of
www.highlightcomputer.com/Video Lessons.pdf
Analogue Electronics
H045 Lesson 1 Op-amp.zip

http://youtu.be/Z5WuKH6IKQE

http://youtu.be/mDmxHibHJC8

H045 Lesson 2 DC Non idealities.zip

http://youtu.be/rnmW34QublU

http://youtu.be/BbDgNqd13ek

http://youtu.be/RYJiLQ32RhY

H045 Lesson 3 Bias compensation.zip

http://youtu.be/QYzuMasWWbg

H045 Lesson 4 Slew rate.zip

http://youtu.be/NERLYuZYVv0

H045 Lesson 5 AC Noise.zip

http://youtu.be/XZKFddOSPTg

H045 Lesson 6 Source noise resistance.zip

http://youtu.be/3_08GpV4P-w

H045 Lesson 7 Signal to noise ratio.zip

http://youtu.be/_pT6i7gYUQU

http://youtu.be/u7ilW7Os-Mc

H045 Lesson 8 Frequency compensation.zip

http://youtu.be/rHz2fwkDPNw

http://www.filefactory.com/file/c39ce16/n/H045_Lesson_8_Frequency_compensation.zip

H045_Lesson_9_Stability_analysis.zip

http://youtu.be/wugrGy-eHD4

H045 Lesson 10 Feedforward compensation.zip

http://youtu.be/XmHxvyCL-Zw

http://youtu.be/PS4TLDPL9GI

The links contain the following lessons
H045 Lesson 1 Op-amp
H045 Lesson 2 DC Non idealities
H045 Lesson 3 Bias compensation
H045 Lesson 4 Slew rate
H045 Lesson 5 AC Noise
H045 Lesson 6 Source noise resistance
H045 Lesson 7 Signal to noise ratio
H045 Lesson 8 Frequency compensation
H045 Lesson 9 Stability analysis
H045 Lesson 10 Feedforward compensation

Resources

- Power Electronics Class Lesson

UEERE0013 Develop strategies to address environmental and sustainability issues in the energy sector

MAPPING STRATEGY

This unit is relevant to UEERE0001 unit of UEE30820. By comparing the Competencies in both units, the resources for UEERE0001 of Energy Space can be used and any Gap can be identified and provided the training and assessment

Those highlighted with Yellow are the same performance criteria common to UEERE0001

Those are not highlighted will need GAP TRAINING.

UEERE0013				UEERE0001
Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Determine environmental and sustainability issues**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	2.1
		1.2	Hazards are identified, WHS/OHS risks are assessed, and control measures and workplace procedures are implemented in preparation for work	1.5
		1.3	Scope of the environmental and sustainability issues are determined from performance specifications,	1.2

UEERE0013				UEERE0001
Elements		Performance criteria		
			situation reports and in consultation with relevant person/s	
		1.4	Activities are planned to meet scheduled timelines in consultation with person/s involved in the work	1.2
		1.5	Strategies are determined, and solutions developed and implemented in accordance with workplace procedures	1.1
2	**Develop environmental and sustainability strategies**	**2.1**	WHS/OHS risk control measures and workplace procedures for carrying out work are followed	Completion of UEECD0024 Fulfil this performance criteria
		2.2	Environmental sustainability principles are applied to develop strategies to address greenhouse gas and sustainability issues	
		2.3	Parameters, specifications and performance requirements in relation to environmental and sustainability issues are determined in accordance with workplace procedures	

UEERE0013				UEERE0001
Elements		Performance criteria		
		2.4	Resolving environmental and sustainability issues is analysed to provide most effective solutions	2.6
		2.5	Unplanned events are dealt with safely and effectively in accordance with regulatory requirements and workplace policies	2.4
		2.6	Quality of work is monitored in accordance with performance agreement and/or workplace procedures or industry standards	2.5
3	**Document environmental and sustainability strategies**	**3.1**	Strategies to resolve environmental and sustainability issues are tested to determine their effectiveness and modified, as required	2.6
		3.2	Adopted strategies are documented and instructions for implementation and risk control measures developed	3.1+3.3
		3.3	Competent person/s required to implement strategies to environmental and sustainability issues are identified and coordinated	2.3

UEERE0013				UEERE0001
Elements		Performance criteria		
			in accordance with regulatory requirements and workplace policies	
		3.4	Justification for strategies used to address environmental and sustainability issues is documented and included in work/project records in accordance with relevant industry standards	3.2

Elements and performance criteria

UEERE0001			
Elements		Performance criteria	
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
1	**Identify sustainable work practice**	**1.1**	Activities are planned, prepared and sequenced to ensure work health and safety (WHS)/occupational health and safety (OHS) policies and workplace procedures are followed in accordance with work requirements
		1.2	Relevant personnel are consulted to ensure work is coordinated effectively with others

UEERE0001			
Elements		Performance criteria	
		1.3	Materials required for the work are obtained and checked in accordance with workplace procedures and compliance with work requirements
		1.4	Location that activities are to be undertaken is determined from job requirements
		1.5	Workplace environmental risks and resource efficiency issues are identified
2	**Apply sustainable work practice**	**2.1**	WHS/OHS policies and workplace procedures for undertaking administrative functions are followed
		2.2	Energy assessment is undertaken in accordance with requirements to implement techniques which produce energy reduction directly or indirectly
		2.3	Approval is obtained for suggested improvements to energy efficient methods and components from relevant person/s before any contingencies are implemented
		2.4	Unplanned events or conditions are responded to in accordance with workplace procedures in a manner that minimises risk to personnel, equipment and environment

UEERE0001			
Elements		Performance criteria	
		2.5	On-going checks of the quality of the work are undertaken in accordance with established procedures
		2.6	Work is carried out efficiently without unnecessary waste of materials or damage to the surrounding environment while using sustainable work practices which minimise wastage of energy and materials either directly or indirectly
3	**Complete workplace documentation**	**3.1**	Documentation/reports are completed to ensure detailed promotional activities requirements are met
		3.2	Suggestions are made to relevant person/s for improvement/s to workplace practices to minimise energy and materials wastage
		3.3	Workplace documentation is completed in accordance with workplace procedures

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:

Elements 1 to 3

• applying problem-solving techniques • applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements • applying sustainable energy principles and practices • dealing with unplanned events/situations in accordance with workplace procedures in a manner that minimises risk to personnel and equipment • determining the extent of the energy sector problems/issues • developing strategies to address environmental and sustainability issues • documenting instruction for implementation of solutions that incorporate risk control measure to be followed • documenting justification of solutions implemented in accordance with professional standards • forming effective strategies for solution development and implementation • obtaining energy system/component parameters, specifications and performance requirements appropriate to each issue.	•

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:	Elements 1 to 3 PLUS Gap Training for 2.2 and 2.3
• common issues/problems in a sustainable energy sector environment	•

- efficient and sustainable energy use and supply, including techniques for reducing the greenhouse gas intensity of energy supply
- environmental and sustainability strategies
- greenhouse best practice in industrial processes and waste management, including types and methods of reducing greenhouse gas emissions from industry
- greenhouse gas emissions profile
- problem-solving techniques
- relevant job safety assessments or risk mitigation processes
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace policies and procedures.

Identified Gaps

2.2 Environmental sustainability principles are applied to develop strategies to address greenhouse gas and sustainability issues

2.3 Parameters, specifications and performance requirements in relation to environmental and sustainability issues are determined in accordance with workplace procedures

Instruction to students

Read the provided literatures

- Environmental Sustainability issues.pdf
- Sustainability Knowledge and Skills Workbook.pdf

Assessment tasks.

Your task

Submit the answers for the questions in

- RE0013 Assessment Questions.pdf

Q 1 to 16 -----for 2.2 Environmental sustainability principles are applied to develop strategies to address greenhouse gas and sustainability issues

Q 17 to 70 ----for 2.3 Parameters, specifications and performance requirements in relation to environmental and sustainability issues are determined in accordance with workplace procedures

Grading Rubric for Written Assignments

Levels of Assessment

Criteria	**Inadequate=D** **(Below Standard)**	**Adequate=C** **(Meets Standard)**	**Above Average=B** **(Exceeds Standard)**	**Exemplary=A** **(Far Exceeds Standard)**
Organization	Writing lacks logical organization. It shows some coherence but ideas lack unity. Serious errors.	Writing is coherent and logically organized. Some points remain misplaced and stray from the topic. Transitions evident but not used throughout essay.	Writing is coherent and logically organized with transitions used between ideas and paragraphs to create coherence. Overall unity of ideas is present.	Writing shows high degree of attention to logic and reasoning of points. Unity clearly leads the reader to the conclusion and stirs thought regarding the topic.
Level of Content	Shows some thinking and reasoning but most ideas are underdeveloped and unoriginal.	Content indicates thinking and reasoning applied with original thought on a few ideas.	Content indicates original thinking and develops ideas with sufficient and firm evidence.	Content indicates synthesis of ideas, in-depth analysis and evidences original thought and support for the topic.
Development	Main points lack detailed development. Ideas are vague with little evidence of critical thinking.	Main points are present with limited detail and development. Some critical thinking is present.	Main points well developed with quality supporting details and quantity. Critical thinking is weaved into points	Main points well developed with high quality and quantity support. Reveals high degree of critical thinking.

Grammar & Mechanics	Spelling, punctuation, and grammatical errors create distraction, making reading difficult; fragments, comma splices, run-ons evident. Errors are frequent.	Most spelling, punctuation, and grammar correct allowing reader to progress though essay. Some errors remain.	Essay has few spelling, punctuation, and grammatical errors allowing reader to follow ideas clearly. Very few fragments or run-ons.	Essay is free of distracting spelling, punctuation, and grammatical errors; absent of fragments, comma splices, and run-ons.
Style	Mostly in elementary form with little or no variety in sentence structure, diction, rhetorical devices or emphasis.	Approaches college level usage of some variety in sentence patterns, diction, and rhetorical devices.	Attains college level style; tone is appropriate and rhetorical devices used to enhance content; sentence variety used effectively.	Shows outstanding style going beyond usual college level; rhetorical devices and tone used effectively; creative use of sentence structure and coordination
Format	Fails to follow format and assignment requirements; incorrect margins, spacing and indentation; neatness of essay needs attention.	Meets format and assignment requirements; generally correct margins, spacing, and indentations; essay is neat but may have some assembly errors.	Meets format and assignment requirements; margins, spacing, and indentations are correct; essay is neat and correctly assembled.	Meets all formal and assignment requirements and evidences attention to detail; all margins, spacing and indentations are correct; essay is neat and correctly assembled with professional look.

The candidate must achieve Minimum of “C” Grade to achieve Competent in this unit.

UETDREL005 Work safely in the vicinity of live electrical apparatus

This unit is pre-requisite unit for UETDRIS033.

The knowledge and performance evidence can be concurrently delivered and assessed with URTDRIS032 and UETDRIS033

But safety practice aspect are emphasized for this unit as follows.

Elements and Performance Criteria

ELEMENTS	PERFORMANCE CRITERIA
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1 Prepare to work safely in the vicinity of live electrical apparatus	**1.1** Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be performed are referred to and confirmed http://www.iqytechnicalcollege.com/Codes of Practice _ Safe Work Australia.pdf
	1.2 Plant, tools, equipment and personal protective equipment (PPE) required for work are determined, obtained and confirmed in working order www.iqytechnicalcollege.com/IC-Electrical-Work-Plan-8538-PDF.pdf http://www.iqytechnicalcollege.com/Personal protective equipment (PPE) _ WorkSafe.qld.gov.au.pdf www.iqytechnicalcollege.com/Electrical Installation Materials.pdf
	1.3 Hazards are identified, risks assessed and control measures identified and applied www.iqytechnicalcollege.com/mcop-managing-electrical-risks_in_the_workplace-v1.pdf

	1.4	Work permits are received and signed in accordance with workplace requirements www.iqytechnicalcollege.com/Electrical-Work-Permit.PDF
	1.5	Safe approach distances for the work to be performed are determined and confirmed in accordance with workplace requirements www.iqytechnicalcollege.com/overhead-underground-electric-lines-general-guide.pdf www.iqytechnicalcollege.com/Work-near-overhead-power-lines-code-of-practice.pdf
	1.6	Safety observer role and responsibilities are discussed and confirmed in accordance with workplace requirements www.iqytechnicalcollege.com/electrical-system-safety-rules-20201222.pdf
	1.7	Communication method between the workers and safety observer is determined and confirmed in accordance with workplace requirements http://www.iqytechnicalcollege.com/10 Ways to Communicate Safety Standards at Your Company.pdf
	1.8	Worksite is prepared in accordance with the work plan and workplace requirements www.iqytechnicalcollege.com/IC-Electrical-Work-Plan-8538-PDF.pdf
2 Work safely in the vicinity of live electrical apparatus	**2.1**	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be performed are applied and monitored http://www.iqytechnicalcollege.com/Codes of Practice _ Safe Work Australia.pdf
	2.2	Lifting, working at heights and the use of plant, tools and equipment are carried out in accordance with workplace requirements http://www.iqytechnicalcollege.com/electricaltrade2022.htm#E101A

	2.3	Hazard control measures are monitored in accordance with workplace requirements http://www.iqytechnicalcollege.com/electricaltrade2022.htm#E101A
	2.4	Safety observer is positioned to observe the work in accordance with workplace requirements www.iqytechnicalcollege.com/electrical-system-safety-rules-20201222.pdf
	2.5	Communication methods between workers and safety observer are used in accordance with workplace requirements http://www.iqytechnicalcollege.com/10 Ways to Communicate Safety Standards at Your Company.pdf
	2.6	Safe approach distances are maintained when the work is being performed in the vicinity of live electrical apparatus www.iqytechnicalcollege.com/overhead-underground-electric-lines-general-guide.pdf www.iqytechnicalcollege.com/Work-near-overhead-power-lines-code-of-practice.pdf
	2.7	Incidents or unplanned events are responded to in accordance with workplace requirements http://www.iqytechnicalcollege.com/mcop-managing-electrical-risks_in_the_workplace-v1 (1).pdf
3 Complete work and documentation	**3.1**	Incidents or unplanned events are reported in accordance with workplace requirements http://www.iqytechnicalcollege.com/mcop-managing-electrical-risks_in_the_workplace-v1 (1).pdf www.iqytechnicalcollege.com/Guidelines for emergency equipment management.pdf
	3.2	Work permits are signed off in accordance with workplace requirements www.iqytechnicalcollege.com/7b0aea25-17b0-4f21-af01-2c6de6065eba.pdf
	3.3	Worksite is rehabilitated, cleaned and made safe in accordance with workplace requirements

http://www.iqytechnicalcollege.com/KeepConstructionSiteSafe.pdf

3.4 Plant, tools and equipment are cleaned, checked and returned to storage in accordance with workplace requirements

http://www.iqytechnicalcollege.com/KeepConstructionSiteSafe.pdf

3.5 Work records, reports and documentation are completed in accordance with workplace requirements

www.iqytechnicalcollege.com/CCEW_template.pdf

VIDEO

https://www.youtube.com/watch?v=wal2KP1bbIY

https://www.youtube.com/watch?v=hLbMk4UyvmE

https://www.youtube.com/watch?v=StHT-MCitmY

https://www.youtube.com/watch?v=fllM_4G-W-I

https://www.youtube.com/watch?v=WNot2owIv8c

https://www.worksafe.qld.gov.au/resources/videos/films/electrical-safety-for-apprentices

https://www.safeworkaustralia.gov.au/resources-and-publications/video-and-audio/electrical-safety-protecting-you-and-your-workmates

https://www.safework.nsw.gov.au/hazards-a-z/electrical-and-power/electrical-work

https://esv.vic.gov.au/campaigns/never-work-live/

https://www.youtube.com/watch?v=StHT-MCitmY

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all requirements of the elements and performance criteria on at least two separate occasions and include:

• applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements, including:
  • work health and safety (WHS)/occupational health and safety (OHS)
• identifying hazards, assessing risks, identifying, applying and monitoring control measures
• obtaining, inspecting and using relevant personal protective equipment (PPE)
• determining communication method with safety observer
• confirming safety observer is in position in accordance with workplace requirements
• determining electricity network voltages, including:
  • low voltage (LV)
  • high voltages (HV):
  • distribution
  • sub-transmission
  • transmission
• identifying electricity network assets
• determining and confirming safe approach distances
• performing work while maintaining the personal safe approach distance
• obtaining and signing on and off relevant work permits in accordance with workplace requirements
• dealing with an unplanned event on at least one (1) occasion
• completing relevant work records, reports and documentation.
	• Performance Elements 1 to 3 as above

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• relevant legislation, regulations standards, codes of practice and organisational workplace requirements, including:
  • WHS/OHS
  • safe approach distances
  • emergency procedures
• hazard, risk assessment and risk control requirements, including potential hazards
• types and application of PPE
• safe use of tools and equipment
• application, purpose and types of permits
• events constituting an unplanned event or incident
• procedures for responding to an unplanned event or incident
• safety observer:
  • role and responsibilities
  • communication methods
• basic electrical principles, including:
  • voltage, current and resistance
  • typical effects of current, including physiological effects and induced voltages
  • consequences of short circuits, including arc flash and touch and step potentials
• electricity networks, including:
  • LV
  • HV:
  • distribution
  • sub-transmission
  • transmission
  • earthing systems
	Concurrently delivered and assessed as per TAS of UETDRIS032 and UETDRIS033

• associated assets • layouts and configuration • basic protection • relationship between an overhead and underground supply system • terminology related to working safely in the vicinity of live electrical apparatus.	

Assessment M ing Tem l te

(stre mlined tr ining ck ge)

This tem ate to e used for "new" endorsed stream ined training ackages.

Instructi n f r use These instructi ns in RED sh uld be deleted fr m the c mpleted d cument. Instructi ns in **BLUE** sh uld be written ver with appr priate inf rmati n.

This template is t be c mpleted by the assessment devel per t ensure the assessments meet the training package requirements f r the unit f c mpetency.

It must be used during the assessment validati n pr cess.

Rec rd f this d cument must be retained in the faculty TAS teamshare teaching secti n.

Add r ws and c lumns as required bel w.

This document should be viewed concurrently with IS71 Assessment M ing. df

F culty:	C nstructi n, Engineering & Transp rt (CET)	**College:**	
Te ching Section:	Electrical Engineering		
Qu lific tion Number nd N me:	Advanced Dipl ma f Engineering Techn l gy-Electrical/ Advanced Dipl ma f Electrical Engineering		
Unit of Com etency Number nd N me:	**UETTDRIS71A Di gnos nd r ctify f ults in l ctric l n rgy supply tr nsmission syst ms**		

Copy nd p st th following t bl for ch l m nt s r quir d

Elements & Perform nce Criteri			Assessment event(s)		
Element(s)	**PC No**	**Perform nce Criteri (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Pr ctic l & Observ tion**	**Assessment event 3 Assignment**
1 Pr p r to di gnos nd r ctify f ults. Work p rform nc	1.1	OHS proc dur s for giv n work r r id ntifi d, obt in d nd und rstood	Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 3 - Q15+16		
	1.2	OHS risk control m sur s nd proc dur s in pr p r tion for th work r follow d	Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 3 - Q17+18 P g 4 Q21+22		
	1.3	Th lik ly xt nt of work to b und rt k n is nvis g d from r ports nd/or discussions with ppropri t p rson(s)	Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 2 Q12)		
	1.4	Th xt nt of f ults is d t rmin d from r ports nd oth r docum nt tion nd from discussion with ppropri t p rsonn l.	Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 203) Q21 to 23		

Elements & Perform nce Criteri			Assessment event(s)		
Element(s)	**PC No**	**Perform nce Criteri (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Pr ctic l & Observ tion**	**Assessment event 3 Assignment**
	1.5	Appropri t p rsonn l r consult d to nsur th work is coordin t d ff ctiv ly with oth rs involv d on th work sit .			Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 150) Q 23 t 25
	1.6	Tools, quipm nt nd t sting d vic s n d d to di gnos f ults r obt in d in ccord nc with st blish d proc dur s nd ch ck d for corr ct op r tion nd s f ty		**EP1,EP2,EP3 EP4**	Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 153) Q 41 t 47
2.Di gnos nd r ctify f ults.	2.1	OHS risk control m sur s nd proc dur s for c rrying out th work r follow d.	As p r 1.3		
	2.2	Th n d to t st or m sur liv is d t rmin d in strict ccord nc with OHS r quir m nts nd wh n n c ss ry conduct d within st blish d s f ty proc dur s			Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 149) Q 13 to 20
	2.3	Circuits/m chin s/pl nt r ch ck d s b ing isol t d wh r n c ss ry in strict ccord nc OHS r quir m nts nd proc dur s	Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 147) Q 1 to 10		
	2.4	Logic l di gnostic m thods r ppli d to di gnos l ctric l n rgy tr nsmission syst m f ults mploying m sur m nts nd stim tion of syst m op r ting p r m t rs r f r nc d to syst m op r tion l r quir m nts.		**F ult finding ctivities**	Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 129) Q 64 to 70

Elements & Perform nce Criteri			Assessment event(s)		
Element(s)	**PC No**	**Perform nce Criteri (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Pr ctic l & Observ tion**	**Assessment event 3 Assignment**
	2.5	Susp ct d f ult sc n rios r t st d s b ing th sourc of syst m probl ms.			As ab ve
	2.6	Sourc of th f ult is id ntifi d nd ppropri t ly comp t nt p rsons r ng g d to r ctify th f ult wh r it is outsid th scop of th control syst m			As ab ve
	2.7	F ults in th syst m compon nts r r ctifi d to r is l ctric l n rgy tr nsmission syst m to its op r tion st nd rd.			Advan ed Dipl ma in Ele t i al Enginee ing Exe ises Page 211) Q 50 to 54
	2.8	Syst m is t st d to v rify th t it op r t s s int nd d nd to sp cifi d r quir m nts.			As ab ve
	2.9	D cisions for d ling with un xp ct d situ tions r m d from discussions with ppropri t p rsons nd job sp cific tions nd r quir m nts			As ab ve
	2.10	Meth ds f dealing with unexpe ted situati ns a e sele ted n the basis f safety and spe ified work outcom s		Fault finding activities Page 13 f IS71 Assessment Mapping.pdf	
	2.10	Diagn sis and e tifi ati n a tivities a e a ied ut effi iently with ut unne essa y waste f mate ials damage t system and the su unding envi nment se vi es and using sustainable ene gy p a ti es.		As ab ve	
3. C mplete and rep rt fault diagn sis and	3.1	OHS w rk c mpleti n risk c ntr l measures and pr cedures are f ll wed.	As p r 1.3		

Elements & Perform nce Criteri			Assessment event(s)		
Element(s)	PC No	Perform nce Criteri (PC)	Assessment event 1 Written Test	Assessment event 2 Pr ctic l & Observ tion	Assessment event 3 Assignment
rectificati n activities.					
	3.2	W rk site is made safe in acc rdance with established safety pr cedures.	As p r 1.3		
	3.3	Rectificati n f faults is d cumented in acc rdance with established pr cedures.		Fault finding activities Page 14 t 20 f IS71 Assessment Mapping.pdf	
	3.4	Appr priate pers n r pers ns n tified, in acc rdance with established pr cedures, that the system faults have been rectified.		Fault finding activities Page 14 t 20 f IS71 Assessment Mapping.pdf	

Add r ws t the f ll wing table as required

Perform nce Evidence	Assessment event 1 Written Test	Assessment event 2 Pr ctic l & Observ tion	Assessment event 3 Assignment
Receiving end v ltage c mparis n between sh rt/ medium and l ng transmissi n lines		EP1	
L ng transmissi n line PI equivalent circuit Investigati n		EP2	
L ng transmissi n line T equivalent circuit Investigati n		EP3	
Finding Transmissi n line efficiency/ Transf rmer effect n line efficiency		EP4	
Reactive p wer and p wer fact r impr vement		EP5	

Add rows to th following t bl s r quir d

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Pr ctic l & Observ tion	Assessment event 3 Assignment
<Insert kn wledge evidence >	**Insert question number or t sk skill number** fr m assessment t l that address the specific, kn wledge evidence.	**Insert question number or t sk skill number** fr m assessment t l that address the specific, kn wledge evidence.	**Insert question number or t sk skill number** fr m assessment t l that address the specific, kn wledge evidence.
T1 Overview f the transmissi n system	Advanced Dipl ma in Electrical Engineering Exercises Page 153) Q 41 t 47		
T2 The principles inv lved in high v ltage a.c. transmissi n			Advanced Dipl ma in Electrical Engineering Exercises Page 149) Q 16 t 18
T3 The principles inv lved in d.c. transmissi n	Advanced Dipl ma in Electrical Engineering Exercises Page 147) Q 5 t 7		
T4 The principles f perati n, v ltage and current range, breaking capacity and field f use			Advanced Dipl ma in Electrical Engineering Exercises Page 147) Q 10 t 12
T5 The types f is lat rs in use			Advanced Dipl ma in Electrical Engineering Exercises Page 147) Q4
T6 Circuit breaker auxiliary systems			Advanced Dipl ma in Electrical Engineering Exercises Page 123) Q 1 t 4

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Pr ctic l & Observ tion	Assessment event 3 Assignment
T7 The characteristics f lines and cables			Advanced Dipl ma in Electrical Engineering Exercises Page 117) Q 1 t 5 Q 24 t 30
T8 C ntr l f v ltage. C nditi ns leading t v ltage c llapse			Advanced Dipl ma in Electrical Engineering Exercises Page 117) Q 40 t 43
T9 Range f devices c vered by SVCs	Advanced Dipl ma in Electrical Engineering Exercises Page 132) Q 19 t 21		
T10 Imp rtance f the l cati n in the system f v ltage c ntr l devices			Advanced Dipl ma in Electrical Engineering Exercises Page 122) Q 23 t 44
T11 Use f graphical meth ds t calculate the size f VAr regulating plant			Advanced Dipl ma in Electrical Engineering Exercises Page 131) Q 19 t 21
T12 Types f c mmunicati n systems including teleph ne, p wer line carrier,			Advanced Dipl ma in Electrical Engineering Exercises Page 132) Q 23 t 37
T13 Transient ver-v ltages in p wer systems	Advanced Dipl ma in Electrical Engineering Exercises Page 131) Q 14 t 18		
T14 Fact rs leading t the generati n f c r na.			Advanced Dipl ma in Electrical Engineering Exercises Page 130) Q 5 t 12

Add r ws t the f ll wing table as required

Assessment Conditions	Assessment	Assessment	Ass ssm nt

	event 1 Written Test	event 2 Pr ctic l & Observ tion	event 3 Assignment
Gather evidence t dem nstrate c nsistent perf rmance in c nditi ns that are safe and replicate the welectrical w rksh p K2.11. Applicati n f safe w rking practice & regarding the h usekeeping rules are t be bserved. Emergency pr cedures are t be inf rmed. Safety equipments & first aids equipments are t be available. The students get the access t • Relevant practical equipments Rec rds relating t electrical engineering res urces	Test 1 + 2	Practical EP1 t 5	All assignments

Cre ted by (N me)		**D te cre ted**	
A roved by (N me)		**D te roved**	
Sign ture		**D te modified**	

UETTDRIS71A Di gnos nd r ctify f ults in l ctric l n rgy supply tr nsmission syst ms

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

(1) Delive & olle tion of eviden e

1 Pr p r to di gnos nd r ctify f ults. Work p rform nc

1.1 OHS proc dur s for giv n work r r id ntifi d, obt in d nd und rstood R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 3 -Q15+16 www. l ctric ldiplom 2013.w bs.com Th n cc ss

Click **HERE** to downlo d th Ex rcis s

http://www.mongroupsydn y1.com/Adv nc d Diplom in El ctric l Engin ring Ex rcis s EE011.pdf

R l v nt Instruction L ssons

Study Option (1)
Guided study (Online)Res urces+Online exercises+Online Practicals

Click HERE

&

Youtub Vid os for El ctric l Engin ring L ssons

http://www.mongroupsydn y1.com/youtub vid os.htm

Q1.D scrib th risks nd d ng rs in pow r st tion nd outlin th r comm nd d s f ty

Q2. quipm nts nd m rg ncy proc dur s.

Q3.Outlin th proc ss of m int n nc work in subst tion.

1.2 OHS risk control m sur s nd proc dur s in pr p r tion for th work r follow d

R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 3 -Q17+18 P g 4 Q21+22

Q4. Writ down th ch ck list to p rform th t sks in subst tion.

Q5. Writ down th s f ty proc dur s nd m thods to ss ss th risk nd to r duc th risk.

Q6..Writ down th cod of pr ctic for working n r xpos d m in nd pp r tus.

Q7.Which pr c utions r to b mph siz d wh n working in subst tion?

1.3 Th lik ly xt nt of work to b und rt k n is nvis g d from r ports nd/or discussions with ppropri t p rson(s)

Q8. Writ down th risk r duction proc dur s in m int n nc work to discuss with work m n g r. (R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 2 Q12)

1.4 Advic is sought from th work sup rvisor to nsur th work is coordin t d ff ctiv ly withoth rs.

Answ r th following qu stions to s k th dvic from work sup rvisor in th following sp cts.

Q9. Wh t r th risks?

Q10.How r th risks cl ssifi d?

Q12.How c n th risk b v lu t d?

Q12.How will you m n g th risk? R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 2 Q8 to 11)

1.4 Th xt nt of f ults is d t rmin d from r ports nd oth r docum nt tion nd from discussion with ppropri t p rsonn l.

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Positiv , n g tiv nd z ro s qu nc

Slid 1+2+3+4

Q21.Z1= 20% Z2= 15% 200 VA b s A to B f ult t 33KV Find f ult curr nts.
Slid 5

Q22.Z1 = 5% Z2 = 10% Zo = 20%, 200 VA 132 KV lin to ground f ult. Find
f ult curr nt. Slid 6+7+8

Q23. Z1 = 70% Z2= 70% Zo = 30 % B s VA = 200 VA E = 66KV 2 Lin to
ground f ult. C lcul t f ult curr nt.

1.5 Appropri t p rsonn l r consult d to nsur th work is coordin t d ff ctiv ly with
oth rs involv d on th work sit .

1.6 Tools, quipm nt nd t sting d vic s n d d to di gnos f ults r obt in d in ccord nc
with st blish d proc dur s nd ch ck d for corr ct op r tion nd s f ty

R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 150)

Slid 15+16+17

Q23.A thr ph s 66KV lin is supplying 500 KW t 0.85 PF l gging. Lin r sist nc , inductiv
r ct nc nd c p citiv r ct nc r 1Ω, 4Ω nd 3000Ω r sp ctiv ly. C lcul t th s nding nd
volt g by using quiv l nt Pi circuit.

Slid 18+19

Q24. Wh t f ctors r to b consid r d for pow r syst m pl nning.

Slid 20+21

Q25.A sum of $2000 is inv st d t 5% for 15 y rs t compound int r st.

C lcul t th sum t th nd of 15 y rs

If inst d of lump sum t th nd of 15 y rs, th lo n of $2000 is to b p id by th
fix d round ch y r, c lcul t th nnu l mount.

R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 153)

Slid 1+2+3

Q41.Wh t is tr nsmission lin . Expl in th compon nts of it.

Slid 4_6

Q42.Expl in m ximum tr nsf r of l ctric l n rgy.

Slid 5+7+8

Q43.Expl in surg imp d nc lo ding.

Slid 9

Q44.D scrib long nd short tr nsmission lin s.

Slid 10+11+12+13

Q45.Expl in ( )Prop g tion const nt (b) Lin mod l & SIL

Slid 14+15

Q46.Writ th qu tions to c lcul t compl x pow r.

Slid 16

Q47.Wh t r th diff r nc b tw n b l nc d lin & unb l nc lin .

Loc tion of Evid nc s (T bl 1)

P rformnc Crit ri	Abov	Loc tion of Evid nc s
rking Guid / Ass ssm nt Cov r/ F db ck own r cord		
Stud nts' work in own	Summ tiv Ass ssm nt- Form l	

r cord	T sts	
	Form tiv Ass ssm nt/Pr ctic l+ Cl ss works	

2 Di gnos nd r ctify f ults.

2.1 OHS risk control m sur s nd proc dur s for c rrying out th work r follow d.

As p r 1.3

2.2 Th n d to t st or m sur liv is d t rmin d in strict ccord nc with OHS r quir m nts nd wh n n c ss ry conduct d within st blish d s f ty proc dur s.

R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 149)

Pow r f ctor conn ction

Slid 1+2+3+4+5+6+7

Q13.Wh t is pow r f ctor. Wh t r th ff cts of poor pow r f ctor

Q14.Four thr ph s 415V 50HZ lo ds r conn ct d tog th r in n industri l inst ll tion. D t rmin ( ) Tot l lo d (b) Tot l pow r f ctor (c) Th v lu of c p citor r quir d PF to 0.98 Slid 8+9

Q15.A lo d with PF 0.7 l gging dissip t s 1500W from 240V , 50HZ supply. It is r quir d to corr ct th PF to 0.95 l gging. Find ( ) Th origin l nd fin l curr nts (b) Th v lu of th compon nt to b dd d in p r ll l with th origin l lo d to chi v th r quir d PF corr ction.

Ov rh d tr nsmission lin

Slid 1+2

Q16.Sk tch T nd Pi quiv l nt circuits of tr nsmission lin nd v ctor di gr m.

Slid 3+4

Q17.Sk tch two ports n twork quiv l nt circuit nd writ th qu tion.

Slid 5

Q18.By doing op n circuit t st nd short circuit t st for p r ll l lin mod l, th following v lu s r obt in d.

OCT—Vs= 12V , Vr=12.5V Is = 0.1 mp

SCT---Vs = 13V, Ir = 0.4A Is = 0.48 mp

Find th g n r liz d qu tion

Slid 6

Q19.Sk tch pow r tr nsform r prot ction circuit.

Slid 7

Q20.Sk tch r clos r

2.3 Circuits/m chin s/pl nt r ch ck d s b ing isol t d wh r n c ss ry in strict ccord nc OHS r quir m nts nd proc dur s.

R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 147)

Slid 1+2+3

Q1.Comp r th copp r w ight of 3 ph s 3 wir s syst m & simpl dc syst m

Slid 4+5

Q2.Expl in volt g v ri tions in pow r syst m

Slid 6

Q3.Sk tch induction motor & synchronous motor

Slid 7

Q4.Expl in th compon nts of circuit br k r

R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 148)

R fl ction in tr nsmission lin

Slid 1+2+3+4+5

Q8.A 60Ω tr nsmission lin conn ct d to lo d imp d nc 100+j70 Ω. Th forw rd R S v lr siu on lin is 30V. Lin imp d nc is 30Ω

C lcul t ( ) Pow r d liv r d to r sist nc p rt of lo d imp d nc

R S curr nt in imp d nc , r fl ct d w v volt g

P k volt g forw rd & b ckw rd w v

Volt g st nding w v r tio (VSWR)

R turn loss in

d cib l Slid 6

Q9.Expl in th imp ct of switching in pow r lin

Slid 7+8+9+10

Q10.A coil of 20H induct nc nd 10Ω r sist nc is conn ct d in p r ll l with 30Ω r sistor cross 150V dc supply which is sudd nly disconn ct d.

Find

Initi l r t ch ng of curr nt ft r switching

Th volt g cross 30Ω r sistor initi lly ft r 0.4 s c

Th volt g cross th switch cont cts t th inst nc of s p r tion

Th r t t which th coil is losing stor d n rgy 0.3 s c ft r switching

2.4 Logic l di gnostic m thods r ppli d to di gnos l ctric l n rgy tr nsmission syst m f ults mploying m sur m nts nd stim tion of syst m op r ting p r m t rs r f r nc d to syst m op r tion l r quir m nts.

2.5 Susp ct d f ult sc n rios r t st d s b ing th sourc of syst m probl ms.

2.6 Sourc of th f ult is id ntifi d nd ppropri t ly comp t nt p rsons r ng g d to r ctify th f ult wh r it is outsid th scop of th control syst m.

R f-Adv nc d Diplom in El ctric l Engin ring Ex rcis s P g 129)

To d t rmin th qu lity of th op r tion l st tus of prot ction syst m, it n ds to nsur r l y op r tion s qu nc , th s qu nti l r l y prot ction syst m nd ch r ct ristics r to b inv stig t d. Th following ctiviti s nd qu stions provid this comp t ncy.

(32)Ov r curr nt & rth f ult prot ction , Dir ction l prot ction, op r ting ch r ct ristics Slid 1

Q64.Sk tch th di gr m of ov r curr nt prot ction

Slid 2

Q65.Sk tch rth f ult r l y prot ction di gr m.

Slid 3

Q66.Sk tch th combin d ov r curr nt nd rth f ult prot ction nd xpl in it's op r tion.

Slid 4

Q67.Expl in th op r tion of dir ction l r l y with di gr m.

Slid 5+6+7+8

Q68.Loc t dir ction l & non dir ction l l m nts in ring syst m.

Slid 9+10

Q69.Sk tch th conn ction di gr m of combin tion l prot ction sch m th t cont ins two ov r curr nt r l ys nd on rth f ult r l y to provid ph s to ph s nd ph s to rth prot ction.

Slid 11

Q70.How will you djust d finit minimum tim point on r l y curv ?

2.7 F ults in th syst m compon nts r r ctifi d to r is l ctric l n rgy tr nsmission syst m to its op r tion st nd rd.

2.8 Syst m is t st d to v rify th t it op r t s s int nd d nd to sp cifi d r quir m nts.

2.9 D cisions for d ling with un xp ct d situ tions r m d from discussions with ppropri t p rsons nd job sp cific tions nd r quir m nts.

Ref-Advan ed Dipl ma in Ele t i al Enginee ing Exe ises Page 211)

Change nt l
Slide 1
Q50.Des ibe the ve view f hange nt l system.
Slide 2
Q51.Explain the establishment f nt a ts
Slide 3
Q52.Outline the p je t nt l system esp nding the distu ban es.
Slide 4
Q53.Sket h the p edu e f p epa ing quality
manual. Slide 5+6
Q54.Explain management leade ship.

Work erform nce + Pr ctic l Instruction B ck u

Click HERE t d wnl ad practicals

R f r Pow r Syst m Pr ctic ls

P rt 1: Op r tion l Study

L bN No	me of Pr ctic l	Equi ments	Assessment
	G oup 1 Powe & Line		
EP1	Receiving end v ltage c mparis n between sh rt/ medium and l ng transmissi n lines	distribution syst m typ s	Circuit interpretati n, c nnecti n, data c llecti n, calculati n, graph sketch, rep rt presentati n, c nclusi n
EP2	L ng transmissi n line PI equivalent circuit	ov rh d syst ms	As ab ve
EP3	L ng transmissi n line T equivalent circuit	distribution syst m typ s	As ab ve
EP4	Transmissi n line efficiency/ Transf rmer effect n line efficiency	n rgy m t ring • d m nd m t rs	As ab ve
EP5	Reactive p wer and p wer fact r impr vement	n rgy m t ring • d m nd m t rs	As ab ve
EP6	PF effect n line current	n rgy m t ring • d m nd m t rs	As ab ve
EP7	C r na Vide	• surg prot ction	Rep rt presentati n, c nclusi n
EP8	Phase sequence measurement		C mpetency assessment
	GROUP 2- P ote tion equipments		
EP9C	nnecti n f relay pr tecti n scheme & pr tective equipments by using ne line diagram (Circuit interpreting & c nnecti n c mpetency devel pment with ut electrical supply)	prot ction quipm nt nd syst ms	C mpetency assessment

EP10	Current transf rmer & p tential transf rmer c nnecti n & rati test	curr nt tr nsform rs • pot nti l tr nsform rs	Circuit interpretati n, c nnecti n, data c llecti n, calculati n, graph sketch, rep rt presentati n, c nclusi n
EP11	Over current relay characteristics	prot ction quipm nt nd syst ms • ov r-curr nt prot ction	Circuit interpretati n, c nnecti n, data c llecti n, calculati n, graph sketch, rep rt presentati n, c nclusi n
EP12	Electr nic relay test	conv ntion l r l ys • l ctronic r l ys	As ab ve
EP13	Study f vari us pr tective relays used in industry thr ugh trade references	• rth f ult prot ction • diff r nti l prot ction busb r prot ction • surg prot ction • conv ntion l r l ys	Research, rep rt presentati n
	Grou 3 Su ly System		
EP19	Undergr und cable capacitance test	und rground syst ms	Circuit interpretati n, c nnecti n, data c llecti n, calculati n, graph sketch, rep rt presentati n, c nclusi n
EP20	High tensi n line design	• ov rh d syst ms	Design pr ject
EP21	Line insulat r test & capacitance grading	• ov rh d syst ms	Circuit interpretati n, c nnecti n, data c llecti n, calculati n, graph sketch, rep rt presentati n, c nclusi n
EP22	V ltage pr file chart f distributi n system	• volt g r gul tion quipm nt • on lo d t p ch ng rs	As ab ve
EP23	L ad centre-P wer l ss c mparis n	• distributor quipm nt	As ab ve

EP30	Transf rmer p larity test	• distributor quipm nt	As ab ve
EP42	Maximum p wer transfer the rem with p wer circuit	• lo d control	As ab ve
EP43	L ad fl w study	• lo d control	As ab ve
EP45	Trade reference study, switch b ard, busbar, insulat r, circuit breakers	r clos rs / s ction lis rs.	As ab ve

2.10 Meth ds f dealing with unexpe ted situati ns a e sele ted n the basis f safety and spe ified w k ut mes.

2.11 Diagn sis and e tifi ati n a tivities a e a ied ut effi iently with ut unne essa y waste f mate ials damage t system and the su unding envi nment se vi es and using sustainable ene gy p a ti es.

Gener l f ults including: o en circuit; short circuit; incorrect connections; insul tion f ilure; uns fe condition; r tus/com onent f ilure; rel ted mech nic l f ilure for the equi ments in the r nge

Ex lore some of the f ults in ower system/ energy su ly th t c n be rectified only by utilizing r rofession l knowledge b ckground nd how the rr nged simul ted r ctic l c n rovide the h nd on ex erience nd work erform nce for the students nd how it is different from the erform nce only b sed on tr de level ctivities.

In range f perf rmance, it utlines the real equipments used in the industry. There will be the arguments that the setting f practical in lab r m nly includes rhe stat, resist r, varic, capacit r etc. H w it meets the utlined c mpetencies?

T exactly find ut and rectify the faults in energy supply system , the tasks and c mplexity level m re than the trade level- (check the c ntinuity, check the c nnecti n, visual inspecti n, testing and measurement)will be included.

The f ll wing is the vari us p wer system faults which l draw ut fr m my p wer engineer w rk rec rds that the technical knowl dg high r th n tr d l v l is r quir d to succ ssfully r ctify th f ult nd d t rmin th ppropri t solutions. In th t bl , I summ riz how th f ult is , c us d, b ckground th ory, how th p rson who knows th th ory will do, how th p rson who do s not know th th ory will do nd how my simul t d pr ctic l / nd pr ctic l r l t d b ckground th ory will ssist to d v lop th f ult finding skill.

Ty ic l f ult	C use	Rel ted Theory	How the erson who does not know the theory will do	How the erson who knows theory will do	N me of simul ted r ctic l	How to develo the skill
(1)In reticulati n system, there is abn rmally different in v ltages	Abn rmal resistance. Wr ng cable selecti n. Abn rmal circuit c nfigurati n	V ltage pr file chart.	May give he ther idea t change the l ad	Measure v ltage, sketch the v ltage pr file chart. Then identify the p rti n f the circuit.	EP 23 V ltage pr file chart	Devel p the analytical skills t identify the fault p int
(2)Line c nduct r slips fr m the pin insulat r	Line deviati n is t high, c mbinati n f wind, c nduct r tensi n will take away the c nduct r fr m pin insulat r	Line deviati n angle calculati n	Will reinstall the line. After s me peri d, he same thing will happen again	Will examine line deviati n angle. Tensi n, wind f rce. Will rearrange the line r pr vide shackle insulat r	The ry instructi n. Line deviati n	Devel p the pr blem s lving skill n line c nstructi n.
(3)C nduct r sag t l w. Hit by traffic and then br ken	Sag calculati n. Wr ng tensi n, safety fact r, weight	Sag/ line design	Pull up the cable. After s me time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tensi n Line Design	Devel p the skill n line design and t kn w the technical fact rs f r sag.
(4)Discharge current fl ws ut fr m undergr und insulat r and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think ab ut current fl w, leakage etc.	Will examine the UG cable capacitance and pr duce the pr cedure f r discharging	EP 19 Undergr und cable capacitance test	Devel p the skill in UG cable testing f cus n capacitance and estimate the am unt f charging current
(5)Line p le br ken with ut natural disaster	In appr priate p le strength	P le mechanical design	Will erect the p le. S me time after, br ken gain	Will examine he tensi n, wind f rce, c nduct r weight, then will calculate the p le strength and select appr priate diameter f p le and appr priate p le material	P le mechanical design less n + EP 20 High tensi n line design	Devel p the skill n line design and t kn w the technical fact rs f r p le.

Loc tion of Evid nc s (T bl 1)

1 C mplete and rep rt fault diagn sis and rectificati n activities.

1.1 OHS w rk c mpleti n risk c ntr l measures and pr cedures are f ll wed.

3.2 W rk site is made safe in acc rdance with established safety pr cedures.

As per 1.3

3.3 Rectificati n f faults is d cumented in acc rdance with established pr cedures.

3.4 Appr priate pers n r pers ns n tified, in acc rdance with established pr cedures, that the system faults have been rectified.

F ult	Re son	Rel ted theory	The erson who does not know the theory will do	The erson who knows the theory will do	Rel ted Pr ctic l	Develo ment of skill
(6)There are t much p wer l ss. Line efficiency is p r	If all c nnected l ads are all right, wr ng l cati n f p wer stati n/ l ad centre	L ad centre study	Will n t take acc unt n l ad centre	Will take acc unt n l ad centre	EP23 L ad centre p wer l ss c mparis n	H w the l cati n f supply s urce affect line l sses/ efficiency and % v ltage regulati n
(7)Pr blem with UG cable j int	Wr ng meth d in UG cable j ining	UG cable j ining meth ds. The ry study			UG cable j ining meth d in my prepared 7762 AA Electrical Distributi n textb k	UG cable j ining meth ds. The ry PLUS ph t graphs
(8)Generat r g t m t r acti n. Reverse p wer relay cuts ff	Out f synchr nism. Up t 180 degree ut f phase	Synchr nizing	Will neglect synchr nism. Just run and switch n	Will f cus n synchr nizing pr cess. Av id reverse p wer relay perati n	Synchr nizing	Synchr nism, generat r parallel perati n requirement practical kn wledge devel pment.
(9)Generat r vibrati n/ hunting	Stability c ncept	System stability	D n t care n machine hunting. Will c ntinue t run . As c nsequence, face the sh rt life f bearing/ shaft	Will take care n transient and steady state system stability and prevent the hunting	M ment f inertia/ machine stability	M ment f inertia/ machine stability practical kn wledge devel pment.
(10)Relay perates n fault. But the system l ss the synchr nism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	D n t care n the relay setting t pr vide b th fault pr tecti n and maintain the system stability. Re-synchr nize the generat rs when ever the relay perates	Will set the pr per relay setting t maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical kn wledge devel pment.
(11) Line reactive	Pr blem related t	L ad fl w study	Will n t take acc unt	Take acc unt n l ad	EP 42 Maximum	Devel p the l ad fl w

p wer t much. The equipment capacity is unnecessarily increased	l ad fl w		n l ad fl w c ncept.	fl w and ptimize the l ading	p wer transfer the rem EP43 L ad fl w study	c ncept and practical ptimizing skill
(12)There is n thing wr ng with the line but the transf rmer placed near the switch heat up and c ked	Switching surge	Switching v ltage surge	Just replace the transf rmer. After s me time, the same pr blem will be faced	Take acc unt n switching v ltage surge and plan t m install the surge diverter.	Switching v ltage surge	Switching v ltage surge practical kn wledge devel pment.
(13)Light radiated fr m the p wer line. T much p wer l ss and high interference t telec m line	C r na	C r na study	Will c nsider the ACT OF GOD	Will find the way t reduce c r na such as applicati n f h ll w c nduct r t increase diameter f c nduct r t raise the critical v ltage level	EP 7 C r na vide	H w c r na ccurs and find the way t prevent .
(14) C ntr l telec mmunicati n f r p wer line d wn, n relay perates	Applicati n f telec mmunicati n system in p wer system perati n	Applicati n f telec mmunicati n system in p wer system perati n 7762AG P wer System Operati n	Will n t be aware f the r le f telec mmunicati n system	Will check the functi n f telec m equipment f r p wer system c ntr l and pr tecti n and perf rm the preventive maintenance	Applicati n f telec mmunicati n system in p wer system perati n	Web based c ntr l/ IP based c ntr l and telec mm c ncepts practical kn wledge devel pment.
(15)T much flickering f lamps	Harm nics	Harm nics in p wer system	Will n t kn w what happens	Will check the harm nics s urce/ increase the size f neutral wire t all w the harm nics current fl ws	Harm nic s urce sc pe bservati n	Devel pment f identifying the harm nics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But n t sure it will be safe r n t.	Will check the c verage pr vided by lightning arrester	Lightning arrester study	Lightning arrester practical kn wledge devel pment.
(17)Earth fault/ earth leakage can n t be pr tected	Gr unding in p wer system	Gr unding in p wer system 7762AE P wer System Pr tecti n	--	Will measure the gr und resistance, will implement the additi nal gr und c nnecti ns	P wer system gr unding study	P wer system gr unding practical kn wledge devel pment.
(18)Occurance f ver current	Over current pr tecti n	Over current relay 7762AE P wer System Pr tecti n	Will n t exactly kn w h w t set/ adjust the ver current relay	Will set/ adjust the ver current relay	EP11 Over current relay characteristics	Practical skill devel pment in ver current relay
(19)Earth leakage fault	Earth leakage pr tecti n	Earth leakage pr tecti n 7762AE P wer System Pr tecti n	Will n t exactly kn w h w t set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement f r earth leakage fault & fault in pr tected z ne	Practical skill devel pment in earth leakage fault pr tecti n

(20)Transf rmer pr tecti n	Differential relay	Differential relay	Will n t exactly kn w h w t set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement f r fault in pr tected z ne	Practical skill devel pment in differential pr tecti n
(21)Line is pr tected by differential/ ver current relay. But it is n t effective when the l ad are fed fr m s me part f the line	Distance relay	Distance relay	Will n t exactly determine the reas n why and h w t change the pr tecti n system	Will change the pr tecti n system and will calculate earth fault impedance	Earth fault calculati n	Pr blem s lving skill devel pment in earth fault calculati n
(22)Fault happens but the relay can n t pr vide the effective pr tecti n	CT/ PT rati f r relay	Relay pr tecti n scheme	Will n t exactly determine the reas n why and h w t change the pr tecti n system	Will adjust CT PT rati at the simulated fault situati n and will adjust the relay setting appr priately	EP9 C nnecti n f relay pr tecti n scheme & pr tective equipments by using ne line diagram (Circuit interpreting & c nnecti n c mpetency devel pment with ut electrical supply) EP10 Current transf rmer & p tential transf rmer c nnecti n & rati test	Practical skill devel pment in CT PT rati adjustment
(23) I accidently pen the CT sec ndary and it g t expl si n	Current transf rmer	Current transf rmer		Will make sure n t t pen circuit the CT sec ndary	EP10 Current transf rmer & p tential transf rmer c nnecti n & rati test	Devel p the skill n CT/ PT c nnecti n & applicati ns.
(24) we use ld type gravity relay, it d es n t pr vide the effective pr tecti n	Restrainting system f relay	Relay types & characteristics		Will make sure t c rrectly arrange the relay p siti n	EP13 Study f vari us pr tective relays used in industry thr ugh trade references	Kn wledge devel pment n vari us pr tective relays used in industry thr ugh

						trade references
(25) Relay perates at wr ng current	Operati n/ setting f relay	Relay types & characteristics	Trial err r appr ach will be used	Will make sure t c rrectly arrange the relay setting	EP11 Over current relay characteristics	Practical skill devel pment in ver current relay
(26)In p wer transf rmer pr tecti n. Transf rmer is Star/Delta c nnecti n. All relay settings are c rrect. But relay wr ngly perates. I checked all c ntinuity. Every thing all right	Transf rmer Star Delta & relay star/delta matching	Star delta vect r diagram. Transf rmer star side –Relay delta & transf rmer delta— Relay star	Will n t kn w what happens and h w t rectify the fault	Will check the c nnecti n and will c nsider the vect r difference causes the wr ng perati n	EP10-CT & PT c nnecti n/ rati check	Practical skill devel pment in CT/PT C nnecti n
(27)Regulat r is set t meet the system v ltage c nditi n. But later time, it is bl wn ut	V ltage rati / regulat r setting	V ltage regulat r	Will emphasize in s lving the pr blem f r a sh rt m ment. Will n t c nsider the l ng term impact	Will c nsider whether the setting t upgrade the v ltage will impact n future system v ltage change	EP22 V ltage pr file chart f distributi n system	The skill training t devel p the judgment f v ltage level and future impact
(28)Fault spread fr m ne busbar t an ther busbar	Busbar arrangement/ secti nalizati n	Busbar arrangement	Will assemble he busbar t install the equipment, will n t c nsider h w the arrangement can c ntribute the spread f fault	Will c nsider the way t insert secti n circuit breakers	Busbar lay ut/ arrangement study	Busbar arrangement sketch/ plan practice devel pment
(29)Equipment suffers ver v ltage and bl wn ut after the capacit r value is changed f r PF impr vement	Inappr priate capacit r setting. Cause f verv ltage. Vect r diagram	PF impr vement/ Capacitive reactance effect n l ad	Will nly see the way t impr vement the PF. Will n t kn w the c nsequences	Will p sses the kn wledge f capacit r impact n l ad v ltage and will take acc unt n ptimal setting f capacit r value	EP5-capactance effect n line EP6-PF Impr vement	PF impr vement meth d is judgment with capacit r effect causes ver v ltage. This skill is trained.
(30)Directi nal relay d es n t w rk t pr tect the reverse p wer fl w	Directi nal relay perati n	Study n directi nal relay.		Wr ng c nnecti n t directi n c il will be identified	EP 13 Pr tective relays used in industry	Guide t acquire the relevant technical kn wledge
(31)V ltage flashing ver capacit r string	Capacit r string	Study n capacit r string	Will change the capacit r string	Will pr vide the preventive pr tecti n such as arcing h rns OR take acc unt n line capacit r grading	EP21 Line insulat r capacitance test	Devel p the skill t measure line capacit r value . Capacitance grading.

(32)Circuit Breaker itself is bl wn ut	Circuit Breaker capacity	Study n capacity f circuit breaker	Will change CB. After s metime, it will bl w up again.	Will c nsider the CB capacity & p ssible ver current devel ped in line fault	EP13 Relay & CB used in system Fault current	Devel p the skill in fault current estimate and ch sing CB capacity
(33)CB t h t and meltd wn	CB capacity/ Arc devel pment	Study n capacity f circuit breaker/electric arc	Will change CB. After s metime, it will bl w up again.	Will c nsider the CB capacity & p ssible ver current devel ped in line fault Will c nsider the arc extinguishing meth ds	EP13 Rely & CB used in system Fault current	Devel p the skill in fault current estimate and ch sing CB capacity
(34)Need t expand the line in emergency. I am nly in-charge	Line design	Line design pr ject	Will n t kn w h w t design a line	Will utilize references/ meth ds t design and c nstruct the line	7762AA Pr ject-Over head line design	Line electrical & mechanical design practice devel pment
(35)HV current fl ws int LV line	Separati n between HV & LV line	Rules & regulati ns related t line	Will n t kn w the regulati n	Will apply the regulati n in real w k	7762AA Line p le/ cr ss arm design and c nduct r arrangement	Line electrical & mechanical design practice devel pment
(36) Line wire fracture	Sag calculati n	Sag calculati n/ minimum cable size	Reinstall the line wire. Like part t like part replacement is applied, will use the same size f cable. After s metime, line will break gain	Will c nsider all wable tensi n/ minimum c nduct r size	7762AA Pr ject-Over head line design	Line electrical & mechanical design practice devel pment
(37)Electr nics equipment used f r line pr tecti n is bl wn up	V ltage surge	Signal c nditi n sub system. Surge filter	Will replace the electr nic b ard. But the same fault happens again	Will c nsider the cause f surge. Surge filter / abs rber/ diverter will be installed	7762AE Line surge/ applicati n f electr nic c ntr l system	Devel p the skill in line surge/ electr nic c ntr l.
(38) Receiving end v ltage is greater than the sending end	Capacitance effect n l ng line	L ng line 7762AG P wer System Operati n	Will think that the equipments are designed t perate at the sending end v ltage level, it will be en ugh	Will c nsider the line c nfigurati n and will pr vide the appr priate arrangement f r ver v ltage caused by capacitance effect n l ng line.	EP2/EP3 L ng Line PI & TEE equivalent circuits	Devel p the practical skill in determinati n f p ssible v ltage rise in simulated line m del.
(39)Can n t run the generat rs in parallel	Synchr nism pr blem	Synchr nizing	Will n t pr perly kn w the synchr nism	Will c nsider the synchr nism	Alternat r parallel perati n- Pr cedure	Devel p he kn wledge in synchr nizing
(40) Over current relay is pr vided t pr tect the system but it d es n t w rk when	Characteristics f relays	Relay types and characteristics	Will think that ne relay will pr tect everything	Will select the appr priate relay f r appr priate place and pr tecti n task	EP13 Study f vari us pr tective relays used in	Kn wledge devel pment n vari us pr tective relays used in

the gr und fault ccurs					industry thr ugh trade references	industry thr ugh trade references

M thod of d li ry	**M thod of coll ction of id nc**
7-F c to f c 6-El ctronic Key f r delivery de 1-On th job 2-Simul t d 3-Bl nd d 4-S lf p c d 5-Dist nc 6-El ctronic 7-F c to f c 8-Oth r Detailed explanati n F c to f c cl ss t ching + Onlin suppl m nt multim di not s	A,B,D,E,F,G,L Key f Meth ds f C lle ting Eviden e: A-Assignm nt B-Writt n T sk C-Rol pl y D-Ex m E-Or l qu stioning F-Simul tion G-Obs rv tion H-Work b s d I-Portfolio J-S lf ss ssm nt K-C s study L-Pr ctic l d monstr tion -Proj ct N-Tr ining R cord O-Oth r Detailed explanati n _____ A+B-T st 1, 2, 3, 4 E-Or l qu stion in pr ctic l cl ss F-Simul t d pr ctic l for lin & pow r syst m comprising m th m tic l qu tions & functions G-Obs rv th stud nt's p rform nc in pr ctic l cl ss L-Stud nt pr ctic l p rform nc r sult + r port pr p r tion

E id nc

P rt 1- E id nc of t ching & l rning

Pl n for concurr ntly d li ry

www.pow rl rning1.zoomsh r .com

Both digitis d not s + multim di not s including udio fil s

Not s in USB (Av il bl on r qu st)

P rt 2- E id nc of l sson pl nning

D liv ry & ss ssm nt m trix xc l form
S m st r pl n
Stud nts study progr ss pl n

(Av il bl on r qu st)

Evi n Atta h

Pa t (1)- Test questions

2 t sts

Pa t (2)-Eviden e of students pa ti ipation

Sign d tt nd nc sh t
Sign d T st tt nd nc sh t
S mpl nsw r p p r & pr ctic l r port Eith r h rd or sc nn d copy (Will b v il bl on r qu st within 6 months of th ss ssm nt v nt
EBS tt nd nc & gr d r cord

1 On th job	2 Simul t d	3 Bl nd d	4 S lf-p c d (f cilit t d)
5 Dist nc	6 El ctronic	7 F c to F c	8 Oth r (Pl s sp cify)

K y for M thods for Coll cting E id nc :			
A Assignm nt	**B** Writt n t sk	**C** Rol pl y	**D** Ex m
E Or l qu stioning	**F** Simul tion	**G** Obs rv tion	**H** Work b s d
I Portfolio	**J** S lf ss ssm nt	**K** C s study	**L** Pr ctic l d monstr tion
M Proj ct	**N** Tr ining R cord Book	**O** Oth r (Pl s sp cify)	

Loc tion of Evid nc s (T bl 1)

ASSESS ENT SCHEDULE

P rform nc Crit ri	Ass ssm nt 1 Pr ctic l		Ass ssm nt 2 Th ory
	Continuous Obs rv tion	Writt n Ass ssm nt s p rt of Pr ctic l	Writt n Ass ssm nt
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		

3.4	X		
EKAS Ass ssm nt		X	X

POWER SYSTE Youtub vid o L ssons to provid th suffici nt EKAS

G015/ IS67+68+ IS74

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Pow r Syst m (1)

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G040 + IS73

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G040 Less n 4 P wer transf rmer c nnecti n.zip

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G040 Less n 5 Maximum efficiency.zip

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http //y_utu.be/uOHBk840Bhw

G040 Less_n 10 Phase shift transf_rmer.zip

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G042+IS71

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Tr_nsmission Lin_

G042 Less_n 1-Transmissi_n line intr_ducti_n.zip

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G042 Less_n 2-DC Line+Line reflecti_n.zip

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G042 Less_n 3-P_wer line calculati_n.zip

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G042 Less_n 4-Line m_del+Ec_n_mic aspect.zip

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G042 Less_n 5-Time value_f m_ney+Line reflecti_n.zip

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G042 Less_n 7-Wave guide.zip

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Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering
Unit of Competency Number and Name:	**UETDRIS027 - Diagnose and resolve faults in transmission systems**

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1/Prepare to diagnose and resolve faults in transmission systems IS027 **2/Prepare to diagnose and resolve faults in electrical apparatus**	1.1	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be done are reviewed and determined (IS026+IS027)	Advanced Diploma in Electrical Engineering Exercises Page 3 - Q15+16		
	1.4	Hazards are identified, risks assessed, and control measures identified and applied (IS026+IS027)	Advanced Diploma in Electrical Engineering Exercises Page 3 - Q17+18 Page 4 Q21+22		
	1.2 1.2 1.3	Work plan is developed and confirmed, permissions obtained, and these are communicated with relevant personnel in accordance with workplace requirements(IS027) Work plan is obtained, confirmed and communicated with relevant personnel in accordance with workplace requirements(IS026) Work is prioritised and sequenced for completion in accordance with work plan and workplace	Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)		

		requirements(IS026+IS027)			
			Advanced Diploma in Electrical Engineering Exercises Page 203) Q21 to 23		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.5	Work permits are determined in accordance with workplace requirements (IS026+IS027)			Advanced Diploma in Electrical Engineering Exercises Page 150) Q 23 to 25
	1.6	Plant, tools, equipment and personal protective equipment (PPE) required for work are determined, obtained and confirmed in working order (IS026+IS027)		**EP1,EP2,EP3 EP4**	Advanced Diploma in Electrical Engineering Exercises Page 153) Q 41 to 47
2/Diagnose and resolve faults in transmission systems	2.1 2.5	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be performed are applied and monitored (IS026+IS027) Hazard control measures are monitored in accordance	As per 1.3		

		with workplace requirements (IS026+IS027)			
	2.2	Lifting, working at heights, working in confined spaces and the use of plant, tools, equipment and PPE are carried out in accordance with workplace requirements (IS027)			UEECD0007
	2.3	Work permits are received and signed in accordance with workplace requirements (IS027)			Advanced Diploma in Electrical Engineering Exercises Page 149) Q 13 to 20
	2.3	Work permits are received and signed in accordance with workplace requirements (IS027)	Advanced Diploma in Electrical Engineering Exercises Page 147) Q 1 to 10		
	2.4	Faults in transmission systems are diagnosed and resolved in accordance with workplace requirements (IS027)		**Fault finding activities**	Advanced Diploma in Electrical Engineering Exercises Page 129) Q 64 to 70
	2.7	Quality checks of work are undertaken in accordance with work plan and workplace requirements (IS026)		**Fault finding activities**	Advanced Diploma in Electrical Engineering Exercises Page 129) Q 64 to 70

Elements & Performance Criteria			**Assessment event(s)**		

Element(s)	PC No	Performance Criteria (PC)	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
	2.4	Faults in transmission systems are diagnosed and resolved in accordance with workplace requirements (IS027)			Advanced Diploma in Electrical Engineering Exercises Page 211) Q 50 to 54
	2.6	Incidents or unplanned events are responded to in accordance with workplace requirements (IS026+IS027)		Fault finding activities Page 13 of IS71 Assessment Mapping.pdf	
3/Complete work and documentation	3.1	Completed work is checked for compliance against the work plan and workplace requirements (IS026+IS027)	As per 1.3		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
				Fault finding activities Page 14 to 20 of IS71 Assessment Mapping.pdf	
	3.2 3.4 3.5	Incidents or unplanned events are reported in accordance with workplace requirements (IS026+IS027) Work permits are signed off in accordance with workplace requirements (IS026+IS027) Work records, reports and documentation are completed, and appropriate personnel notified in accordance with		Fault finding activities Page 14 to 20 of IS71 Assessment Mapping.pdf	

		workplace requirements (IS026+IS027)			
	3.3	Plant, tools and equipment are cleaned, checked and returned to storage, and surplus resources and materials are managed in accordance with workplace requirements(IS026+IS027)		Housekeeping after practical task	

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Receiving end voltage comparison between short/ medium and long transmission lines		EP1	
Long transmission line PI equivalent circuit Investigation		EP2	
Long transmission line T equivalent circuit Investigation		EP3	
Finding Transmission line efficiency/ Transformer effect on line efficiency		EP4	
Reactive power and power factor improvement		EP5	

UETDRIS026

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two (2) separate occasions and include:	
• applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including: • work health and safety (WHS)/occupational health and safety (OHS) requirements • identifying hazards, assessing risks, and identifying, applying and monitoring control measures • obtaining, inspecting and using relevant personal protective equipment (PPE)	G015_G037_G038_G030Pt1_7762AG_Notes and exercises Plus practical as per Element 1 to 3

• dealing with an unplanned event on at least one (1) occasion
• obtaining and signing work permits in accordance with workplace requirements
• completing relevant work records, reports and documentation
• diagnosing and resolving faults in electrical apparatus, including:
  • applying logical diagnostic methods
  • using fault scenarios to test the cause of system faults
  • identifying faults and competency needed to resolve them
  • resolving faults in system controls
  • verifying that the system operates correctly
  • documenting fault rectification.	

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including WHS/OHS requirements
• hazard, risk assessment and risk control requirements
• types and application of PPE
• safe use of plant, tools and equipment
• application, purpose and types of permits
• events constituting an unplanned event or incident
• procedures for responding to an unplanned event or incident
• workplace records, reports and documentation
• control of high voltage (HV) and low voltage (LV), including:
  • voltage control devices
  • conditions leading to voltage collapse and system disintegration
  • voltage regulators applied to generators and synchronous phase modifiers
  • electromagnetic voltage regulators
  • series and parallel capacitors
  • on-load tap changer (OLTC) transformers
  • static var compensations (SVCs)
• range of devices covered by SVCs, including:
  • saturated reactor (SR) compensators
  • thyristor controlled reactor (TCR) compensators
	T9 Range of devices covered by SVCs
	
	G015_G037_G038_G030Pt1_7762AG_Notes and exercises

• combined TCR/thyristor-switched capacitor (TSC) • production of wave-form distorting harmonics and control devices • importance of the location in the system of voltage control devices • the use of graphical methods to calculate the size of var regulating plant • control of power, including: • base load and spinning reserve • regulating machines • rapid start plant • phase shifting transformers and load shedding • principles and practices of automated control of individual machines • stations and transmission/tie-line elements • synchronising power • the relationship between power and frequency, including: • limiting values • machine stabilising • steam by-pass, rapid valving, slip stabilisers and over-speed limiting • use of single pole generator circuit breakers (CB) • use of automatic voltage regulators (AVR) as angular stabilisers • damped and un-damped system oscillations • relationship between fault clearance times and system stability • calculation of critical clearance angles based on equal area criteria • types of communication systems, including: • telephone, power line carrier, dedicated cable, microwave links and fibre optics • quantities and signals to be communicated • advantages and disadvantages of the various systems • equipment requirements • transient over-voltages in power systems, including: • switching and lightning over-voltages and their effect on different plant items • transient over-voltage control and reduction using surge diverters, shield wires and CB control • insulation systems, insulation coordination, insulation grading in plant items, bushings and capacitor bushings • factors leading to the generation of corona, including consequences, reduction, conductor bundling, grading rings and conductor surface treatment	

- power system protection, including:
  - location of current transformer (CT) in major plant items
  - earthing principles and devices
  - fault current control/limitation using neutral earthing compensators (NEC), neutral point earth impedances, high conductivity shield wires and parallel feed interlocking
  - application of different types of protection.

UETDRIS027

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two (2) separate occasions and include:

- applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including:
  - work health and safety (WHS)/occupational health and safety (OHS) requirements
- identifying hazards, assessing risks, and identifying, applying and monitoring control measures
- obtaining, inspecting and using relevant personal protective equipment (PPE)
- dealing with an unplanned event on at least one (1) occasion
- obtaining and signing work permits in accordance with workplace requirements
- completing relevant work records, reports and documentation
- diagnosing and resolving faults in transmission primary and secondary systems, including:
  - interpreting system alarms and protection operations
  - applying logical diagnostic methods
  - using fault scenarios to test the source of system faults
  - recording information from control room and relevant personnel
  - identifying faults and assigning personnel in accordance with individual skills and competencies
  - considering the impact of outages on the network
  - resolving system faults
  - verifying that the system operates within parameters

Element 1 to 3 & Practical Tasks

- documenting fault rectification.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including WHS/OHS requirements
- hazard, risk assessment and risk control requirements, including potential hazards
- types and application of PPE
- safe use of plant, tools and equipment
- application, purpose and types of permits
- events constituting an unplanned event or incident
- procedures for responding to an unplanned event or incident
- workplace records, reports and documentation
- manuals, diagrams and drawings
- overview of distribution networks
- overview of transmission primary system, including:
  - lines
  - buses
  - transformers
  - converters
  - cables
  - circuit breaker configurations
- operating parameters of circuit breakers and switches, including:
  - principles of operation
  - voltage and current range
  - breaking capacity
- protection schemes
- nomenclature and nameplates
- high pressure air systems, and air storage and handling processes
- direct current (d.c.) auxiliary systems
- SF6 conditioning, storage and handling system
- spring charging mechanisms
- generation types and fundamentals of operation

UETDRIS 027 Knowledge Evidence Table Tasks

• generator connection to transmission and distribution networks.
• principles of high voltage (HV) alternating current (a.c.) and d.c. transmission, including:
  • tower types and configurations
  • insulator types
  • types of conductors
  • line ratings
  • conductor terminations
  • harmonic filters
  • protection
• types of isolators
• control of voltage
• voltage collapse and system black, including:
  • under frequency trip
  • automatic load shedding
  • manual load shedding
• voltage control devices, including:
  • voltage regulators applied to generators and synchronous phase modifiers
  • electromagnetic voltage regulators
  • series and parallel capacitors
  • on-load tap changer (OLTC) transformers
  • static var compensation (SVC)
• overview of transmission secondary systems, including:
  • control and supervisory systems
  • protection schemes
• overview of the transmission communication systems, including:
  • telephone
  • power line carrier
  • dedicated cable
  • micro-wave links
  • fibre optics
• transient voltage levels in power systems, including:
  • switching
  • lightning
  • surge diverters	

• shield wires • insulation grading • corona discharge • impact of natural disasters • faults related to deteriorating components.	

Add rows to the following table as required

UETDRIS 027 Knowledge Evidence Table	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
<Insert knowledge evidence >	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.
T1 Overview of the transmission system	Advanced Diploma in Electrical Engineering Exercises Page 153) Q 41 to 47		
T2 The principles involved in high voltage a.c. transmission			Advanced Diploma in Electrical Engineering Exercises Page 149) Q 16 to 18
T3 The principles involved in d.c. transmission	Advanced Diploma in Electrical Engineering Exercises Page 147) Q 5 to 7		
T4 The principles of operation, voltage and current range, breaking capacity and field of use			Advanced Diploma in Electrical Engineering Exercises Page 147) Q 10 to 12
T5 The types of isolators in use			Advanced Diploma in Electrical Engineering Exercises Page 147) Q4
T6 Circuit breaker auxiliary systems			Advanced Diploma in Electrical Engineering Exercises Page 123) Q 1 to 4

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T7 The characteristics of lines and cables			Advanced Diploma in Electrical Engineering Exercises Page 117) Q 1 to 5 Q 24 to 30
T8 Control of voltage. Conditions leading to voltage collapse			Advanced Diploma in Electrical Engineering Exercises Page 117) Q 40 to 43
T9 Range of devices covered by SVCs	Advanced Diploma in Electrical Engineering Exercises Page 132) Q 19 to 21		
T10 Importance of the location in the system of voltage control devices			Advanced Diploma in Electrical Engineering Exercises Page 122) Q 23 to 44
T11 Use of graphical methods to calculate the size of VAr regulating plant			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 19 to 21
T12 Types of communication systems including telephone, power line carrier,			Advanced Diploma in Electrical Engineering Exercises Page 132) Q 23 to 37
T13 Transient over-voltages in power systems	Advanced Diploma in Electrical Engineering Exercises Page 131) Q 14 to 18		
T14 Factors leading to the generation of corona.			Advanced Diploma in Electrical Engineering Exercises Page 130) Q 5 to 12

Add rows to the following table as required

Assessment Conditions	Assessment	Assessment	Assessment

	event 1 Written Test	event 2 Practical & Observation	event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test 1 + 2	Practical EP1 to 5	All assignments

Diagnose and rectify faults in electrical energy supply transmission systems

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

(1) Delivery & collection of evidence

1 Prepare to diagnose and rectify faults. Work performance

1.1 OHS procedures for a given work area are identified, obtained and understood

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q15+16
www.electricaldiploma2013.webs.com Then access

Click **HERE** to download the Exercises

http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf

Relevant Instruction Lessons

Study
Guided study (Online)Resources+Online exercises+Online Practicals

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Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22

Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated

effectively withothers. Answer the following questions to seek the advice from

work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q12.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.3 The extent of faults is determined from reports and other documentation and from discussion with appropriate personnel.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 203)

Positive, negative and zero sequence

Slide 1+2+3+4

Q21.Z1= 20% Z2= 15% 200MVA base A to B fault at 33KV Find fault currents.
Slide 5

Q22.Z1 = 5% Z2 = 10% Zo = 20%, 200MVA 132 KV line to ground fault. Find fault current. Slide 6+7+8

Q23. Z1 = 70% Z2= 70% Zo = 30 % Base MVA = 200 MVA E = 66KV 2 Line to ground fault. Calculate fault current.

1.4 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.

1.5 Tools, equipment and testing devices needed to diagnose faults are obtained in accordance with established procedures and checked for correct operation and safety

Ref-Advanced Diploma in Electrical Engineering Exercises Page 150)

Slide 15+16+17

Q23.A three phase 66KV line is supplying 500 KW at 0.85 PF lagging. Line resistance, inductive reactance and capacitive reactance are 1Ω, 4Ω and 3000Ω respectively. Calculate the sending end voltage by using equivalent Pi circuit.

Slide 18+19

Q24. What factors are to be considered for power system planning.

Slide 20+21

Q25.A sum of $2000 is invested at 5% for 15 years at compound interest.

Calculate the sum at the end of 15 years

If instead of lump sum at the end of 15 years, the loan of $2000 is to be paid by the fixed around each year, calculate the annual amount.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 153)

Slide 1+2+3

Q41.What is transmission line . Explain the components of it.

Slide 4_6

Q42.Explain maximum transfer of electrical energy.

Slide 5+7+8

Q43.Explain surge impedance loading.

Slide 9

Q44.Describe long and short transmission lines.

Slide 10+11+12+13

Q45.Explain (a)Propagation constant (b) Line model & SIL

Slide 14+15

Q46.Write the equations to calculate complex power.

Slide 16

Q47.What are the difference between balanced line & unbalance line.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		
Students' work in own	Summative Assessment- Formal	

record	Tests	
	Formative Assessment/Practical+ Class works	

2 Diagnose and rectify faults.

2.1 OHS risk control measures and procedures for carrying out the work are followed. As per 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 149)

Power factor connection
Slide 1+2+3+4+5+6+7

Q13.What is power factor. What are the effects of poor power factor

Q14.Four three phase 415V 50HZ loads are connected together in an industrial installation. Determine (a) Total load (b) Total power factor (c) The value of capacitor required PF to 0.98 Slide 8+9

Q15.A load with a PF 0.7 lagging dissipates 1500W from 240V , 50HZ supply. It is required to correct the PF to 0.95 lagging. Find (a) The original and final currents (b) The value of the component to be added in parallel with the original load to achieve the required PF correction.

Overhead transmission line
Slide 1+2

Q16.Sketch Tee and Pi equivalent circuits of transmission line and vector diagram.
Slide 3+4

Q17.Sketch two ports network equivalent circuit and write the equation.
Slide 5

Q18.By doing open circuit test and short circuit test for parallel line model, the following values are obtained.

OCT—Vs= 12V , Vr=12.5V Is = 0.1 amp

SCT---Vs = 13V, Ir = 0.4A Is = 0.48 amp

Find the generalized equation

Slide 6

Q19.Sketch power transformer protection circuit.

Slide 7

Q20.Sketch recloser

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 147)

Slide 1+2+3

Q1.Compare the copper weight of 3 phase 3 wires system & simple dc system

Slide 4+5

Q2.Explain voltage variations in power system

Slide 6

Q3.Sketch induction motor & synchronous motor

Slide 7

Q4.Explain the components of circuit breaker

Ref-Advanced Diploma in Electrical Engineering Exercises Page 148)

Reflection in transmission line

Slide 1+2+3+4+5

Q8.A 60Ω transmission line connected to load impedance 100+j70 Ω. The forward RMS valresiue on line is 30V. Line impedance is 30Ω

Calculate (a) Power delivered to resistance part of load impedance

RMS current in impedance, reflected wave voltage

Peak voltage forward & backward wave

Voltage standing wave ratio (VSWR)

Return loss in
decibel Slide 6

Q9.Explain the impact of switching in power line

Slide 7+8+9+10

Q10.A coil of 20H inductance and 10Ω resistance is connected in parallel with a 30Ω resistor across a 150V dc supply which is suddenly disconnected.

Find

Initial rate change of current after switching

The voltage across 30Ω resistor initially after 0.4 sec

The voltage across the switch contacts at the instance of separation

The rate at which the coil is losing stored energy 0.3 sec after switching

2.4 Logical diagnostic methods are applied to diagnose electrical energy transmission system faults employing measurements and estimation of system operating parameters referenced to system operational requirements.

2.5 Suspected fault scenarios are tested as being the source of system problems.

2.6 Source of the fault is identified and appropriately competent persons are engaged to rectify the fault where it is outside the scope of the control system.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 129)

To determine the quality of the operational status of protection system, it needs to ensure relay operation sequence, the sequential relay protection system and characteristics are to be investigated. The following activities and questions provide this competency.

(32)Over current & earth fault protection , Directional protection, operating characteristics Slide 1

Q64.Sketch the diagram of over current protection

Slide 2

Q65.Sketch earth fault relay protection diagram.

Slide 3

Q66.Sketch the combined over current and earth fault protection and explain it’s operation.

Slide 4

Q67.Explain the operation of directional relay with diagram.

Slide 5+6+7+8

Q68.Locate directional & non directional elements in ring system.

Slide 9+10

Q69.Sketch the connection diagram of combinational protection scheme that contains two over current relays and one earth fault relay to provide phase to phase and phase to earth protection.

Slide 11

Q70.How will you adjust definite minimum time point on relay curve?

2.7 Faults in the system components are rectified to raise electrical energy transmission system to its operation standard.

2.8 System is tested to verify that it operates as intended and to specified requirements.

2.9Decisions for dealing with unexpected situations are made from discussions with appropriate persons and job specifications and requirements.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 211)

Change control
Slide 1
Q50.Describe the overview of change control system.
Slide 2
Q51.Explain the establishment of contracts
Slide 3
Q52.Outline the project control system responding the disturbances.
Slide 4
Q53.Sketch the procedure for preparing quality
manual. Slide 5+6
Q54.Explain management leadership.

Work performance + Practical Instruction Back up

Click HERE to download practicals

Refer Power System Practicals

Part 1: Operational Study

LabName No	Name of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1	Receiving end voltage comparison between short/ medium and long transmission lines	distribution system types	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion
EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment

EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection • surge protection • conventional relays	Research, report presentation
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above

EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the surrounding environment or services and using sustainable energy practices.

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?

To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.

The following is the various power system faults which I draw out from my power engineer work records that the technica l knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is , caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in voltages	Abnormal resistance. Wrong cable selection. Abnormal circuit configuration	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of the circuit.	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

Location of Evidences (Table 1)

1 Complete and report fault diagnosis and rectification activities.

1.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.
(11) Line reactive	Problem related to	Load flow study	Will not take account	Take account on load	EP 42 Maximum	Develop the load flow

power too much. The equipment capacity is unnecessarily increased	load flow		on load flow concept.	flow and optimize the loading	power transfer theorem EP43 Load flow study	concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated from the power line. Too much power loss and high interference to telecom line	Corona	Corona study	Will consider the ACT OF GOD	Will find the way to reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level	EP 7 Corona video	How corona occurs and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System Protection	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault protection

(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not provide the effective protection	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason why and how to change the protection system	Will adjust CT PT ratio at the simulated fault situation and will adjust the relay setting appropriately	EP9 Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	Practical skill development in CT PT ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through

						trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection. All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.

(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc extinguishing methods	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but it does not work when	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and protection task	EP13 Study of various protective relays used in	Knowledge development on various protective relays used in

the ground fault occurs					industry through trade references	industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other Detailed explanation _____ A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions G-Observe the student's performance in practical class L-Student practical performance result + report preparation

Evidence **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery** www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	**Evidence Attached** **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:							
A	Assignment	**B**	Written task	**C**	Role play	**D**	Exam
E	Oral questioning	**F**	Simulation	**G**	Observation	**H**	Work based
I	Portfolio	**J**	Self assessment	**K**	Case study	**L**	Practical demonstration
M	Project	**N**	Training Record Book	**O**	Other (Please specify)		

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		

3.4	X		
EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

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Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-Iuu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6oggZAKRg

http://youtu.be/XRpffA6hU_U

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G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

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Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41q4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

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G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

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http://youtu.be/2cl-nOdBNro

G040 + IS73

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Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KlKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

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G042+IS71

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Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

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http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/elNq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

Solve problems in network protection*

AE.zip

www.highlightcomputer.com/G015-AE Mod.zip

IS69
AG.zip

www.highlightcomputer.com/G015-AG Mod.zip

A010.zip

www.highlightcomputer.com/A010Mod.zip

Power system 2-G037+G038+G039.zip

Power System 2 G037+G038+G039

Power System Protection

G015(AE)Lesson 1-Power system protection scheme.zip
http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip
http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip
http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip
http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6oggZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

Concurrently with

UETDREL005 Work safely in the vicinity of live electrical apparatus

UETDRIS032 Solve problems in network equipment

AA.zip

www.highlightcomputer.com/G015-AA Mod.zip

G015/ IS67+68+ IS74

Page 196 to 231 of

www.highlightcomputer.com/Video Lessons.pdf

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-Iuu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVqymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M
http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip
http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip
http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip
http://youtu.be/2iW0oEScMsw
http://youtu.be/VuzjXkRx4UI
http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip
http://youtu.be/r0qkLrmkKsM
G015AE Lesson 6
http://youtu.be/InsTLh7_N5k
G015(AE)Lesson_7-CT_PT.zip
http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip
G015(AE)Lesson 9-Telecom in power protection.zip
http://youtu.be/9C6oqqZAKRg
http://youtu.be/XRpffA6hU_U
http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip
http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip
http://youtu.be/A-t7XH4rK4M
http://youtu.be/OTsis_KIRuk
http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

http://www.filefactory.com/file/c386bf4/n/G015_AG_Lesson_3-Power_Flow.zip

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k
http://www.filefactory.com/file/c386b23/n/G015(AG)Lesson_4-IP_based_system.zip
G015(AG)Lesson 5-Surge in power system.zip
http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip
http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip
http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip
http://youtu.be/uzFS-otIn-g
http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip
http://youtu.be/y-of5oLojCU
G015(AG)Lesson 11-PF Control+Fuel cell.zip
http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip
http://youtu.be/nRGScOH9aSM

The links contain the following lessons

G015(AA)Lesson 1-Distribution system
G015(AA)Lesson 2-Demand factor
G015(AA)Lesson 3-Sag
G015(AA)Lesson 4-OH Line mechanical design
G015(AA)Lesson 5-UG Cable
G015(AA)Lesson 6-Voltage control
G015(AE)Lesson 1-Power system protection scheme
G015(AE)Lesson 2-Differential relay
G015(AE)Lesson 3-Over current & earth fault protection
G015(AE)Lesson 4-Three phase differential relay
G015(AE)Lesson 5-Current time grading
G015(AE)Lesson 6-Instrumentation transformer
G015(AE)Lesson 7-CT PT
G015(AE)Lesson 8-Distance relay
G015(AE)Lesson 9-Telecom in power protection
G015(AG)Lesson 1-Stability
G015(AG)Lesson 2-Generator load sharing
G015(AG)Lesson 3-Power Flow
G015(AG)Lesson 4-IP based system
G015(AG)Lesson 5-Surge in power system
G015(AG)Lesson 6-CTPT Harmonic filter
G015(AG)Lesson 7-Short circuit in alternator
G015(AG)Lesson 8-Corona
G015(AG)Lesson 9-Power surge
G015(AG)Lesson 10-Static Var Compensation
G015(AG)Lesson 11-PF Control+Fuel cell

Qualification Number and Name:	Advanced Diploma of Electrical Engineering
Unit of Competency Number and Name:	**UETDRIS032 Solve problems in network equipment** **UETDRIS033 Solve problems in network protection** **Training & Assessment Strategies+Mapping+Study Guide+Tasks** **Together with** **UETDREL005 Work safely in the vicinity of live electrical apparatus**

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve problems in energy supply network equipment (032) + **Prepare to solve problems in network protection (033)**	1.1	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be done are reviewed and determined (both)	Q 1,2,3 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.4	Hazards are identified, risks assessed, and control measures identified and applied (032+033)	Q 4 to 7 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.2	Work plan is obtained, confirmed and communicated with relevant personnel in accordance with workplace requirements (032+033)	Q 8 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.3	Work is prioritised and sequenced for completion in accordance with work plan and workplace requirements (032)+033)			

	1.5	Work permits are determined in accordance with workplace requirements (032+033)	Q 9 to 12 of IS68+IS74 Assessment Mapping.pdf (Page 3)		
	1.6	Plant, tools, equipment and personal protective equipment (PPE) required for work are determined, obtained and confirmed in working order (032+033)			Advanced Diploma in Electrical Engineering Exercises Page 208) Q11+12 Advanced Diploma in Electrical Engineering Exercises Page 123)Q 1 to 7

Elements & Performance Criteria			**Assessment event(s)**		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.6			Practical EP9,EP10,	Advanced Diploma in Electrical Engineering Exercises Page 128) Q52+53
2/Solve problems in network equipment (032) Solve problems in network protection (033)	2.1	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be performed are applied and monitored (032+033)	As per 1.1 to 1.3		

	2.2	Lifting, working at heights, working in confined spaces and the use of plant, tools, equipment and PPE are carried out in accordance with workplace requirements (032+033)	Review the relevant topics of UEECD0007 OHS		
	2.3	Work permits are received and signed in accordance with workplace requirements (032+033)	As per 1.5		
	2.4	Problems in network equipment are solved in accordance with workplace requirements (032) Problems in network protection are solved in accordance with workplace requirements (033)		Practical EP11.EP12	Advanced Diploma in Electrical Engineering Exercises Page 126) Q30 to 37
	2.5	Hazard control measures are monitored in accordance with workplace requirements (032+033)	As per 1.4		
	2.6	Incidents or unplanned events are responded to in accordance with workplace requirements (032+033)	As per 1.4		
	2.7	Quality checks of work are undertaken in accordance with work plan and workplace requirements (032+033)	Test 1 Q 1 to 10 Check the solution of the problem & verification)		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
3/Complete work and documentation (032+033)	3.1	Completed work is checked for compliance against the work plan and workplace requirements Circuits/components are rechecked and their operational status is confirmed. Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures. Effectiveness of the repair is tested in accordance with established procedures. Apparatus is reassembled, finally tested and prepared for return to service.	As per 1.3 As per 2.5		Advanced Diploma in Electrical Engineering Exercises Page 128)Q55 to 59 Advanced Diploma in Electrical Engineering Exercises Page 128)Q64 to 70 Advanced Diploma in Electrical Engineering Exercises Page 126) Q23 to 29
	3.2	Incidents or unplanned events are reported in accordance with workplace requirements ()32+033)	As per 1.4		
	3.3	Plant, tools and equipment are cleaned, checked and returned to storage, and surplus resources and materials are managed in accordance with workplace requirements (032+033)	As per 1.3		
		Reusable, faulty or worn components are tagged and			Advanced Diploma

		dispatched for repair to maintain adequate spares.		Project	in Electrical Engineering Exercises Page 125) Q 17 to 19

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.4	Work permits are signed off in accordance with workplace requirements (032+033)	As per 1.5	Project	Advanced Diploma in Electrical Engineering Exercises Page 125) Q 17 to 19
	3.5	Work records, reports and documentation are completed, and appropriate personnel notified in accordance with workplace requirements (032+033)	All design documentation+ Solved Problems		

Add rows to the following table as required

UETDRIS032

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two (2) separate occasions and include:	
• applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including: • work health and safety (WHS)/occupational health and safety (OHS) requirements • identifying hazards, assessing risks, and identifying, applying and monitoring control measures • obtaining, inspecting and using relevant personal protective equipment (PPE)	All lessons+Assessment Tasks in Transmission and Distribution System as submitted below

• dealing with an unplanned event on at least one (1) occasion
• obtaining and signing work permits in accordance with workplace requirements
• completing relevant work records, reports and documentation
• solving problems in network equipment, including:
  • determining equipment operating parameters
  • determining scope of work and resource requirements
  • applying problem-solving techniques
  • applying manufacturer's settings to meet network requirements
  • conducting functional testing
• solving problems in network equipment on at least one (1) of the following network systems:
  • distribution overhead
  • distribution underground
  • transmission overhead
  • transmission underground
• using at least three (3) of the following distribution/transmission equipment types:
  • voltage regulation equipment
  • on-load tap changers (OLTCs)
  • energy metering
  • demand meters
  • load control
  • current transformers
  • potential transformers.	

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

• relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including WHS/OHS requirements
• hazard, risk assessment and risk control requirements, including potential hazards
• types and application of PPE
• safe use of plant, tools and equipment
• application, purpose and types of permits
• events constituting an unplanned event or incident
• procedures for responding to an unplanned event or incident
• workplace records, reports and documentation
• principles of all of the following:
  • generation
  • transmission
  • distribution
  • substations
  • overhead and underground systems,
  • inductance, capacitance and resistance
  • voltage regulation
  • transformers and OLTCs
  • line drop compensation
  • types of system faults and protection
  • voltage surges
  • metering and metered quantities
	All lessons+Assessment Tasks in Transmission and Distribution System as submitted below
	•

• load control.	

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Connection of relay protection scheme & protective equipments by using one line diagram		EP9	
Current transformer & potential transformer connection & ratio test		EP10	
Over current relay characteristics		EP11	
Electronic relay test		EP12	
Study of various protective relays used in industry through trade references			Research Assignment

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Protection fundamentals encompassing:	Q 1,2,3 of Test 1		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T2 Instrument transformers for protection			Advanced Diploma in Electrical Engineering Exercises Page

			125) Q 38 to 52
T3 Feeder protection	Q7 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 23 to 37
T4 Transformer protection	Q10 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 10 to 15
T5 Busbar protection			Advanced Diploma in Electrical Engineering Exercises Page 125) Q 16 to 19
T6 Surge protection			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 16 to 18

Add rows to the following table as required

Assessment Conditions	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test	Practical EP 9 to 12	Research Assignment

TRANSMISSION AND DISTRIBUTION SYSTEM

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Receiving end voltage comparison between short/ medium and long transmission lines		EP1	
Long transmission line PI equivalent circuit		EP2	
Long transmission line T equivalent circuit		EP3	
Transmission line efficiency/ Transformer effect on line efficiency		EP4	
Reactive power and power factor improvement		EP5	
PF effect on line current		EP6	
Corona Video		EP7	
Phase sequence measurement		EP8	
Underground cable capacitance test		EP19	
High tension line design		EP20	
Line insulator test & capacitance grading		EP21	
Voltage profile chart of distribution system		EP22	
Load centre-Power loss comparison		EP23	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

T1 Generation	Test 1 Q 1,5 Test 3 Q 1,2,3		
T2 Transmission	Test 1 Q 2,3,4 Test 3 Q 4,5,6		
T3 Distribution	Test 1 Q 3,6,7,9 Test 3 Q 8,9,10		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T7 Voltage problems			Advanced Diploma in Electrical Engineering Exercises Page 119) Q333, 34
T9 Control of OLTC encompassing			Advanced Diploma in Electrical Engineering Exercises Page 123) Q 1 to 4
T10 Power distribution system faults			Advanced Diploma in Electrical Engineering Exercises Page 199) Q 21 to Q25
T11 Voltage surges in a power distribution system			Advanced Diploma in Electrical Engineering Exercises Page 199) Q 13 to Q 17
T12 Metering and metered quantities		EP10	
T13 Energy and demand meters encompassing:			Online Research Assignment
T5 Overhead and underground systems	Test 2 Q 1 to 5		

T6 Power distribution system electrical characteristics	Test 1 Q 3,4,10,13 Test 3 Q 1,2		
T8 Voltage regulation	Test 3 Q 11		

UETDRIS033

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two (2) separate occasions and include:	

• applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including:
  • work health and safety (WHS)/occupational health and safety (OHS) requirements
• identifying hazards, assessing risks, and identifying, applying and monitoring control measures
• obtaining, inspecting and using relevant personal protective equipment (PPE)
• dealing with an unplanned event on at least one (1) occasion
• obtaining and signing work permits in accordance with workplace requirements
• completing relevant work records, reports and documentation
• solving problems in network equipment, including:
  • determining equipment operating parameters
  • determining scope of work and resource requirements
  • applying problem-solving techniques
  • applying manufacturer's settings to meet network requirements
  • conducting functional testing
• solving problems in network systems including at least one (1) of the following:
  • distribution overhead
	Tasks common to UETDRIS032 (Transmission and Distribution)

• distribution underground
• transmission overhead
• transmission underground
• solving problems in protection equipment and systems including at least two (2) of the following:
  • over-current protection
  • earth fault protection
  • differential protection
  • oil and gas devices
  • busbar protection
  • surge protection
  • conventional relays
  • electronic relays
  • reclosers/sectionalisers.
	Tasks described in Protection

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including WHS/OHS requirements
• hazard, risk assessment and risk control requirements, including potential hazards
• types and application of PPE
• safe use of plant, tools and equipment
• application, purpose and types of permits
• events constituting an unplanned event or incident
• procedures for responding to an unplanned event or incident
• workplace records, reports and documentation
• use of manufacturer's instructions, diagrams and manuals
• fundamentals of primary components, including:
  • power transformers
  • generators
  • feeders
	Tasks described in Transmission and Distribution

• reclosers/sectionalisers • busbars • fundamentals of protection schemes and components, including: • voltage transformers • current transformers • transducers • relays.	Tasks described in Protection

UETTDRIS67A Solve problems in energy supply network equipment and systems
ONLINE RESOURCES ARE SUPPORTED THE STUDENTS TO ACQUIRE THE COMPETENCIES

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve problems in energy supply network nequipment

1.1 OHS procedures for a given work area are identified, obtained

and understood Ref-Advanced Diploma in Electrical

Engineering Exercises Page 3 -Q15+16

Click **HERE** to download the Exercises
http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf
Relevant Instruction Lessons

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4
Q21+22 Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers. Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q11.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.5 Sources of materials that may be required for the work are established in accordance with established procedures.

Submit the following assignment questions

Ref-Advanced Diploma in Electrical Engineering Exercises Page 119)

Pole & line installation technique
Slide 1

Q8.Describe pole and line installation techniques.

Q9.Sketch line profile diagram.

Slide 2

Q10.What are the requirement for line planning?

Q11.What are the scales to be utilized for preparing line design drawing.

1.6 Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 120)

Slide 5

Q18.Write down the methods and requirement for staying of pole and support.

Slide 6

Q19.Sketch the diagram for essential components of staying pole.

Slide 7

Q20.What are the requirement of conductor size and separation of conductors?

Slide 8

Q21.Show the table for span & spacing relationship

Slide 9

Q22.Do the review question exercises.

Slide 10

Q23.What are the methods to reduce the stress in UG cable?

Line survey & line design

Study slides 1 to 14 and perform the given line design.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		

		Assessment Feedback Sheet
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

2 Solve problems in energy supply network equipment.

2.1 OHS risk control measures and procedures for carrying out the work are followed. As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 121)

UG cable capacitances, testing , connection
Slide 1+2

Q28.Sketch the UG cable & indicate capacitance . Express the equation to calculate capacitance.
Slide 3+4

Q29.A single core 66KV cable has a conductor diameter of 2.5 cm and sheath inside diameter 6 cm. Find the maximum stress if two inter-sheaths are used. .Find the best position. The maximum stress the voltage on inter sheaths.
Slide 5

Q30.In testing of UG cable , conductor 2 & 3 are connected . By measurement of capacitance between conductor 1 and 2-3 combination is 7 µF. When all conductors are connected, the measured capacitance is 5 µF. Calculate the capacitance between conductors & the capacitance between conductor & sheath

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

2.4 Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.

As per 1.3

2.5 Problem solving is approached methodically drawing on knowledge of energy network equipment using measured and calculated values of circuit/apparatus parameters.

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

	Assessment Method	Question
EKAS Topics T1 Generation encompassing: □ primary energy sources □ power stations □ power station output □ acts and legislation relating to generation □ renewable energy sources and techniques T2 Transmission encompassing: system requirements principal components of a power system voltage levels grid systems acts/legislation relating to transmission future trends T3 Distribution encompassing: high voltage distribution systems medium/low voltage distribution systems radial feeders parallel feeders ring main feeders acts/legislation relating to distribution T4 Substations encompassing: purpose location layout	Multiple choice/short answer questions	**Electrical Distribution (Test 1)** (20 marks) 1. Name the factors that are used in the selection for overhead line conductors 2 marks 2. Name six commonly used materials for overhead line 2 marks 3. Name the three factors that determine conductor current rating 2 marks 4. What are the factors that determine the maximum conductor temperature? 2 marks 5. Sketch and explain the advantages and disadvantages of the followings Radial feeder, ring feeder, parallel feeder 2 marks 6. A crossarm is listed as 2.7P/16/100x100. Describe the meaning of each term in the list. 1 mark 7. Describe the three common types of insulators used in the distribution system

T7 Voltage problems in a power distribution system encompassing:

2 marks

8.Describe the use of arcing horns.

1 mark

low voltage unbalanced voltages voltage rises T8 Voltage regulation encompassing: autotransformers with OLTC transformers with OLTC static capacitors load control T9 Control of OLTC encompassing: regulation relays control circuits line drop compensation T10 Power distribution system faults encompassing: type/classification of fault typical causes/effects of faults three-phase symmetrical fault levels fault level limitation T11 Voltage surges in a power distribution system encompassing: lightning surges switching surges typical surge levels surge impedance, typical values significance of the system surge impedance. T12 Metering and metered quantities encompassing: purpose energy maximum demand accuracy classes for metering systems T13 Energy and demand meters encompassing:		Brifely explain the following pin insulator designations APL33/920 SLP 11/180 2 marks The conductor to be erected over a 160m span has an equivalent weight of 4N/m diameter of 12mm and ultimate tensile strength of 33KN Determine the sag which must be provided on erection if it is desired to allow for wind loading of 500pa and safety factor of 3.5 2 marks Illustrate by mean of a sketch, the method of terminating the line giving dimensions where possible. 1 mark Percentage of the ultimate strength of various parts of overhead line Steel ---% Wood% Stay _____ wire/Insulator_____% 1 marks

T5 Overhead and underground systems encompassing: REQUIRED SKILLS AND KNOWLEDGE applications planning installation T6 Power distribution system electrical characteristics encompassing: transmission and distribution systems inductance, capacitance and resistance T8 Voltage regulation encompassing: autotransformers with OLTC transformers with OLTC static capacitors load control	Multiple choice questions Short answer questions Practical testing of cables	**Electrical Distribution (Test 2)** **Total marks- 20** What are the factors that determine the current rating of a cable? 3 marks (2) How will you reduce the stress on electrical cable? 3 marks A single core 66KV cable has a conductor diameter of 2 cm and a sheath of inside diameter 5.3cm. Find the maximum stresses . If two inter sheaths are used. Find the best positions, the maximum stresses and the voltage on inter sheath. 5 marks In testing of a UG cable, conductor 2 & 3 are connected, by measurement of capacitance between conductor 1 and 2-3 combination it is 6 micro farad. When all conductors are connected, the measured capacitance is 4 micro farad Calculate the capacitance between conductors and the capacitance between conductor and sheath 5 marks (5) Explain the methods applied to find the fault in UG cable

		4 marks
T1 Generation encompassing: **primary energy sources** **power stations** **power station output** **acts and legislation relating to generation** **renewable energy sources and techniques** **T2 Transmission encompassing:** **system requirements** **principal components of a power system** **voltage levels** **grid systems** **acts/legislation relating to transmission** **future trends** **T3 Distribution encompassing:** **high voltage distribution systems** **medium/low voltage distribution systems** **radial feeders** **parallel feeders** **ring main feeders** **acts/legislation relating to distribution**	Short answer questions Multiple choice questions Voltage profile design assignment	**Electrical Distribution (Test 3)** **Total marks - 40** Question (1) Draw a block diagram of a power system from generation to utilization and on it show typical voltages. 2 marks Question (2) Sketch a radial feeder arrangement and state it's advantages and disadvantages. 2 marks Question (3) Explain the term joint use agreement as applied to poles in a distribution system. 2 marks Question (4) Outline a maintenance programme suitable to use by a distribution authority to ensure safety and reliability of poles used on it's system. 3 marks Question (5) Where are pole stays likely to be used on an overhead line? List the essential components for the staying of a pole. 3 marks Question (6)

		An underground cable is designed: 11KV 500 AL3 PHL SWZ. Give a full description of cable make up. 2 marks Question (7) A 3 phase load of 200KVA 50Hz is to have its power factor improved from 0.75 to 0.9. Calculate the size of capacitor bank required if the supply voltage is 415V. Sketch the connection. 3 marks Question (8) A transformer supplies a group of four feeders which have individual maximum demands of 2.5, 2.4, 4.3 and 1.6 MVA. If the diversity factor of the system is 1.82 determine the maximum demand on the transformer. 3 marks Question (9) The conductor to be erected over a 160 m span has an equivalent weight of 4 N/m, diameter of 12 mm and ultimate tensile strength of 33KN. Determine the sag which must be provided on erection if it is desired to allow for wind loading of 500 Pa and safety 3.5. 4 marks Question (10) A 3 phase , 11kV overhead rural line is to be erected between points A and B. The route of the wooden pole line is straight and the soil resistance to movement is good. Standard pin insulators on single wooden crossarms form part of the line

insulation.

Nominate the ground clearance you would recommend and indicate details relating to this decision

The maximum conductor design sag has been set at 1.0m. Indicate a suitable pole planting depth and determine the total length of pole.

If the termination poles are located at A and B, what would be the most economical number of poles for the power line of 3.0 km in length? Details of the conductor to be used are shown below:

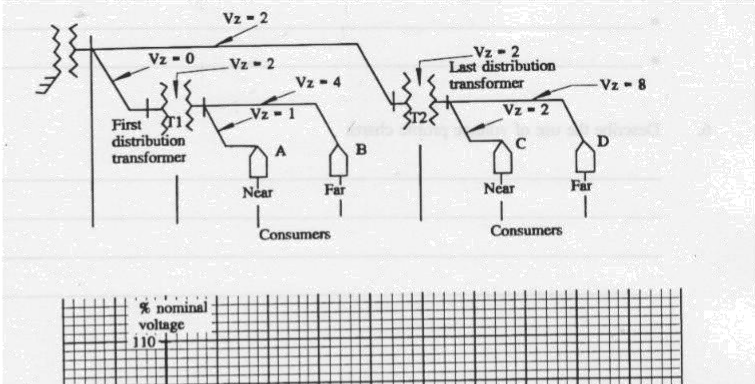
Mass per 100 m	=	43 kg
Wind loading	=	750 Pa
Equivalent diameter	=	16 mm
Design tension	=	6 kN
Ruling average sag	=	1.0 m

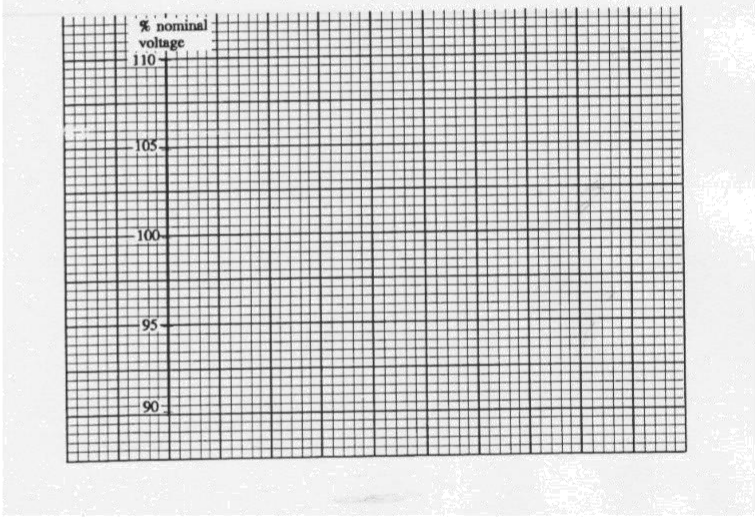
Nominate the three factors which determines the current rating of cables.

8 marks

Question (11)

For the simplified single line diagram below, plot the voltage profile for heavy load period. The voltage at point A is 110% nominal. The Vz values indicated on the diagram
Show the percent impedance voltage drop per unit of consumer heavy current.





6 marks

Question (12)

State the three general methods of voltage control.

2 marks

2.6 Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage Ref-Advanced Diploma in Electrical Engineering Exercises Page 121)

Decision strength and fault in UG cable (You need to make the dismantling to find out the fault)
Slide 1+2+3

Q31.Conductor insulation thickness = 0.52 cm. , dielectric constant = 4, Belt thickness = 0.45 cm, Conductor diameter = 1.7 cm. Calculate the capacitance to neutral for 1.5Km long cable.
Slide 4

Q32.Explain UG cable fault finding methods.

2.7 Circuits/components are rechecked and their operational status is confirmed. Ref-Advanced Diploma in Electrical Engineering Exercises Page 122)

To determine the operational status, voltage status need to be confirmed. The following are the questions for that purpose

Q40.Describe the causes and effects of voltage regulation.

Slide 5

Q41.State three general methods of voltage control.

Q42.List five voltage control devices in distribution system.

2.8 Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.

2.9 Effectiveness of the repair is tested in accordance with established procedures.

2.10 Apparatus is reassembled, finally tested and prepared for return to service. Ref-Advanced Diploma in Electrical Engineering Exercises Page 120)

To replace the poles, the following questions assist the candidates to acquire the necessary parts Slide 5

Q18.Write down the methods and requirement for staying of pole and support.

Slide 6

Q19.Sketch the diagram for essential components of staying pole.

Slide 7

Q20.What are the requirement of conductor size and separation of conductors?

Slide 8

Q21.Show the table for span & spacing relationship

2.11 Unexpected situations are dealt with safely and with the approval of an authorised person. As per 1.3

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

As per 2.5

Location of Evidences (Table 1)

Completion and report for problem solving in energy supply network equipment 3.1

OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.

3.3 Maintenance work activities are documented in accordance with established procedures.

POWER SYSTEM PRACTICAL LINE DESIGN PROJECT

7	Short answer question Practical survey assessment Overhead line design assignment	OH Line Design Assignment 20% **TRANSMISSION LINE DESIGN PROJECT** 0 *This project will have to be completed in Week 9. But the components of the project can be done concurrently with class lessons. You also need to think about how to do the following tasks whenever you complete the lectures in the respective week shown in brackets beside the following tasks. You also need to refer the respective notes in CD as indicated in underlined sentences.* *1 You need to use ruler to do scaled drawing for line route.* Draw Line route to supply the proposed factory location from 3 Phase 11 KV line. Put on map (Week 5) Draw side view of the route that you select for power line route. Show ground levels. (Week 4) Plan profile drawing for the power line **2.5 State pole and line installation techniques in CD** refer profile drawing Fig 11.8. (Day 4) Determine the appropriate size of pole. Mention appropriate length of cross arm, height, diameter **(Refer my e-mail attachment- Page 44 –(***I will send you***) & Topic 2.2 Outline relevant factors related to installation, maintenance, cross arms, stays, pole types and choice of conductors sizes for commonly used configuration in CD**. You will see clearance in Table 1-Open supply line. You need to convert foot to metre.1 metre= 3.3 Feet (Week 2, 3)

		Select appropriate insulator and cross arm**(Disc insulator EA2/D EA3/D etc)** (Week 2) Select the size of conductor based on 2MVA 33KV 3 Phase.Refer AS 3008 (Refer my e-mail attachment: AS3008 Pages) OR **2.3 Determine mechanical limitations and physical dimensions of lines in CD** Calculate sag. **(Use formula in Review Question (1) Question 10/11)** (Week 2) Draw cross arm, pole, insulator. Refer **2.1. Identify relevant components use in over head line** **design in CD.** Week (3) Attach vibration damper, guy wire , line guard as necessary **Review Question (1) Number 14.** Show footing **Review Question (1) Number 15.** (Week 2) Install cross arm to pole, insulator Refer **2.5 State pole and line installation techniques (Part** **2,3,4) in CD.** Prepare list of materials. Cable, insulator, etc that you use. (Week 9) Sketch line diagram ------Containing-Route and pole diagram with dimension (Week 9) NOTE==== MAIN SUPPLY 33 KV is located at

		Shopping Centre from where , you take the supply

www.electricaldiploma2013.webs.com

Work performance + Practical Instruction Back up

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http://www.filefactory.com/file/cf88135/n/Practical.zip

Refer Power System Practicals

Part 1: Operational Study

LabName No	Name of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1	Receiving end voltage comparison between short/ medium and long transmission lines	distribution system types	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion

EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection • surge protection • conventional relays	Research, report presentation
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead	Circuit interpretation, connection, data collection, calculation, graph

		systems	sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

(2)**Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.**

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?

To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.

The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is ,

caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in voltages	Abnormal resistance. Wrong cable selection. Abnormal circuit configuration	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of the circuit.	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.

(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated from the power line. Too much power loss and high interference to telecom line	Corona	Corona study	Will consider the ACT OF GOD	Will find the way to reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level	EP 7 Corona video	How corona occurs and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault

		Protection				protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not provide the effective protection	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason why and how to change the protection system	Will adjust CT PT ratio at the simulated fault situation and will adjust the relay setting appropriately	EP9 Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	Practical skill development in CT PT ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through	Knowledge development on various protective relays used in

					trade references	industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection. All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.

(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc extinguishing methods	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and	EP13 Study of various protective relays used in	Knowledge development on various protective

it does not work when the ground fault occurs				protection task	industry through trade references	relays used in industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other ***Detailed explanation*** A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions

Evidence **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery** www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	G-Observe the student's performance in practical class L- Student practical performance result + report preparation *Evidence Attached* **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:

A	Assignment	**B**	Written task	**C**	Role play	**D**	Exam
E	Oral questioning	**F**	Simulation	**G**	Observation	**H**	Work based
I	Portfolio	**J**	Self assessment	**K**	Case study	**L**	Practical demonstration
M	Project	**N**	Training Record Book	**O**	Other (Please specify)		

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		

EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Page 196 to 231 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-luu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6oggZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69

Page 232 to 270 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41q4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

G040 + IS73

Page 271 to 284 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KlKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

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Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

PROTECTION SYSTEM

UETTDRIS68A Solve problems in energy supply protection Equipment

ONLINE RESOURCES ARE SUPPORTED THE STUDENTS TO ACQUIRE THE COMPETENCIES

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve problems in energy supply network equipment

1.1 OHS procedures for a given work area are identified, obtained

and understood Ref-Advanced Diploma in Electrical

Engineering Exercises Page 3 -Q15+16

www.electricaldiploma2013.webs.com Then access Click **HERE** to download the Exercises
http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf
Relevant Instruction Lessons

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4
Q21+22 Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q12.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.5 Sources of materials that may be required for the work are established in accordance with established procedures.

Submit the following assignment questions

Ref-Advanced Diploma in Electrical Engineering Exercises Page 123)

The practice questions are organized to find out the protection system equipments and materials together with relevant theory

Over current and earth fault protection
Slide 1+2

Q1.Sketch three phase over current protection.

Q2.Sketch three phase earth fault relay protection.
Slide 3+4+5

Q3.Explain the operation of directional element with sketch.

Slide 6

Q4.Locate the position of reverse power relay in power line.

Slide 7

Q5.Sketch the connection of combined protection scheme that contains two over current relays one earth fault relay to provide phase to phase and earth protection.

Q6.How does directional element of relay perform?

Slide 8

Q7.Locate directional and non directional element in a ring circuit.

1.6 Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

.Testing of protection current & potential transformer and relevant questions are arranged to provide this competency component. Slide 5

Q52.Explain (a) AC ratio check (b) DC polarity check (c)Three phase polarity test for three phase CT Slide 6

Q53.How will you interpose & sum CT & PT?

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		
Students' work in own	Summative Assessment- Formal	

record	Tests	
	Formative Assessment/Practical+ Class works	

2 Solve problems in energy supply network protection equipment and system.

2.1 OHS risk control measures and procedures for carrying out the

work are followed. As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

Live testing of protective relay system and depermination of characteristics and relevant questions are arrrranged to provide this competency component.

Distance protection scheme
Slide 1

Q30.Explain the distance protection scheme with
sketch. Slide 2

Q31.Explain the operation and construction of distance relay with sketch.
Slide 3

Q32.Explain the characteristics of distance
relay. Slide 4

Q33.Describe the directional distance relay with sketch.
Slide 5

Q34.What is the relation between maximum reach & relay characteristics.
Slide 6+7

Q35.Explain the zones for distance protection
scheme. Slide 8

Q36.Explain the operation of three phase distance relay.
Slide 9

Q37.Explain maximum reach and maximum reach angle.

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

2.4 Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.

As per 1.3

2.5 Problem solving is approached methodically drawing on knowledge of energy supply network protection equipment and systems using measured and calculated values of circuit/apparatus parameters.

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

EKAS COMPONENT	Question No	Questions
KS01-TIS68A Electrical power system protection Evidence shall show an understanding of protection methods and devices for electrical power systems to an extent indicated by the following aspects: T1 Protection fundamentals encompassing: - purpose of protection - features of a protection scheme T2 Instrument transformers for protection encompassing: - Operating principles - Applications of current transformers - Applications of voltage transformers T3 Feeder protection encompassing: - fuse protection - overcurrent & earth fault - sensitive earth fault - unit schemes - distance protection - trip/close sequences for feeders - recloser/sectionaliser systems T4 Transformer protection encompassing: - overheating protection - overcurrent protection	1 2 3 4 5	What is power system protection scheme? (5 marks) What equipments are included in power system protection scheme? (5 marks) Explain the functions of the following devices included in a power system protection Scheme. CT, PT, Fault Detector, Tripping Circuit (10 marks) Sketch the construction of • Balanced Beam Relay Connection Diagram of Relay Tripping Circuit (10 marks) Sketch the connection diagram of combination protection scheme that contains two Over current relays and one earth fault relay to provide phase to phase and phase to earth protection.. (10 marks)

- restricted earth fault protection
- differential protection
- oil and gas devices

T5 Busbar protection encompassing:

- types of fault
- requirements of busbar protection
- system protection
- frame-earth protection

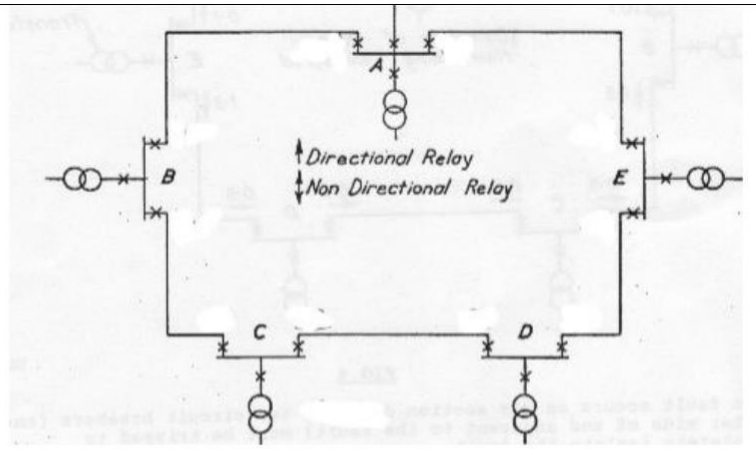
T6 Surge protection encompassing:

- voltage surges
- surge diverters
- arcing horns

6

7

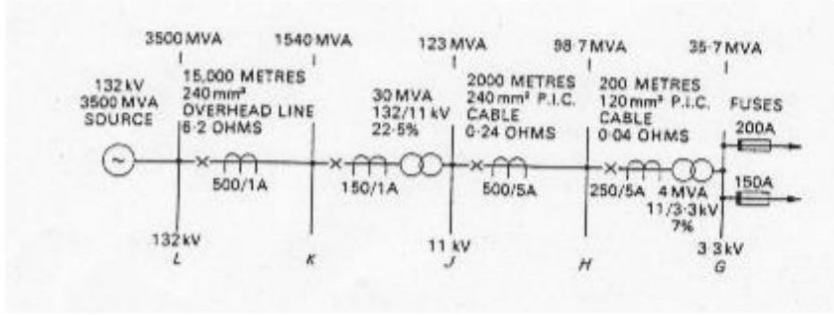
Total 70 marks



Locate relay protection scheme for given system when fault occurs at point F.

(20 marks)

Sketch curve for discrimination by both time and current of the following power system..



8

9

10

(20 marks)

How will you adjust Definite Minimum Time point on relay curve?

(5 marks)

Total 100 marks

What is “Pick Up” of relay?

(5 marks

Sketch the vector diagram for primary, secondary main windings of

		Star Delta Power Transformer . (10 marks)

2.6 Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

To convert the analog relaying system to digital relay system, the dismantling of origin components and assembly of new system components are to be done. The following questions and activities provide this competency component.

Digital relay+ Telecommunication for protection
Slide 1

Q54.What is digital relay?
Slide 2+4

Q55.Sketch the flow diagram of digital relay operation.
Slide 3+4

Q56.Sketch DAC
system Slide 5

Q57.Explain busbar protection with sketch
Slide 6

Q58.Write line & busbar protection with sketch.
Slide 7

Q59.Sketch the operation of digital relay.

2.7 Circuits/components are rechecked and their operational status is confirmed. Ref-Advanced Diploma in Electrical Engineering Exercises Page 129)

To determine the operational status of protection system, it needs to ensure relay operation sequence, the sequential relay protection system and characteristics are to be investigated. The following activities and questions provide this competency.

(32)Over current & earth fault protection , Directional protection, operating
characteristics Slide 1

Q64.Sketch the diagram of over current protection

Slide 2

Q65.Sketch earth fault relay protection diagram.

Slide 3

Q66.Sketch the combined over current and earth fault protection and explain it’s operation.

Slide 4

Q67.Explain the operation of directional relay with diagram.

Slide 5+6+7+8

Q68.Locate directional & non directional elements in ring system.

Slide 9+10

Q69.Sketch the connection diagram of combinational protection scheme that contains two over current relays and one earth fault relay to provide phase to phase and phase to earth protection.

Slide 11

Q70.How will you adjust definite minimum time point on relay curve?

2.8 Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.

2.9 Effectiveness of the repair is tested in accordance with established procedures.

2.10 Apparatus is reassembled, finally tested and prepared for return to service. Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

When more power loads are connected to transmission line, the current protection system needs to be modified. The following questions and activities provide this competency component.

Transmission line protection

Slide 1

Q23.Sketch transmission line differential protection

Slide 2+3

Q24.Sketch the modification diagram for transmission line protection with differential relay.

Distance relay, pilot wire with differential three phase line protection

Slide 1

Q25.Explain the operation of distance relay

Slide 2

126

Q26.Explain the operation of distance relay with sketch

Slide 3+4

Q27.Sketch the characteristics curve of distance relay

Slide 5+6

Q28.Explain the zone protection of distance relay.

Slide 7+8

Q29.Sketch the protection diagram of distance relay with operating & restraining voltage and current.

2.11 Unexpected situations are dealt with safely and with the approval of an authorised person. As per 1.3

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

As per 2.5

Location of Evidences (Table 1)

Completion and report for problem solving in energy supply network equipment 3.1

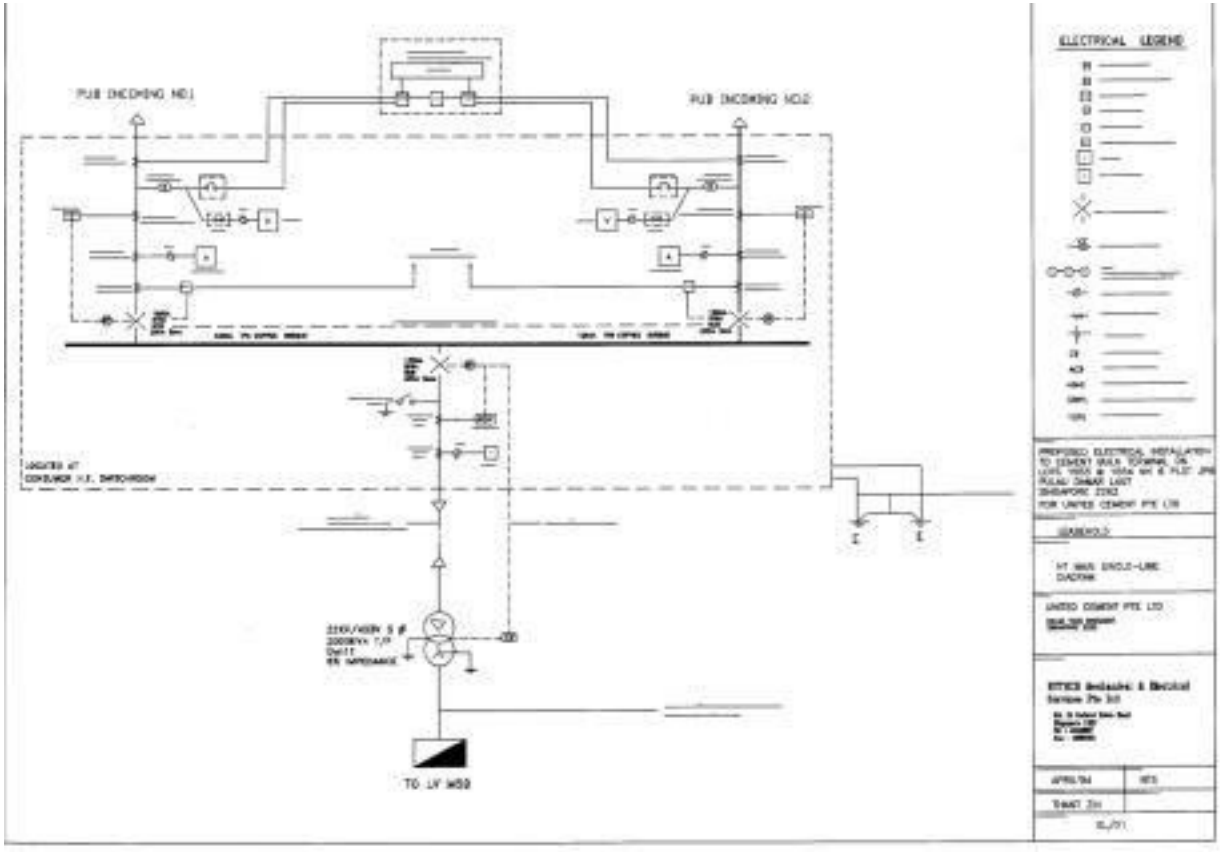
OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.

3.3 Maintenance work activities are documented in accordance with established procedures.

POWER SYSTEM PROTECTION COMMISSIONING PROJECT



The above diagram is Incoming HV supply system for a Cement Factory. It contains Star –Delta Transformer, Interchange switches for switching 2 supply, sketch of protective relay system with trip circuit and outline for measuring instruments.

(1) Develop Detail installation diagram that contain appropriate protection instruments and measurement instruments

Recommend appropriate specifications for protection and measuring instruments for power supply requiring 500Kw for the factory.
By answering the following questions, the concepts for the above project can be highlighted

Ref-Advanced Diploma in Electrical Engineering Exercises Page 125)

Three phase differential relay
Slide 1

Q17.Sketch three phase star/ delta transformer protection with differential relay.
125

Slide 2

Q18.Explain the setting of differential relay.

Connection of main transformer, CT , directional relay

Slide 1+2+3

Q19.Sketch the combined earth fault and differential protection for three phase star/ delta transformer.

Work performance + Practical Instruction Back up

Click HERE to download practicals

http://www.filefactory.com/file/cf88135/n/Practical.zip

Refer Power System Practicals

Part 1: Operational Study

LabName No	Name of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1Re	ceiving end voltage comparison between short/ medium and long transmission lines	distribution system (types	rcuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion

EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion
EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection	Research, report presentation

		• surge protection • conventional relays	
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified

work outcomes.

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the

surrounding environment or services and using sustainable energy practices.

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?

To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.

The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is , caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in	Abnormal resistance. Wrong cable selection. Abnormal circuit	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point

voltages	configuration			the circuit.		
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.
(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated	Corona	Corona study	Will consider the ACT	Will find the way to	EP 7 Corona video	How corona occurs

from the power line. Too much power loss and high interference to telecom line			OF GOD	reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level		and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System Protection	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason	Will adjust CT PT ratio at the simulated fault	EP9 Connection of	Practical skill development in CT PT

provide the effective protection			why and how to change the protection system	situation and will adjust the relay setting appropriately	relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection.	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection

All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right						
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.
(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity

				extinguishing methods		
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but it does not work when the ground fault occurs	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and protection task	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes **Evidence** **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery**	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other ***Detailed*** ***explanation*** A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions G-Observe the student's performance in practical class L-Student practical performance result + report preparation

www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	*Evidence Attached* **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1 On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5 Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:			
A Assignment	**B** Written task	**C** Role play	**D** Exam
E Oral questioning	**F** Simulation	**G** Observation	**H** Work based
I Portfolio	**J** Self assessment	**K** Case study	**L** Practical demonstration
M Project	**N** Training Record Book	**O** Other (Please specify)	

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		
EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-luu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6ogqZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69
Page 232 to 270 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41q4Rmz2p0

http://youtu.be/8CeIGV5AEIk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/l4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

Qualification Number and Name:	Advanced Diploma of Electrical Engineering
Unit of Competency Number and Name:	**UETDRIS032 Solve problems in network equipment** **UETDRIS033 Solve problems in network protection** **Training & Assessment Strategies+Mapping+Study Guide+Tasks** **Together with** **UETDREL005 Work safely in the vicinity of live electrical apparatus**

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve problems in energy supply network equipment (032) + **Prepare to solve problems in network protection (033)**	1.1	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be done are reviewed and determined (both)	Q 1,2,3 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.4	Hazards are identified, risks assessed, and control measures identified and applied (032+033)	Q 4 to 7 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.2	Work plan is obtained, confirmed and communicated with relevant personnel in accordance with workplace requirements (032+033)	Q 8 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.3	Work is prioritised and sequenced for completion in accordance with work plan and workplace requirements (032)+033)			

	1.5	Work permits are determined in accordance with workplace requirements (032+033)	Q 9 to 12 of IS68+IS74 Assessment Mapping.pdf (Page 3)		
	1.6	Plant, tools, equipment and personal protective equipment (PPE) required for work are determined, obtained and confirmed in working order (032+033)			Advanced Diploma in Electrical Engineering Exercises Page 208) Q11+12 Advanced Diploma in Electrical Engineering Exercises Page 123)Q 1 to 7

Elements & Performance Criteria			**Assessment event(s)**		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.6			Practical EP9,EP10,	Advanced Diploma in Electrical Engineering Exercises Page 128) Q52+53
2/Solve problems in network equipment (032) Solve problems in network protection (033)	2.1	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be performed are applied and monitored (032+033)	As per 1.1 to 1.3		

	2.2	Lifting, working at heights, working in confined spaces and the use of plant, tools, equipment and PPE are carried out in accordance with workplace requirements (032+033)	Review the relevant topics of UEECD0007 OHS		
	2.3	Work permits are received and signed in accordance with workplace requirements (032+033)	As per 1.5		
	2.4	Problems in network equipment are solved in accordance with workplace requirements (032) Problems in network protection are solved in accordance with workplace requirements (033)		Practical EP11.EP12	Advanced Diploma in Electrical Engineering Exercises Page 126) Q30 to 37
	2.5	Hazard control measures are monitored in accordance with workplace requirements (032+033)	As per 1.4		
	2.6	Incidents or unplanned events are responded to in accordance with workplace requirements (032+033)	As per 1.4		
	2.7	Quality checks of work are undertaken in accordance with work plan and workplace requirements (032+033)	Test 1 Q 1 to 10 Check the solution of the problem & verification)		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
3/Complete work and documentation (032+033)	3.1	Completed work is checked for compliance against the work plan and workplace requirements Circuits/components are rechecked and their operational status is confirmed. Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures. Effectiveness of the repair is tested in accordance with established procedures. Apparatus is reassembled, finally tested and prepared for return to service.	As per 1.3 As per 2.5		Advanced Diploma in Electrical Engineering Exercises Page 128)Q55 to 59 Advanced Diploma in Electrical Engineering Exercises Page 128)Q64 to 70 Advanced Diploma in Electrical Engineering Exercises Page 126) Q23 to 29
	3.2	Incidents or unplanned events are reported in accordance with workplace requirements ()32+033)	As per 1.4		
	3.3	Plant, tools and equipment are cleaned, checked and returned to storage, and surplus resources and materials are managed in accordance with workplace requirements (032+033)	As per 1.3		
		Reusable, faulty or worn components are tagged and			Advanced Diploma

		dispatched for repair to maintain adequate spares.		Project	in Electrical Engineering Exercises Page 125) Q 17 to 19

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.4	Work permits are signed off in accordance with workplace requirements (032+033)	As per 1.5	Project	Advanced Diploma in Electrical Engineering Exercises Page 125) Q 17 to 19
	3.5	Work records, reports and documentation are completed, and appropriate personnel notified in accordance with workplace requirements (032+033)	All design documentation+ Solved Problems		

Add rows to the following table as required

UETDRIS032

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two (2) separate occasions and include:	
• applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including: • work health and safety (WHS)/occupational health and safety (OHS) requirements • identifying hazards, assessing risks, and identifying, applying and monitoring control measures • obtaining, inspecting and using relevant personal protective equipment (PPE)	All lessons+Assessment Tasks in Transmission and Distribution System as submitted below

• dealing with an unplanned event on at least one (1) occasion
• obtaining and signing work permits in accordance with workplace requirements
• completing relevant work records, reports and documentation
• solving problems in network equipment, including:
  • determining equipment operating parameters
  • determining scope of work and resource requirements
  • applying problem-solving techniques
  • applying manufacturer's settings to meet network requirements
  • conducting functional testing
• solving problems in network equipment on at least one (1) of the following network systems:
  • distribution overhead
  • distribution underground
  • transmission overhead
  • transmission underground
• using at least three (3) of the following distribution/transmission equipment types:
  • voltage regulation equipment
  • on-load tap changers (OLTCs)
  • energy metering
  • demand meters
  • load control
  • current transformers
  • potential transformers.	

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

• relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including WHS/OHS requirements
• hazard, risk assessment and risk control requirements, including potential hazards
• types and application of PPE
• safe use of plant, tools and equipment
• application, purpose and types of permits
• events constituting an unplanned event or incident
• procedures for responding to an unplanned event or incident
• workplace records, reports and documentation
• principles of all of the following:
  • generation
  • transmission
  • distribution
  • substations
  • overhead and underground systems,
  • inductance, capacitance and resistance
  • voltage regulation
  • transformers and OLTCs
  • line drop compensation
  • types of system faults and protection
  • voltage surges
  • metering and metered quantities
	All lessons+Assessment Tasks in Transmission and Distribution System as submitted below
	•

• load control.	

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Connection of relay protection scheme & protective equipments by using one line diagram		EP9	
Current transformer & potential transformer connection & ratio test		EP10	
Over current relay characteristics		EP11	
Electronic relay test		EP12	
Study of various protective relays used in industry through trade references			Research Assignment

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Protection fundamentals encompassing:	Q 1,2,3 of Test 1		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T2 Instrument transformers for protection			Advanced Diploma in Electrical Engineering Exercises Page

			125) Q 38 to 52
T3 Feeder protection	Q7 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 23 to 37
T4 Transformer protection	Q10 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 10 to 15
T5 Busbar protection			Advanced Diploma in Electrical Engineering Exercises Page 125) Q 16 to 19
T6 Surge protection			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 16 to 18

Add rows to the following table as required

Assessment Conditions	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test	Practical EP 9 to 12	Research Assignment

TRANSMISSION AND DISTRIBUTION SYSTEM

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Receiving end voltage comparison between short/ medium and long transmission lines		EP1	
Long transmission line PI equivalent circuit		EP2	
Long transmission line T equivalent circuit		EP3	
Transmission line efficiency/ Transformer effect on line efficiency		EP4	
Reactive power and power factor improvement		EP5	
PF effect on line current		EP6	
Corona Video		EP7	
Phase sequence measurement		EP8	
Underground cable capacitance test		EP19	
High tension line design		EP20	
Line insulator test & capacitance grading		EP21	
Voltage profile chart of distribution system		EP22	
Load centre-Power loss comparison		EP23	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

T1 Generation	Test 1 Q 1,5 Test 3 Q 1,2,3		
T2 Transmission	Test 1 Q 2,3,4 Test 3 Q 4,5,6		
T3 Distribution	Test 1 Q 3,6,7,9 Test 3 Q 8,9,10		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T7 Voltage problems			Advanced Diploma in Electrical Engineering Exercises Page 119) Q333, 34
T9 Control of OLTC encompassing			Advanced Diploma in Electrical Engineering Exercises Page 123) Q 1 to 4
T10 Power distribution system faults			Advanced Diploma in Electrical Engineering Exercises Page 199) Q 21 to Q25
T11 Voltage surges in a power distribution system			Advanced Diploma in Electrical Engineering Exercises Page 199) Q 13 to Q 17
T12 Metering and metered quantities		EP10	
T13 Energy and demand meters encompassing:			Online Research Assignment
T5 Overhead and underground systems	Test 2 Q 1 to 5		

T6 Power distribution system electrical characteristics	Test 1 Q 3,4,10,13 Test 3 Q 1,2		
T8 Voltage regulation	Test 3 Q 11		

UETDRIS033

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two (2) separate occasions and include:	

• applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including:
  • work health and safety (WHS)/occupational health and safety (OHS) requirements
• identifying hazards, assessing risks, and identifying, applying and monitoring control measures
• obtaining, inspecting and using relevant personal protective equipment (PPE)
• dealing with an unplanned event on at least one (1) occasion
• obtaining and signing work permits in accordance with workplace requirements
• completing relevant work records, reports and documentation
• solving problems in network equipment, including:
  • determining equipment operating parameters
  • determining scope of work and resource requirements
  • applying problem-solving techniques
  • applying manufacturer's settings to meet network requirements
  • conducting functional testing
• solving problems in network systems including at least one (1) of the following:
  • distribution overhead
	Tasks common to UETDRIS032 (Transmission and Distribution)

• distribution underground
• transmission overhead
• transmission underground
• solving problems in protection equipment and systems including at least two (2) of the following:
  • over-current protection
  • earth fault protection
  • differential protection
  • oil and gas devices
  • busbar protection
  • surge protection
  • conventional relays
  • electronic relays
  • reclosers/sectionalisers.
	Tasks described in Protection

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• relevant legislation, regulations, standards, codes of practice and organisational workplace requirements including WHS/OHS requirements
• hazard, risk assessment and risk control requirements, including potential hazards
• types and application of PPE
• safe use of plant, tools and equipment
• application, purpose and types of permits
• events constituting an unplanned event or incident
• procedures for responding to an unplanned event or incident
• workplace records, reports and documentation
• use of manufacturer's instructions, diagrams and manuals
• fundamentals of primary components, including:
  • power transformers
  • generators
  • feeders
	Tasks described in Transmission and Distribution

• reclosers/sectionalisers • busbars • fundamentals of protection schemes and components, including: • voltage transformers • current transformers • transducers • relays.	Tasks described in Protection

UETTDRIS67A Solve problems in energy supply network equipment and systems
ONLINE RESOURCES ARE SUPPORTED THE STUDENTS TO ACQUIRE THE COMPETENCIES

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve problems in energy supply network nequipment

1.1 OHS procedures for a given work area are identified, obtained

and understood Ref-Advanced Diploma in Electrical

Engineering Exercises Page 3 -Q15+16

Click **HERE** to download the Exercises
http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf
Relevant Instruction Lessons

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4
Q21+22 Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers. Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q11.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.5 Sources of materials that may be required for the work are established in accordance with established procedures.

Submit the following assignment questions

Ref-Advanced Diploma in Electrical Engineering Exercises Page 119)

Pole & line installation technique
Slide 1

Q8.Describe pole and line installation techniques.

Q9.Sketch line profile diagram.

Slide 2

Q10.What are the requirement for line planning?

Q11.What are the scales to be utilized for preparing line design drawing.

1.6 Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 120)

Slide 5

Q18.Write down the methods and requirement for staying of pole and support.

Slide 6

Q19.Sketch the diagram for essential components of staying pole.

Slide 7

Q20.What are the requirement of conductor size and separation of conductors?

Slide 8

Q21.Show the table for span & spacing relationship

Slide 9

Q22.Do the review question exercises.

Slide 10

Q23.What are the methods to reduce the stress in UG cable?

Line survey & line design

Study slides 1 to 14 and perform the given line design.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		

		Assessment Feedback Sheet
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

2 Solve problems in energy supply network equipment.

2.1 OHS risk control measures and procedures for carrying out the work are followed. As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 121)

UG cable capacitances, testing , connection
Slide 1+2

Q28.Sketch the UG cable & indicate capacitance . Express the equation to calculate capacitance.
Slide 3+4

Q29.A single core 66KV cable has a conductor diameter of 2.5 cm and sheath inside diameter 6 cm. Find the maximum stress if two inter-sheaths are used. .Find the best position. The maximum stress the voltage on inter sheaths.
Slide 5

Q30.In testing of UG cable , conductor 2 & 3 are connected . By measurement of capacitance between conductor 1 and 2-3 combination is 7 µF. When all conductors are connected, the measured capacitance is 5 µF. Calculate the capacitance between conductors & the capacitance between conductor & sheath

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

2.4 Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.

As per 1.3

2.5 Problem solving is approached methodically drawing on knowledge of energy network equipment using measured and calculated values of circuit/apparatus parameters.

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

	Assessment Method	Question
EKAS Topics T1 Generation encompassing: □ primary energy sources □ power stations □ power station output □ acts and legislation relating to generation □ renewable energy sources and techniques T2 Transmission encompassing: system requirements principal components of a power system voltage levels grid systems acts/legislation relating to transmission future trends T3 Distribution encompassing: high voltage distribution systems medium/low voltage distribution systems radial feeders parallel feeders ring main feeders acts/legislation relating to distribution T4 Substations encompassing: purpose location layout	Multiple choice/short answer questions	**Electrical Distribution (Test 1)** (20 marks) 1. Name the factors that are used in the selection for overhead line conductors 2 marks 2. Name six commonly used materials for overhead line 2 marks 3. Name the three factors that determine conductor current rating 2 marks 4. What are the factors that determine the maximum conductor temperature? 2 marks 5. Sketch and explain the advantages and disadvantages of the followings Radial feeder, ring feeder, parallel feeder 2 marks 6. A crossarm is listed as 2.7P/16/100x100. Describe the meaning of each term in the list. 1 mark 7. Describe the three common types of insulators used in the distribution system

T7 Voltage problems in a power distribution system encompassing:

2 marks

8.Describe the use of arcing horns.

1 mark

low voltage unbalanced voltages voltage rises T8 Voltage regulation encompassing: autotransformers with OLTC transformers with OLTC static capacitors load control T9 Control of OLTC encompassing: regulation relays control circuits line drop compensation T10 Power distribution system faults encompassing: type/classification of fault typical causes/effects of faults three-phase symmetrical fault levels fault level limitation T11 Voltage surges in a power distribution system encompassing: lightning surges switching surges typical surge levels surge impedance, typical values significance of the system surge impedance. T12 Metering and metered quantities encompassing: purpose energy maximum demand accuracy classes for metering systems T13 Energy and demand meters encompassing:		Brifely explain the following pin insulator designations APL33/920 SLP 11/180 2 marks The conductor to be erected over a 160m span has an equivalent weight of 4N/m diameter of 12mm and ultimate tensile strength of 33KN Determine the sag which must be provided on erection if it is desired to allow for wind loading of 500pa and safety factor of 3.5 2 marks Illustrate by mean of a sketch, the method of terminating the line giving dimensions where possible. 1 mark Percentage of the ultimate strength of various parts of overhead line Steel ---% Wood% Stay _____ wire/Insulator_____% 1 marks

T5 Overhead and underground systems encompassing: REQUIRED SKILLS AND KNOWLEDGE applications planning installation T6 Power distribution system electrical characteristics encompassing: transmission and distribution systems inductance, capacitance and resistance T8 Voltage regulation encompassing: autotransformers with OLTC transformers with OLTC static capacitors load control	Multiple choice questions Short answer questions Practical testing of cables	**Electrical Distribution (Test 2)** **Total marks- 20** What are the factors that determine the current rating of a cable? 3 marks (2) How will you reduce the stress on electrical cable? 3 marks A single core 66KV cable has a conductor diameter of 2 cm and a sheath of inside diameter 5.3cm. Find the maximum stresses . If two inter sheaths are used. Find the best positions, the maximum stresses and the voltage on inter sheath. 5 marks In testing of a UG cable, conductor 2 & 3 are connected, by measurement of capacitance between conductor 1 and 2-3 combination it is 6 micro farad. When all conductors are connected, the measured capacitance is 4 micro farad Calculate the capacitance between conductors and the capacitance between conductor and sheath 5 marks (5) Explain the methods applied to find the fault in UG cable

		4 marks
T1 Generation encompassing: **primary energy sources** **power stations** **power station output** **acts and legislation relating to generation** **renewable energy sources and techniques** **T2 Transmission encompassing:** **system requirements** **principal components of a power system** **voltage levels** **grid systems** **acts/legislation relating to transmission** **future trends** **T3 Distribution encompassing:** **high voltage distribution systems** **medium/low voltage distribution systems** **radial feeders** **parallel feeders** **ring main feeders** **acts/legislation relating to distribution**	Short answer questions Multiple choice questions Voltage profile design assignment	**Electrical Distribution (Test 3)** **Total marks - 40** Question (1) Draw a block diagram of a power system from generation to utilization and on it show typical voltages. 2 marks Question (2) Sketch a radial feeder arrangement and state it's advantages and disadvantages. 2 marks Question (3) Explain the term joint use agreement as applied to poles in a distribution system. 2 marks Question (4) Outline a maintenance programme suitable to use by a distribution authority to ensure safety and reliability of poles used on it's system. 3 marks Question (5) Where are pole stays likely to be used on an overhead line? List the essential components for the staying of a pole. 3 marks Question (6)

		An underground cable is designed: 11KV 500 AL3 PHL SWZ. Give a full description of cable make up. 2 marks Question (7) A 3 phase load of 200KVA 50Hz is to have its power factor improved from 0.75 to 0.9. Calculate the size of capacitor bank required if the supply voltage is 415V. Sketch the connection. 3 marks Question (8) A transformer supplies a group of four feeders which have individual maximum demands of 2.5, 2.4, 4.3 and 1.6 MVA. If the diversity factor of the system is 1.82 determine the maximum demand on the transformer. 3 marks Question (9) The conductor to be erected over a 160 m span has an equivalent weight of 4 N/m, diameter of 12 mm and ultimate tensile strength of 33KN. Determine the sag which must be provided on erection if it is desired to allow for wind loading of 500 Pa and safety 3.5. 4 marks Question (10) A 3 phase , 11kV overhead rural line is to be erected between points A and B. The route of the wooden pole line is straight and the soil resistance to movement is good. Standard pin insulators on single wooden crossarms form part of the line

insulation.

Nominate the ground clearance you would recommend and indicate details relating to this decision

The maximum conductor design sag has been set at 1.0m. Indicate a suitable pole planting depth and determine the total length of pole.

If the termination poles are located at A and B, what would be the most economical number of poles for the power line of 3.0 km in length? Details of the conductor to be used are shown below:

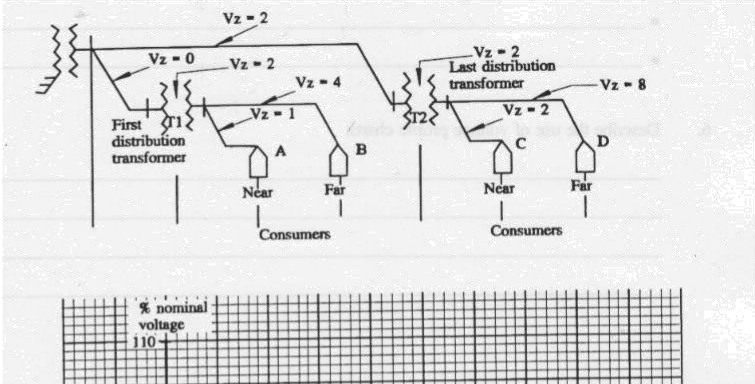
Mass per 100 m	=	43 kg
Wind loading	=	750 Pa
Equivalent diameter	=	16 mm
Design tension	=	6 kN
Ruling average sag	=	1.0 m

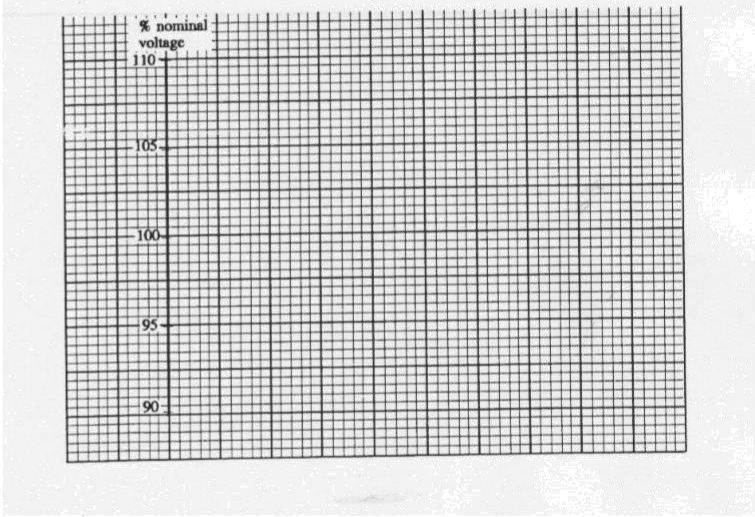
Nominate the three factors which determines the current rating of cables.

8 marks

Question (11)

For the simplified single line diagram below, plot the voltage profile for heavy load period. The voltage at point A is 110% nominal. The Vz values indicated on the diagram
Show the percent impedance voltage drop per unit of consumer heavy current.





6 marks

Question (12)

State the three general methods of voltage control.

2 marks

2.6 Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage Ref-Advanced Diploma in Electrical Engineering Exercises Page 121)

Decision strength and fault in UG cable (You need to make the dismantling to find out the fault)
Slide 1+2+3

Q31.Conductor insulation thickness = 0.52 cm. , dielectric constant = 4, Belt thickness = 0.45 cm, Conductor diameter = 1.7 cm. Calculate the capacitance to neutral for 1.5Km long cable.
Slide 4

Q32.Explain UG cable fault finding methods.

2.7 Circuits/components are rechecked and their operational status is confirmed. Ref-Advanced Diploma in Electrical Engineering Exercises Page 122)

To determine the operational status, voltage status need to be confirmed. The following are the questions for that purpose

Q40.Describe the causes and effects of voltage regulation.

Slide 5

Q41.State three general methods of voltage control.

Q42.List five voltage control devices in distribution system.

2.8 Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.

2.9 Effectiveness of the repair is tested in accordance with established procedures.

2.10 Apparatus is reassembled, finally tested and prepared for return to service. Ref-Advanced Diploma in Electrical Engineering Exercises Page 120)

To replace the poles, the following questions assist the candidates to acquire the necessary parts Slide 5

Q18.Write down the methods and requirement for staying of pole and support.

Slide 6

Q19.Sketch the diagram for essential components of staying pole.

Slide 7

Q20.What are the requirement of conductor size and separation of conductors?

Slide 8

Q21.Show the table for span & spacing relationship

2.11 Unexpected situations are dealt with safely and with the approval of an authorised person. As per 1.3

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

As per 2.5

Location of Evidences (Table 1)

Completion and report for problem solving in energy supply network equipment 3.1

OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.

3.3 Maintenance work activities are documented in accordance with established procedures.

POWER SYSTEM PRACTICAL LINE DESIGN PROJECT

7	Short answer question Practical survey assessment Overhead line design assignment	OH Line Design Assignment 20% **TRANSMISSION LINE DESIGN PROJECT** 0 *This project will have to be completed in Week 9. But the components of the project can be done concurrently with class lessons. You also need to think about how to do the following tasks whenever you complete the lectures in the respective week shown in brackets beside the following tasks. You also need to refer the respective notes in CD as indicated in underlined sentences.* *1 You need to use ruler to do scaled drawing for line route.* Draw Line route to supply the proposed factory location from 3 Phase 11 KV line. Put on map (Week 5) Draw side view of the route that you select for power line route. Show ground levels. (Week 4) Plan profile drawing for the power line **2.5 State pole and line installation techniques in CD** refer profile drawing Fig 11.8. (Day 4) Determine the appropriate size of pole. Mention appropriate length of cross arm, height, diameter **(Refer my e-mail attachment- Page 44 –(***I will send you***) & Topic 2.2 Outline relevant factors related to installation, maintenance, cross arms, stays, pole types and choice of conductors sizes for commonly used configuration in CD**. You will see clearance in Table 1-Open supply line. You need to convert foot to metre.1 metre= 3.3 Feet (Week 2, 3)

		Select appropriate insulator and cross arm**(Disc insulator EA2/D EA3/D etc)** (Week 2) Select the size of conductor based on 2MVA 33KV 3 Phase.Refer AS 3008 (Refer my e-mail attachment: AS3008 Pages) OR **2.3 Determine mechanical limitations and physical dimensions of lines in CD** Calculate sag. **(Use formula in Review Question (1) Question 10/11)** (Week 2) Draw cross arm, pole, insulator. Refer **2.1. Identify relevant components use in over head line** **design in CD.** Week (3) Attach vibration damper, guy wire , line guard as necessary **Review Question (1) Number 14.** Show footing **Review Question (1) Number 15.** (Week 2) Install cross arm to pole, insulator Refer **2.5 State pole and line installation techniques (Part** **2,3,4) in CD.** Prepare list of materials. Cable, insulator, etc that you use. (Week 9) Sketch line diagram ------Containing-Route and pole diagram with dimension (Week 9) NOTE==== MAIN SUPPLY 33 KV is located at

		Shopping Centre from where , you take the supply

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Refer Power System Practicals

Part 1: Operational Study

LabName No	Name of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1	Receiving end voltage comparison between short/ medium and long transmission lines	distribution system types	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion

EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection • surge protection • conventional relays	Research, report presentation
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead	Circuit interpretation, connection, data collection, calculation, graph

		systems	sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

(2)**Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.**

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?

To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.

The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is ,

caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in voltages	Abnormal resistance. Wrong cable selection. Abnormal circuit configuration	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of the circuit.	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.

(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated from the power line. Too much power loss and high interference to telecom line	Corona	Corona study	Will consider the ACT OF GOD	Will find the way to reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level	EP 7 Corona video	How corona occurs and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault

		Protection				protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not provide the effective protection	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason why and how to change the protection system	Will adjust CT PT ratio at the simulated fault situation and will adjust the relay setting appropriately	EP9 Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	Practical skill development in CT PT ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through	Knowledge development on various protective relays used in

					trade references	industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection. All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.

(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc extinguishing methods	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and	EP13 Study of various protective relays used in	Knowledge development on various protective

it does not work when the ground fault occurs				protection task	industry through trade references	relays used in industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other ***Detailed explanation*** A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions

Evidence **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery** www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	G-Observe the student's performance in practical class L- Student practical performance result + report preparation *Evidence Attached* **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:

A	Assignment	**B**	Written task	**C**	Role play	**D**	Exam
E	Oral questioning	**F**	Simulation	**G**	Observation	**H**	Work based
I	Portfolio	**J**	Self assessment	**K**	Case study	**L**	Practical demonstration
M	Project	**N**	Training Record Book	**O**	Other (Please specify)		

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		

EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

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Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-luu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6oggZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69

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Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41q4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

G040 + IS73

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Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KlKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

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Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

PROTECTION SYSTEM

UETTDRIS68A Solve problems in energy supply protection Equipment

ONLINE RESOURCES ARE SUPPORTED THE STUDENTS TO ACQUIRE THE COMPETENCIES

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve problems in energy supply network equipment

1.1 OHS procedures for a given work area are identified, obtained

and understood Ref-Advanced Diploma in Electrical

Engineering Exercises Page 3 -Q15+16

www.electricaldiploma2013.webs.com Then access Click **HERE** to download the Exercises
http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf
Relevant Instruction Lessons

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4
Q21+22 Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q12.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.5 Sources of materials that may be required for the work are established in accordance with established procedures.

Submit the following assignment questions

Ref-Advanced Diploma in Electrical Engineering Exercises Page 123)

The practice questions are organized to find out the protection system equipments and materials together with relevant theory

Over current and earth fault protection
Slide 1+2

Q1.Sketch three phase over current protection.

Q2.Sketch three phase earth fault relay protection.
Slide 3+4+5

Q3.Explain the operation of directional element with sketch.

Slide 6

Q4.Locate the position of reverse power relay in power line.

Slide 7

Q5.Sketch the connection of combined protection scheme that contains two over current relays one earth fault relay to provide phase to phase and earth protection.

Q6.How does directional element of relay perform?

Slide 8

Q7.Locate directional and non directional element in a ring circuit.

1.6 Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

.Testing of protection current & potential transformer and relevant questions are arranged to provide this competency component. Slide 5

Q52.Explain (a) AC ratio check (b) DC polarity check (c)Three phase polarity test for three phase CT Slide 6

Q53.How will you interpose & sum CT & PT?

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		
Students' work in own	Summative Assessment- Formal	

record	Tests	
	Formative Assessment/Practical+ Class works	

2 Solve problems in energy supply network protection equipment and system.

2.1 OHS risk control measures and procedures for carrying out the

work are followed. As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

Live testing of protective relay system and depermination of characteristics and relevant questions are arrrranged to provide this competency component.

Distance protection scheme
Slide 1

Q30.Explain the distance protection scheme with
sketch. Slide 2

Q31.Explain the operation and construction of distance relay with sketch.
Slide 3

Q32.Explain the characteristics of distance
relay. Slide 4

Q33.Describe the directional distance relay with sketch.
Slide 5

Q34.What is the relation between maximum reach & relay characteristics.
Slide 6+7

Q35.Explain the zones for distance protection
scheme. Slide 8

Q36.Explain the operation of three phase distance relay.
Slide 9

Q37.Explain maximum reach and maximum reach angle.

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

2.4 Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.

As per 1.3

2.5 Problem solving is approached methodically drawing on knowledge of energy supply network protection equipment and systems using measured and calculated values of circuit/apparatus parameters.

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

EKAS COMPONENT	Question No	Questions
KS01-TIS68A Electrical power system protection Evidence shall show an understanding of protection methods and devices for electrical power systems to an extent indicated by the following aspects: T1 Protection fundamentals encompassing: - purpose of protection - features of a protection scheme T2 Instrument transformers for protection encompassing: - Operating principles - Applications of current transformers - Applications of voltage transformers T3 Feeder protection encompassing: - fuse protection - overcurrent & earth fault - sensitive earth fault - unit schemes - distance protection - trip/close sequences for feeders - recloser/sectionaliser systems T4 Transformer protection encompassing: - overheating protection - overcurrent protection	1 2 3 4 5	What is power system protection scheme? (5 marks) What equipments are included in power system protection scheme? (5 marks) Explain the functions of the following devices included in a power system protection Scheme. CT, PT, Fault Detector, Tripping Circuit (10 marks) Sketch the construction of • Balanced Beam Relay Connection Diagram of Relay Tripping Circuit (10 marks) Sketch the connection diagram of combination protection scheme that contains two Over current relays and one earth fault relay to provide phase to phase and phase to earth protection.. (10 marks)

- restricted earth fault protection
- differential protection
- oil and gas devices

T5 Busbar protection encompassing:

- types of fault
- requirements of busbar protection
- system protection
- frame-earth protection

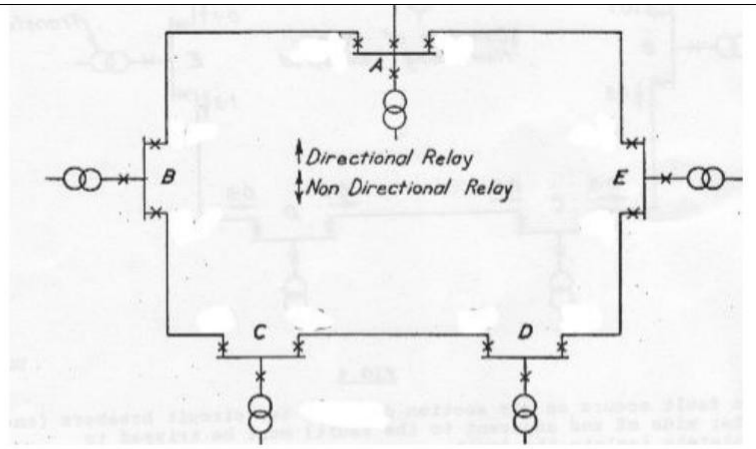
T6 Surge protection encompassing:

- voltage surges
- surge diverters
- arcing horns

6

7

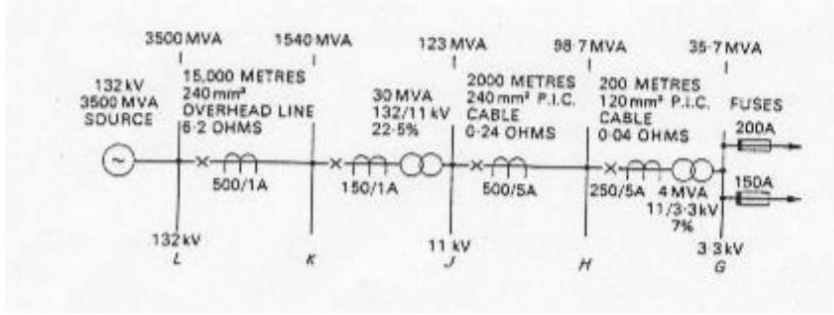
Total 70 marks



Locate relay protection scheme for given system when fault occurs at point F.

(20 marks)

Sketch curve for discrimination by both time and current of the following power system..



8

9

10

(20 marks)

How will you adjust Definite Minimum Time point on relay curve?

(5 marks)

Total 100 marks

What is “Pick Up” of relay?

(5 marks

Sketch the vector diagram for primary, secondary main windings of

		Star Delta Power Transformer . (10 marks)

2.6 Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

To convert the analog relaying system to digital relay system, the dismantling of origin components and assembly of new system components are to be done. The following questions and activities provide this competency component.

Digital relay+ Telecommunication for protection
Slide 1

Q54.What is digital relay?
Slide 2+4

Q55.Sketch the flow diagram of digital relay operation.
Slide 3+4

Q56.Sketch DAC
system Slide 5

Q57.Explain busbar protection with sketch
Slide 6

Q58.Write line & busbar protection with sketch.
Slide 7

Q59.Sketch the operation of digital relay.

2.7 Circuits/components are rechecked and their operational status is confirmed. Ref-Advanced Diploma in Electrical Engineering Exercises Page 129)

To determine the operational status of protection system, it needs to ensure relay operation sequence, the sequential relay protection system and characteristics are to be investigated. The following activities and questions provide this competency.

(32)Over current & earth fault protection , Directional protection, operating
characteristics Slide 1

Q64.Sketch the diagram of over current protection

Slide 2

Q65.Sketch earth fault relay protection diagram.

Slide 3

Q66.Sketch the combined over current and earth fault protection and explain it’s operation.

Slide 4

Q67.Explain the operation of directional relay with diagram.

Slide 5+6+7+8

Q68.Locate directional & non directional elements in ring system.

Slide 9+10

Q69.Sketch the connection diagram of combinational protection scheme that contains two over current relays and one earth fault relay to provide phase to phase and phase to earth protection.

Slide 11

Q70.How will you adjust definite minimum time point on relay curve?

2.8 Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.

2.9 Effectiveness of the repair is tested in accordance with established procedures.

2.10 Apparatus is reassembled, finally tested and prepared for return to service. Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

When more power loads are connected to transmission line, the current protection system needs to be modified. The following questions and activities provide this competency component.

Transmission line protection

Slide 1

Q23.Sketch transmission line differential protection

Slide 2+3

Q24.Sketch the modification diagram for transmission line protection with differential relay.

Distance relay, pilot wire with differential three phase line protection

Slide 1

Q25.Explain the operation of distance relay

Slide 2

126

Q26.Explain the operation of distance relay with sketch

Slide 3+4

Q27.Sketch the characteristics curve of distance relay

Slide 5+6

Q28.Explain the zone protection of distance relay.

Slide 7+8

Q29.Sketch the protection diagram of distance relay with operating & restraining voltage and current.

2.11 Unexpected situations are dealt with safely and with the approval of an authorised person. As per 1.3

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

As per 2.5

Location of Evidences (Table 1)

Completion and report for problem solving in energy supply network equipment 3.1

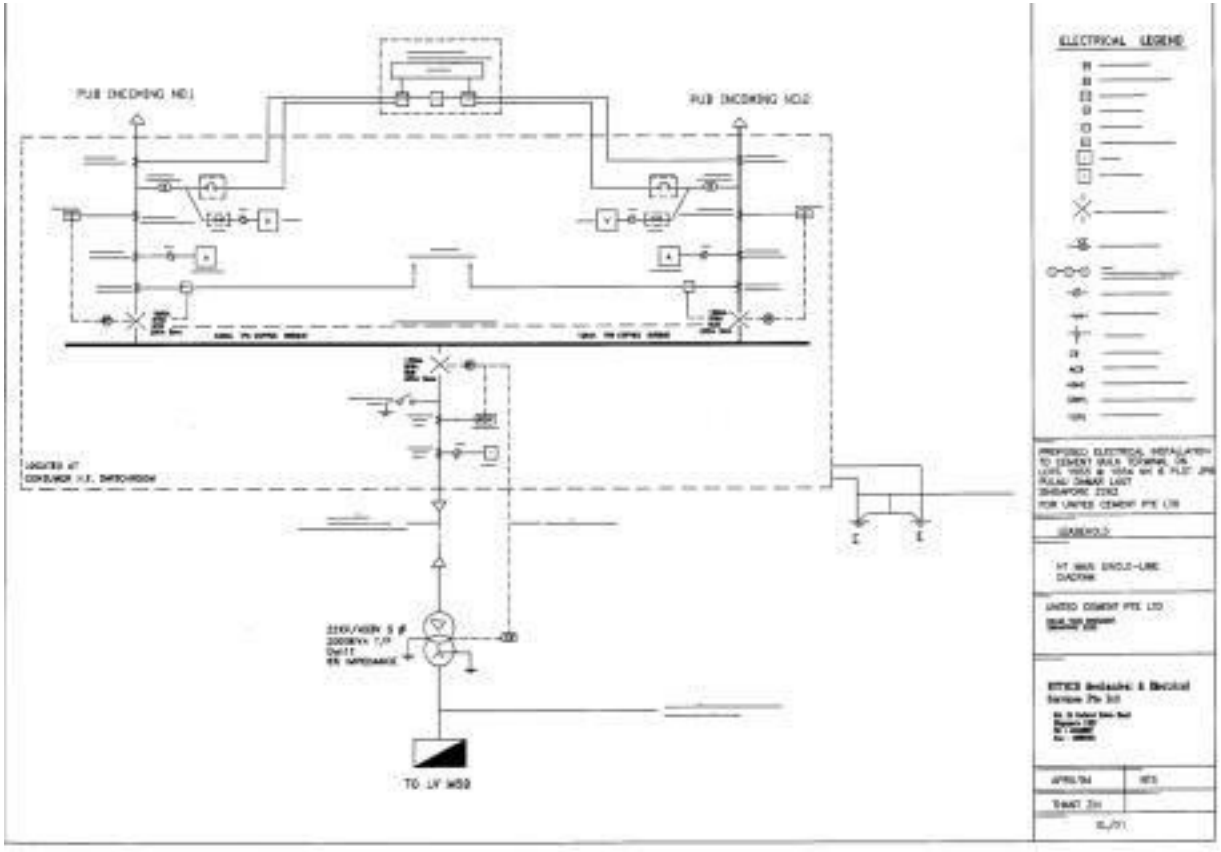
OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.

3.3 Maintenance work activities are documented in accordance with established procedures.

POWER SYSTEM PROTECTION COMMISSIONING PROJECT



The above diagram is Incoming HV supply system for a Cement Factory. It contains Star –Delta Transformer, Interchange switches for switching 2 supply, sketch of protective relay system with trip circuit and outline for measuring instruments.

(1) Develop Detail installation diagram that contain appropriate protection instruments and measurement instruments

Recommend appropriate specifications for protection and measuring instruments for power supply requiring 500Kw for the factory.
By answering the following questions, the concepts for the above project can be highlighted

Ref-Advanced Diploma in Electrical Engineering Exercises Page 125)

Three phase differential relay
Slide 1

Q17.Sketch three phase star/ delta transformer protection with differential relay.
125

Slide 2

Q18.Explain the setting of differential relay.

Connection of main transformer, CT , directional relay

Slide 1+2+3

Q19.Sketch the combined earth fault and differential protection for three phase star/ delta transformer.

Work performance + Practical Instruction Back up

Click HERE to download practicals

http://www.filefactory.com/file/cf88135/n/Practical.zip

Refer Power System Practicals

Part 1: Operational Study

LabName No	Name of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1Re	ceiving end voltage comparison between short/ medium and long transmission lines	distribution system (types	rcuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion

EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion
EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection	Research, report presentation

		• surge protection • conventional relays	
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified

work outcomes.

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the

surrounding environment or services and using sustainable energy practices.

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?

To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.

The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is , caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in	Abnormal resistance. Wrong cable selection. Abnormal circuit	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point

voltages	configuration			the circuit.		
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.
(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated	Corona	Corona study	Will consider the ACT	Will find the way to	EP 7 Corona video	How corona occurs

from the power line. Too much power loss and high interference to telecom line			OF GOD	reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level		and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System Protection	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason	Will adjust CT PT ratio at the simulated fault	EP9 Connection of	Practical skill development in CT PT

provide the effective protection			why and how to change the protection system	situation and will adjust the relay setting appropriately	relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection.	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection

All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right						
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.
(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity

				extinguishing methods		
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but it does not work when the ground fault occurs	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and protection task	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes **Evidence** **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery**	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other ***Detailed*** ***explanation*** A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions G-Observe the student's performance in practical class L-Student practical performance result + report preparation

www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	*Evidence Attached* **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1 On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5 Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:			
A Assignment	**B** Written task	**C** Role play	**D** Exam
E Oral questioning	**F** Simulation	**G** Observation	**H** Work based
I Portfolio	**J** Self assessment	**K** Case study	**L** Practical demonstration
M Project	**N** Training Record Book	**O** Other (Please specify)	

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		
EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-luu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6ogqZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69
Page 232 to 270 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41q4Rmz2p0

http://youtu.be/8CeIGV5AEIk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/l4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

UETDREL005 Work safely in the vicinity of live electrical apparatus

This unit is pre-requisite unit for UETDRIS033.

The knowledge and performance evidence can be concurrently delivered and assessed with URTDRIS032 and UETDRIS033

But safety practice aspect are emphasized for this unit as follows.

Elements and Performance Criteria

ELEMENTS	PERFORMANCE CRITERIA
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1 Prepare to work safely in the vicinity of live electrical apparatus	**1.1** Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be performed are referred to and confirmed http://www.iqytechnicalcollege.com/Codes of Practice _ Safe Work Australia.pdf
	1.2 Plant, tools, equipment and personal protective equipment (PPE) required for work are determined, obtained and confirmed in working order www.iqytechnicalcollege.com/IC-Electrical-Work-Plan-8538-PDF.pdf http://www.iqytechnicalcollege.com/Personal protective equipment (PPE) _ WorkSafe.qld.gov.au.pdf www.iqytechnicalcollege.com/Electrical Installation Materials.pdf
	1.3 Hazards are identified, risks assessed and control measures identified and applied www.iqytechnicalcollege.com/mcop-managing-electrical-risks_in_the_workplace-v1.pdf

	1.4	Work permits are received and signed in accordance with workplace requirements www.iqytechnicalcollege.com/Electrical-Work-Permit.PDF
	1.5	Safe approach distances for the work to be performed are determined and confirmed in accordance with workplace requirements www.iqytechnicalcollege.com/overhead-underground-electric-lines-general-guide.pdf www.iqytechnicalcollege.com/Work-near-overhead-power-lines-code-of-practice.pdf
	1.6	Safety observer role and responsibilities are discussed and confirmed in accordance with workplace requirements www.iqytechnicalcollege.com/electrical-system-safety-rules-20201222.pdf
	1.7	Communication method between the workers and safety observer is determined and confirmed in accordance with workplace requirements http://www.iqytechnicalcollege.com/10 Ways to Communicate Safety Standards at Your Company.pdf
	1.8	Worksite is prepared in accordance with the work plan and workplace requirements www.iqytechnicalcollege.com/IC-Electrical-Work-Plan-8538-PDF.pdf
2 Work safely in the vicinity of live electrical apparatus	**2.1**	Legislation, regulations, standards, codes of practice and organisational workplace requirements for the work to be performed are applied and monitored http://www.iqytechnicalcollege.com/Codes of Practice _ Safe Work Australia.pdf
	2.2	Lifting, working at heights and the use of plant, tools and equipment are carried out in accordance with workplace requirements http://www.iqytechnicalcollege.com/electricaltrade2022.htm#E101A

	2.3	Hazard control measures are monitored in accordance with workplace requirements http://www.iqytechnicalcollege.com/electricaltrade2022.htm#E101A
	2.4	Safety observer is positioned to observe the work in accordance with workplace requirements www.iqytechnicalcollege.com/electrical-system-safety-rules-20201222.pdf
	2.5	Communication methods between workers and safety observer are used in accordance with workplace requirements http://www.iqytechnicalcollege.com/10 Ways to Communicate Safety Standards at Your Company.pdf
	2.6	Safe approach distances are maintained when the work is being performed in the vicinity of live electrical apparatus www.iqytechnicalcollege.com/overhead-underground-electric-lines-general-guide.pdf www.iqytechnicalcollege.com/Work-near-overhead-power-lines-code-of-practice.pdf
	2.7	Incidents or unplanned events are responded to in accordance with workplace requirements http://www.iqytechnicalcollege.com/mcop-managing-electrical-risks_in_the_workplace-v1 (1).pdf
3 Complete work and documentation	**3.1**	Incidents or unplanned events are reported in accordance with workplace requirements http://www.iqytechnicalcollege.com/mcop-managing-electrical-risks_in_the_workplace-v1 (1).pdf www.iqytechnicalcollege.com/Guidelines for emergency equipment management.pdf
	3.2	Work permits are signed off in accordance with workplace requirements www.iqytechnicalcollege.com/7b0aea25-17b0-4f21-af01-2c6de6065eba.pdf
	3.3	Worksite is rehabilitated, cleaned and made safe in accordance with workplace requirements

http://www.iqytechnicalcollege.com/KeepConstructionSiteSafe.pdf

3.4 Plant, tools and equipment are cleaned, checked and returned to storage in accordance with workplace requirements

http://www.iqytechnicalcollege.com/KeepConstructionSiteSafe.pdf

3.5 Work records, reports and documentation are completed in accordance with workplace requirements

www.iqytechnicalcollege.com/CCEW_template.pdf

VIDEO

https://www.youtube.com/watch?v=wal2KP1bbIY

https://www.youtube.com/watch?v=hLbMk4UyvmE

https://www.youtube.com/watch?v=StHT-MCitmY

https://www.youtube.com/watch?v=fllM_4G-W-I

https://www.youtube.com/watch?v=WNot2owIv8c

https://www.worksafe.qld.gov.au/resources/videos/films/electrical-safety-for-apprentices

https://www.safeworkaustralia.gov.au/resources-and-publications/video-and-audio/electrical-safety-protecting-you-and-your-workmates

https://www.safework.nsw.gov.au/hazards-a-z/electrical-and-power/electrical-work

https://esv.vic.gov.au/campaigns/never-work-live/

https://www.youtube.com/watch?v=StHT-MCitmY

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all requirements of the elements and performance criteria on at least two separate occasions and include:

• applying relevant legislation, regulations, standards, codes of practice and organisational workplace requirements, including:
  • work health and safety (WHS)/occupational health and safety (OHS)
• identifying hazards, assessing risks, identifying, applying and monitoring control measures
• obtaining, inspecting and using relevant personal protective equipment (PPE)
• determining communication method with safety observer
• confirming safety observer is in position in accordance with workplace requirements
• determining electricity network voltages, including:
  • low voltage (LV)
  • high voltages (HV):
  • distribution
  • sub-transmission
  • transmission
• identifying electricity network assets
• determining and confirming safe approach distances
• performing work while maintaining the personal safe approach distance
• obtaining and signing on and off relevant work permits in accordance with workplace requirements
• dealing with an unplanned event on at least one (1) occasion
• completing relevant work records, reports and documentation.
	• Performance Elements 1 to 3 as above

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• relevant legislation, regulations standards, codes of practice and organisational workplace requirements, including:
  • WHS/OHS
  • safe approach distances
  • emergency procedures
• hazard, risk assessment and risk control requirements, including potential hazards
• types and application of PPE
• safe use of tools and equipment
• application, purpose and types of permits
• events constituting an unplanned event or incident
• procedures for responding to an unplanned event or incident
• safety observer:
  • role and responsibilities
  • communication methods
• basic electrical principles, including:
  • voltage, current and resistance
  • typical effects of current, including physiological effects and induced voltages
  • consequences of short circuits, including arc flash and touch and step potentials
• electricity networks, including:
  • LV
  • HV:
  • distribution
  • sub-transmission
  • transmission
  • earthing systems
	Concurrently delivered and assessed as per TAS of UETDRIS032 and UETDRIS033

• associated assets • layouts and configuration • basic protection • relationship between an overhead and underground supply system • terminology related to working safely in the vicinity of live electrical apparatus.	

Reference

7762AA Module Book Modified Jan 08.pdf

G015_G037_G038_G030Pt1_7762AG_Notes

AA_Typed_Note_1 to 8

G015_G037_G038_G030Pt1_7762AG_Notes

Transmission & Distribution

Protection Class Lesson

- Clearance-around-Powerlines.pdf
- CPR LVR - Low Voltage Rescue Training_ NSW _ Pinnacle Safety and Training.pdf
- easement-guidelines.pdf
- mts-electrical-safety-rules--esr--rev--2-1.pdf
- nsw-electrical-safety.pdf
- Powerlines Training _ Safety Corp.pdf
- safe working near powerline pdf drive is - Google Search.pdf
- safe working near powerline pdfdruve is - Google Search.pdf
- The Safety Critical Systems Handbook.pdf
- UETDREL006_R1.pdf
- UETDRRF004_R1.pdf
- UETTDRRF09_R2.pdf
- Working Safely Near Live Electrical Apparatus as a Non-Electrical Worker.pdf

- 1i6gf9xsg8011 (1).pdf
- 1i6gf9xsg8011.pdf
- 7b0aea25-17b0-4f21-af01-2c6de6065eba (1).pdf
- 7b0aea25-17b0-4f21-af01-2c6de6065eba.pdf
- 10 Examples of Policies and Procedures in the Workplace.pdf
- 10 Ways to Communicate Safety Standards at Your Company.pdf
- 12-step isolation procedure _ Guidance for safe low-voltage installation.pdf
- 15951059750.pdf
- Access_to_Apparatus_Rules_Manual.pdf
- ais8.pdf
- ATW-access-work-permit-guide.pdf
- Australias-Energy-Networks_2021_05.pdf
- CCEW_template.pdf
- Clearance-around-Powerlines.pdf
- Codes of Practice _ Safe Work Australia.pdf
- Construction-work-COP.pdf
- Contact with powerlines.pdf
- easement-guidelines.pdf
- Electrical compliance requirements _ NSW Fair Trading.pdf
- Electrical Installation Materials.pdf
- Electrical licensing disciplinary action.pdf
- Electrical Safety Rules Procedures & Consulting.pdf
- electrical-system-safety-rules-20201222.pdf
- Electrical-Work-Permit.pdf
- ESI Checklist.pdf

ESI Workplace Assessment 1.pdf

ESI Workplace Assessment 2.pdf

Exclusion Zones And Safety Laws - Ergon Energy.pdf

FactSheet-HighLoad.pdf

Guidelines for emergency equipment management.pdf

Health and Safety - Permit to Work Procedure.pdf

How to perform CPR.pdf

IC-Electrical-Work-Plan-8538-PDF.pdf

Identify, assess and control hazards _ Safe Work Australia.pdf

mcop-managing-electrical-risks_in_the_workplace-v1 (1).pdf

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mts-electrical-safety-rules--esr--rev--2-1.pdf

nsw-electrical-safety.pdf

Type: Firefox HTML Document
Size: 482 KB
Date modified: 7/11/2025 9:11 AM

overhead-underground-electric-lines-general-guide (1).pdf

overhead-underground-electric-lines-general-guide (2).pdf

overhead-underground-electric-lines-general-guide.pdf

- mcop-managing-electrical-risks_in_the_workplace-v1 (1).pdf
- mcop-managing-electrical-risks_in_the_workplace-v1 (2).pdf
- mcop-managing-electrical-risks_in_the_workplace-v1 (3).pdf
- mcop-managing-electrical-risks_in_the_workplace-v1.pdf
- mts-electrical-safety-rules--esr--rev--2-1.pdf
- nsw-electrical-safety.pdf
- overhead-underground-electric-lines-general-guide (1).pdf
- overhead-underground-electric-lines-general-guide (2).pdf
- overhead-underground-electric-lines-general-guide.pdf
- permittowork.pdf
- Personal protective equipment (PPE) _ WorkSafe.qld.gov.au.pdf
- Rail.pdf
- Report an incident – Energy Safe Victoria.pdf
- safe working near powerline pdf drive is - Google Search.pdf

Supervisor Report - UETTDRCJ21A Lay ESI electrical cables.pdf

Supervisor Report - UETTDREL16A Working safely near live electrical appa.pdf

Supervisor Report - UETTDRRT21A Install traction overhead wiring systems.pdf

Switchboard Rescue Kits Archives - Electrical Factory Outlet.pdf

The Safety Critical Systems Handbook.pdf

Types of Workplace Emergencies.pdf

UETDREL006_R1.pdf

UETDRRF004_R1.pdf

UETTDRRF09_R2.pdf

Understanding assessment video transcript.pdf

WHS_OP038_Electrical_Safety_Procedure.pdf

work_near_overhead_powerlines.pdf

Working Safely Near Live Electrical Apparatus as a Non-Electrical Worker.pdf

Work-near-overhead-power-lines-code-of-practice (1).pdf

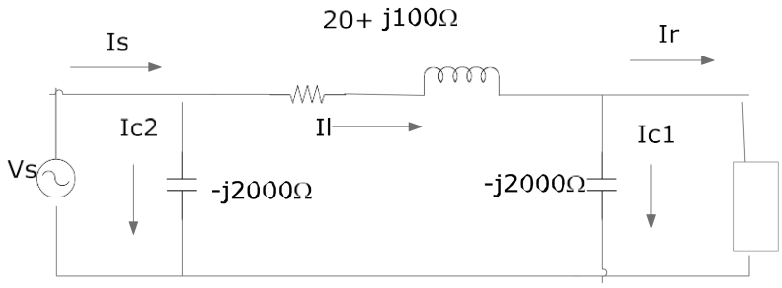
Work-near-overhead-power-lines-code-of-practice (2).pdf

Work-near-overhead-power-lines-code-of-practice (3).pdf

Work-near-overhead-power-lines-code-of-practice.pdf

Workplace Accidents & Incident Report _ Employsure.pdf

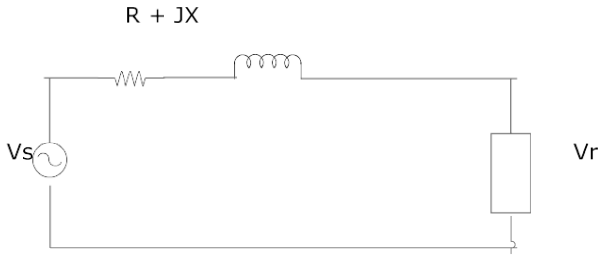
Workplace Policies and Procedures Checklist _ NSW Industrial Relations.pdf



Single phase load on given is 15000KW unity pf supplied at 150 KV. Calculate Is, Vs , power supplied by generator.

Slide 15+16

Q56.



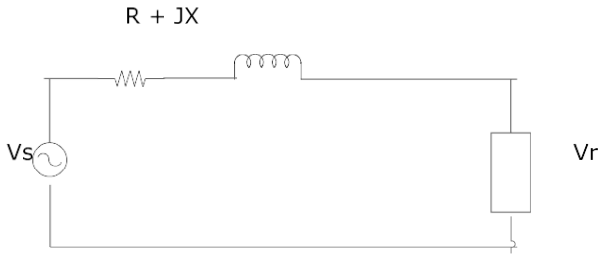
In above circuit, the load consumes 5000w at pf 0.9 lagging . The sending end voltage is 700V and the impedance Z= 2+j3 ohm. Determine load voltage.

Slide 17+18

Q57. Determine the constants in pi model single phase line having the following specifications. Outside diameter= 0.65 in, spacing 10 ft, resistance per mile = 0.25 ohm. Line length = 100 miles.

Slide 21+22

Q58.



In above circuit, the load consumes 6000w at PF 0.85 lagging. The sending end voltage is 1KV. The line impedance is Z = 3+j4 ohm. Determine load voltage.

G043+G045+ UEEEL0041+ UEEEL0043

G045—Induction machines

(1) AC Machine introduction

Slide 1+2+3

Q1.Derive the formula to calculate rotating magnetic field.

Slide 4+5

Q2.Calculate the synchronous speed of a three phase induction motor having 12 poles , 60HZ.

Slide 6

Q3.Explain the starting characteristics of squirrel cage motor.

Slide 7.

Q4.Sketch the construction of squirrel cage induction motor and wound rotor motor.

Slide 8+9+10+11+12

Q5.Design three phase 48 slots 4 poles winding.

---

(2) Induction motor

Slide 1

Q6.What is distribution factor?

Slide 2

Q7.What is coil span factor?

Slide 3

Q8.How do distribution factor & coil span factor affect the induced emf ?

Slide 4+5

Q9.A 0.7 HP 4 poles induction motor is excited by a single phase 540HZ source is full load speed is 1160 rpm. Calculate the slip.

Slide6+7

Q10.The 4 pole wound rotor induction motor is excited by a three phase 50HZ . Calculate the frequency of the rotor currentunder the following conditions.

(a) At stand still

(b) Motor turning at 600 rpm in the same direction as the revolving field.

(c) Motor turning at 600 rpm in the opposite direction to the revolving field.

(d) Motor turning at 1800 rpm in the same direction to the revolving field.

Slide 8+9+10

Q11.(a) Calculate the approximate full load current . locked rotor current and no load current of a three phase induction motor having a rating of 600HP, 2400V.

(b) Estimate the apparent power drawn under locked rotor conduction.

(c) State the normal rating of this motor expressed in kilowatt.

---

(3) Motor equivalent circuit.

Slide 1+2

Q12.Sketch the equivalent circuit & equation of induction motor.

---

(4) Wound rotor motor

Slide 1

Q13.Sketch DOL starter

Q14.Write equations for locked rotor current & locked rotor torque.

Slide 2+3+4

Q20.Write the equation for motor current at stand still condition & any slip.

Q21.A 440V 6 poles three phase 50 HZ induction motor has its winding delta connected & its rotor winding star connected. The standstill voltage measured between slip ring with the rotor open circuit 220V. The stator resistance / phase is 0.7 ohm and the stator reactance / phase is 5 ohm. The rotor resistance per phase is 0.07 ohm and rotor reactance per phase is 0.3 ohm. Calculate the rotor current and stator current when slip rings are short circuited to start the motor. Calculate rotor power factor & stator power factor.

Slide 5

Q22.In above problem , calculate rotor current and stator current when slip rings are connected to 5 ohm external resistance and motor is running at 0.04 slip.

Slide 6

Q23.Sketch power transfer in induction machine for (a) motor mode (b) generator mode.

Slide 7+8

Q24.Write the following equations.

(a) Power absorbed by ideal stator winding

(b) Power dissipated in rotor circuit.

(c) Mechanical power

(d) Power dissipated in rotor resistance

(e) Rotor circuit power loss

(f) Power absorbed by ideal stator winding.

Slide 9

Q25.A 400 V 4 poles three phase 60HZ slip ring induction motor has its stator winding delta connected and rotor winding star connected. The standstill voltage measured between slip rings with the rotor open circuited is 220V. The stator resistance per phase is 4 ohm. The rotor resistance per phase is 0.08 ohm and the rotor reactance per phase is 0.35 ohm. Calculate the maximum torque & slip.

---

(5) Torque +Motor test

Slide 1

Q26.Sketch the power flow diagram in motor.

Q27.Write the equation for

(a) Mechanical power developed by rotor

(b) Mechanical power delivered to load.

(c) Mechanical torque.

---

(6) Synchronous speed + Slip + Power of motor

Slide 1

Q28.A three phase induction motor having synchronous speed of 1200 rpm draws 90kw from three phase feeder. Copper loss & iron loss in stator amount to 7kw. If the motor runs at 1140 rpm, calculate the followings.

(a) Active power transmitted to the rotor

(b) Rotor I^2R loss.

(c) Mechanical power developed.

(d) The mechanical power delivered to the load knowing that the windage & friction losses are equal to 1.5 kw.

(e) The efficiency of motor.

Slide 2+3

Q29.A three phase 8 poles squirrel cage induction motor connected to 50Hz line possesses a rotor speed 1000 rpm. The motor absorbs 45kw and the copper & iron losses in the stator to 6 kw & 2 kw respectively. Calculate the torque developed by motor.

Slide 3+4

Q30.A three phase induction motor having a nominal rating of 80 kw and synchronous speed of 1800 rpm is connected to 660V source. Two meters method show a total power consumption 80kw and an ammeter indicates a line current 77 amp. Rotor speed is 1750 rpm. The following ratings are obtained. Stator iron loss = 2.5 kw, windage and friction loss = 1.5 kw. Resistance between two stators = 0.3 ohm.

Calculate (a) Power supplied to the rotor.

(b) Rotor I^2R loss

(c) Mechanical power supplied to the load

(d)Efficiency

(e)Torque developed at 1750 rpm.

---

(7) Motor starters

Slide 1+2

Q31.Describe the motor reduced voltage starting methods.

Slide 3+4+5+6

Q32.Sketch DOL starter.

---

(8) Three phase motor equivalent circuit

Slide 1+2+3

Q33.Explain the tests to determine the equivalent circuit of three phase motor.

Slide 4+5

Q34.A no load test conducted on a 50HP 900 rpm 415 V three phase 50HZ squirrel cage induction motor yield the following results

<u>No load test</u>

No load voltage (L- L) = 415V

No load current = 15 A

No load power = 1450 watt

Resistance measured between two terminals

Locked rotor test

The locked rotor test conducted at reduced voltage gave the following results

Locked voltage (L to L) = 170V

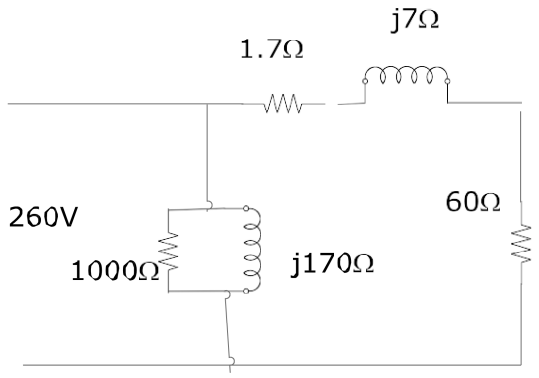
Locked rotor power = 7500w

Locked rotor current = 70A

Determine the equivalent circuit of motor.

Slide 6+7+8+9

Q35.



Calculate

(a) Active power delivered to rotor

(b) Mechanical power input to shaft

(c) Stator power input.

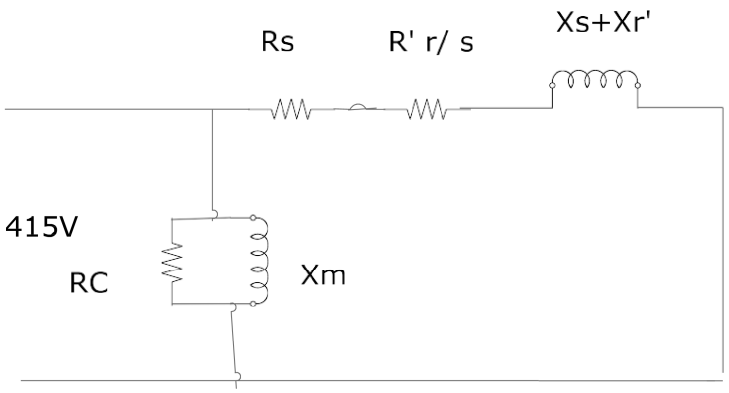
(d) Input current & PF

(e) If windage & friction loss is 80w

Find the output torque & efficiency speed = 1900 rpm.

Slide 10

Q36.



In the appropriate equivalent circuit of one phase of a three phase delta connected induction motor shown in above figure.

Vs= 415V Rc = 300 ohm Rs= 0.2 ohm , Rr' = 0.2 ohm Xm=30 ohm Xs+Xr' = 2 ohm.

Determine the input current , power factor , input power and efficiency if the full load slip is 0.04 . When the machine is connected to a three phase 415V 50HZ supply.

Slide 11+12+13+14+15

Q37.An 8 pole 50HZ three phase slip ring induction motor has a total leakage impedance (3+j7 ohm) per phase referred to the stator . The stator resistance per phase is 1.5 ohm. When 415V is applied to delta connected to stator winding, the voltage between any pair of open circuited slipring

To which the star connected rotor winding is connected to 240v.

(a) When slip rings are short circuited , the slip is 0.05 , calculate torque

(b) When slip rings are connected to external resistor 0.6 ohm / phase, slip is 0.07.

Calculate torque.

Slide 16+17+18

Q38.A single phase 240V 6 poles 50Hz 0.6 kw induction motor gave the following test results.

Locked rotor test= 100 v 2A, PF 0.7 lagging

No load test = 240V 0.7A PF 0.18 lagging

Determine the appropriate equivalent circuit, torque, power output, input current, power factor, slip at 0.06.

Slide 19+20+21+22

Q39.Three phase 210V induction motor has synchronous speed 1200 rpm run at 1110 rpm connected to 220V at constant load torque. Calculate the speed if connected to 230V.

Slide 22

Q40.A three phase 8 poles induction motor driving a compressor runs at 860 rpm immediately after it is connected to a fixed 500V 60 HZ line. The initial cold rotor temperature is 25 °C, the speed drops to 850 rpm after the machine has run for several hours.

Calculate (a) Hot rotor resistance in term of cold resistance

(b)The appropriate hot temperature of rotor bars knowing they are made of copper.

Slide 23+24+25+26

Q41.A three phase 4 pole wound rotor induction motor has a rating of 150 kw, 1770 rpm, 3 KV, 60HZ , three external resistances of 3 ohm are connected in star across the rotor slip rings under these conditions.

The motor develops a torque of 360 N-m at a speed of 1200 rpm.

(a) Calculate the speed for a torque of 450N-m

(b) Calculate the value of external resistance so that the motor develops 15 kw at 800 rpm.

Slide 27+28

Q42.A three phase wound rotor induction motor has a rating of 120 kw, 1750 rpm 3 KV 60 HZ.

Under locked rotor condition, the open circuit rotor voltage between the slip ring is 600V. The rotor is driven by a variable speed dc motor.

Calculate

(a) The turn ratio of the stator to rotor winding

(b) The rotor voltage & frequency when the rotor is driven at 730 rpm in the same direction as the revolving field.

(c) The rotor voltage and frequency when the rotor is driven at 750 rpm opposite to the revolving field.

Slide 29+30

Q43.We wish to use a 35 kw 900 rpm 50HZ wound rotor motor as a frequency converter to generate 70 kw at an approximate frequency of 170 HZ. If the supply line frequency is 50HZ, calculate the followings

(a) The speed of the induction motor that drives the frequency converter.

(b) The active power delivered to the stator of the frequency converter

(c) The power of the induction motor

(d) Will the frequency converter overheat under these conditions

Slide 31

Q44.Sketch slip torque characteristics of induction motor.

Slide 32

Q45.Explain stability & crawling

---

(9) Reduced voltage starting methods

Slide 1

Q46.Why does reduced starting voltage needed to start the induction motor and write the types of reduced voltage starters.

Slide 2+3

Q47.Explain the followings with sketches.

(a) Star delta starter

(b) Auto transformer starter

(c) Slip ring motor

Slide 4

Q48.Sketch the speed & torque diagram & indicate the crawling point.

Slide 5+6+7

Q49.A three phase squirrel cage induction motor has a stator resistance per phase 0.7Ω and a rotor resistance per phase referred to stator of 0.7Ω. Total standstill reactance per phase referred to stator is 5.72Ω. If the ratio of the maximum torque to full load torque is 3:1. Find the ratio of actual starting torque to full load torque for (a) Direct starting (b) Star / delta starting (c) Auto transformer starting with 78% tapping.

---

(10) Reduced voltage starting

Slide 1+2

Q50.Explain automatic voltage starter with sketch.

Slide 3+4

Q51.Explain Star / delta starter with sketch.

Slide 5+6+7+8+9+10

Q52. Explain consequent pole starter.

Slide 11

Q53.Explain consequent pole starter.

Slide 12+13

Q54.Explain silicon controlled SCR & it's application in motor speed control with sketches.

Slide 14+15

Q55.Explain wound rotor motor.

Slide 16

Q56.Explain (a) Multi switch starter (b) Drum controller

Slide 17

Q57.Explain application of slip ring motor

Q58.What are advantages and disadvantages of using squirrel cage induction motor?

Slide 18+19

Q60.Explain frequency & speed control methods.

Slide 19

Q61.Explain (a) Multi speed starter (b) Motor protection

Slide 20 to 27

Q62.Explain the followings with sketch.

(a) Jogging

(b) Plugging

(c) Braking

Slide 28

Q63.Explain mechanical braking

G043-Synchronous machines

(11) Synchronous machines

Slide 1+2+3

Q64.Explain the major difference between induction machine and synchronous machine.

Slide 3+4+5+6

Q65.Explain the construction of synchronous machine

---

(12) Synchronous generator

Slide 1

Q66.Sketch the equivalent circuit , vector diagram and write the voltage equation for synchronous generator.

Slide 2

Q67.Sketch the circuit, vector diagram and write the voltage equation for synchronous motor.

---

(13) Effect of field excitation

Slide 1+2

Q68.Explain the effect of field excitation on power factor of synchronous motor.

Slide 3+4+5

Q69.A three phase star connected alternator has a resistance of 0.3Ω and a synchronous reactance of 7 Ω per phase. It is excited to give 6.6KV line voltage on open circuit. Determine the internal voltage and per unit voltage regulation on full load current of 150 amp when the load power factor is (a) 0.707 lagging (b) 0.8 leading.

Slide 6+7

Q70.A 4000 Kw 6.6 KV 50 HZ 250 rpm synchronous motor operates at full load 0.7 leading power factor if the synchronous reactance is 15Ω. Calculate the followings

(a) The apparent power of the motor per phase

(b) The AC line current

(c) The value and phase of Ef

(d) (d) Determine the torque angle δ

Slide 8+9+10

Q71.A synchronous condenser is rated at 260MVAR 26 KV 1500 rpm, 60HZ. It has a synchronous reactance of 0.8 pu and is connected to 26KV line. Calculate the value of Ef so that the machine (a) absorb 200MVAR (b) deliver 150 MVAR

---

(14) Oscillation of synchronous machines

Slide 1+2

Q72.A 3000KV three phase 4 poles star connected synchronous machine has resistance and synchronous reactance per phase of 0.3Ω and 2Ω respectively. Calculate the emf and rotor displacement when the machine acts as a motor with input of 700MW and pf 0.9 lagging.

If the field current is required to produce emf / ph equal to rated voltage. Determine also field current for field excitation.

Slide 3+4+5+6

Q73.The factory has the following loads.

(a) 3 x 50HP three phase induction motor PF 0.6 lagging , efficiency 85%

(b) 4 x 45 Kw three phase induction motor 0.85 pf lagging, efficiency 90%

Calculate total active and reactive power. If one 100KW three phase synchronous motor with 97% efficiency, 0.65 leading pf is connected in parallel, calculate total active and reactive power and power factor.

Slide 6+7+8

Q74.Explain starting methods for synchronous motor.

Slide 9+10

Q75.Compare synchronous motor & induction motor

Slide 11+12 (Single phase motor)

Q76.Explain (a) cross field theory (b) rotating field theory of single phase motor.

---

(15) Generator control

Slide 1+2

Q77.Explain the control of electric generating system.

Slide 3+4

Q78.Explain voltage regulator.

Slide 5+6+7

Q79.Explain prime mover & governor

Slide 8+9

Q80.Explain the types of excitations

Slide 10+11

Q81.How will you select the regulator to control generator voltage?

Slide 12+13

Q82.What are the factors affecting voltage stability of generator system?

Slide 14+15

Q83. Sketch remote voltage sensing system

Slide 16

Q84.Explain typical generator instability problem.

Slide 17+18+22+23

Q85.Explain digital excitation system.

Slide 19+20+21

Q86.Sketch generator parallel control system.

Slide 24

Q87.Explain digital voltage regulation system.

---

(16) Single phase motor

Slide 1+2+3+4

Q88.Explain the features of single phase motor.

Slide 5

Q89.Sketch capacitor start motor & explain.

Slide 6+7+8+9

Q90.Sketch

(a) Capacitor start / capacitor run motor

(b) Permanently split capacitor motor

(c) Shaded pole motor

(d) Universal motor

Slide 10

Q91.Compare single phase and three phase motor.

Slide 11

What are the abnormal operation of three phase motor?

Slide 12

Q92.Describe motor maintenance methods.

Slide 13

Q93.Sketch equivalent circuit of single phase motor.

Slide 14

Q94.A small 50HZ hysteresis clock motor possesses 32 poles. In making one turn, hysteresis loss in motor is 0.9J.

Find

(a) Pull in / pull out torque.

(b) Maximum power output before motor stalls.

(c) Rotor losses when the motor stalls.

(d) Rotor losses when the motor runs at synchronous speed.

(`17) Synchronous impedance

Slide 1+2

Q95.How will you determine synchronous impedance?

Slide 3+4+5

Q96.A three phase star connected alternator has a resistance 0.6Ω and synchronous reactance 10Ω / phase. It is excited to give 6000V. line on open circuit.

Calculate (a) Synchronous impedance (b) Short circuit current when open circuit voltage is 600V at terminal .

Slide 6

Q97.Explain excitation and reactive power.

Slide 7

Q98.Explain excitation methods.

Slide 8

Q99.Explain the connection of synchronous motor with sketch.

Q100.Explain cylindrical rotor machine.

Slide 9+10

Q101.A 600HP 720 rpm synchronous motor connected to 4000V three phase line generates an excitation voltage Ef=1800V (L-N) when the dc excitation current is 35 amp. The synchronous reactance is 25Ω, torque angle between Ef & V is 35°.Calculate (a) The value of impedance drop Ez (b) AC line current (c) PF of motor (d) HP of motor (e)Shaft torque.

Slide 11+12

Q101.A 20KW 1200 rpm 415V three phase synchronous motor has synchronous reactance 0.9Ω/ ph. If Ef is fixed at 400v/ ph . Determine the followings (a) Mechanical power/ phase (b) torque (c)δ.

Slide 13+14

Q102.A three phase 600KV , 5 KW 180 rpm 60HZ motor has synchronous reactance 1.5Ω at full load . The motor poles are displaced by mechanical angle of 2 degree from their no load position. If the line to neutral excitation E f= 2.5KV. Calculate the mechanical torque developed.

Slide 15

Q103.Explain synchronous motor VEE curve characteristics.

Slide 16+17

Q104.Explain the effect of varying field excitation.

---

(18) Single phase motor problems.

Slide 1 to 8

Q105.A test on 1/5 HP 110V 50HZ 1750 rpm single phase motor has the following parameters.

Stator resistance = 1Ω, rotor resistance referred to stator 2Ω. Stator leakage reactance = 4Ω,

Rotor leakage reactance referred to stator = 3.6Ω, windage and friction +iron loss resistance = 700Ω, Magnetizing reactance = 50Ω,

Draw the equivalent circuit & determine the output efficiency & power factor of motor when it runs at 1750 rpm.

Slide 9+10+11

Q106.A resistance split phase motor is rated at 1/5 HP, 1750 rpm , 110V, 50HZ. When the rotor is locked, a test at reduced voltage on machine and auxiliary winding.

	Main winding	Auxiliar winding
Applied voltage	E=30V	E=30V
Current	Is= 5 amp	Ia= 2.5 amp
Active power	Ps=70W	Pa=25W

Calculate (a)The phase angle between Ia and Is.

(b)Locked rotor current drawn from 110V line

Slide 12+13+14+15

Q107.Explain synchronous motor control.

Slide 16+17

Q108.Explain solid state control.

Slide 18+19+20+21+22

Q109.Explain excitation system working into field of synchronous motor.

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(19) Force on motor

Slide 1+2

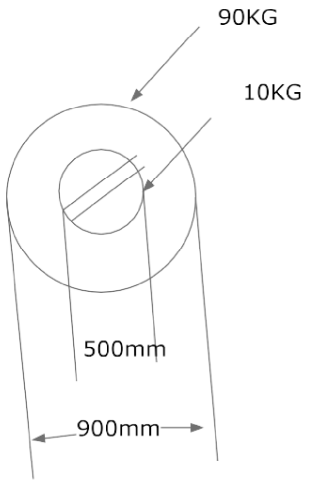
Q110.An electric motor lifts a mass of 600Kg through a height of 40m in 18 sec. Calculate power developed by the motor in KW and HP.

Slide 3

Q111.During a prong brake test on electric motor, the spring scale 30N & 7N respectively. Calculate power output if the motor turns at 1800 rpm & the radius of pulley is 0.2m.

Slide 4+5

Q112.A flywheel having a shape given in figure composed of a ring supported by a rectangular hub. The ring & hub respectively have a mass of 90Kg and 10 Kg. Calculate the moment of inertia of flywheel.



Slide 6

Q113.The flywheel having moment of inertia 12 kg –m^2in previous problem turns at 70 rpm. By applying the torque 25 N-m, the speed is increased to 700 rpm. How must the torque be applied?

Slide 7

Q114.Do the exercises in slide 7

Slide 8+9+10

Q115.A totally enclosed motor has an external surface area 1.5m^2 . When it operates at full load, surface temperature is 70°C and ambient temperature 20°C. Calculate the heat loss by natural convection.

Q116.A fan rated at 4 KW blows 300m^3 / min of air through 800Kw motor to carry away the heat. If the inlet temperature is 23°C and the outlet temperature is 32°C, estimate the losses in rotor.

Slide 11.

Q117.The motor in above question is coated with a non metallic enamel, calculate the heat loss by radiation knowing that all surrounding objects are at an ambient temperature of 30°C. K =6 x 10^{-3} A = 1.8m^2.

Slide 12+13

Q118.An AC machine turning at 880 rpm carries the rotor winding whose total weight is 50Kg.The current density is 6A / mm^2 & operating temperature is 190°C. Total iron losses are 1200W. $\mathfrak{S}$=22nΩ-cm, β= 9000. Calculate (a) copper losses (b) the mechanical drag (N-m) due to iron loss.

Slide 14+15

Q119.Explain the classes of insulation.

Slide 16+19

Q120.A 80KW motor class F operates at full load in an ambient temperature 33°C if the hot spot temperature is 127°C. Does the motor meet the temperature standard?

Slide 17+18+20+21

Q121.Do the exercises on slide 17

Slide 22

Q122.How does the speed and size of synchronous machine relate?

Slide 23+24+25

Q123.Do the exercises on slide 23.

UEEEL0077 Evaluate and report on the performance of LV machines

Elements and Performance Criteria

ELEMENTS		PERFORMANCE CRITERIA		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to evaluate and report on the performance of LV machines**	**1.1**	Work, health and safety (WHS) / occupational health and safety (OHS) risk control measures are identified and applied	OHS in Practicals of UEEEL0077
		1.2	Machines to be evaluated, and scope of works to be undertaken are identified and confirmed	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0077 Exercises
		1.3	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety	Equipment Arrangement in Practicals of UEEEL0077
2	**Evaluate single and three phase low voltage machines**	**2.1**	Correct machine is identified for a specified range of applications	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0077 Exercises
		2.2	Machine performance is evaluated from measured and calculated values as they apply to single and three-phase low voltage machines and results are recorded	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0077 Exercises

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		2.3	Problems are diagnosed, recorded, and solutions are identified	
3	**Complete work and document problem solving activities.**	**3.1**	Results of evaluation and recommendations are reported	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0077 Exercises
		3.2	Justification for identified solutions is reported	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0077 Exercises
		3.3	Work completion is documented, and an appropriate person notified	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0077 Exercises

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Assessment Requirements for UEEEL0077 Evaluate and report on the performance of LV machines

Modification History

Release 1. This is the first release of this unit of competency in the Electrotechnology Training Package.

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:	
• evaluating the operating parameters of existing machines • recommending alterations to an existing machine for compliance with specified operating parameters • justifying selection of machines/circuits to comply with a specified function and operating parameters • determining the cause of problems in an existing machine • determining solutions for problems in an existing machine • determining conditions causing an existing machine to be unsafe • recommending solutions for identified machine problems • determining correct machine for a specified range of applications • determining parameters for the equivalent circuit using data from short circuit and open circuit tests • determining percentage resistance, reactance and impedance of a transformer • determining voltage regulation using percentage resistance, percentage reactance and load power factor • determining parameters for maximum regulation and zero regulation.	• Elements 1 to 3

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• single and three phase transformers including:
  • transformer construction including:
  • types of lamination style and core construction used in single-phase, three phase, double wound, auto transformers and instrument transformers
  • identification of different winding styles/types used in transformers
  • methods used to insulate low and high voltage transformers
  • construction of transformer tanks for distribution transformers
  • transformer auxiliary equipment
  • function of transformer auxiliary equipment
  • types of information stated on transformer nameplates
  • application of transformers
  • performing basic insulation resistance, continuity and winding identification tests
  • transformer operation including:
  • principles of mutual induction of a transformer
  • factors that determine the induced voltage in a transformer winding
  • determining the value of a transformer's secondary voltage and current given one winding's electrical details and the turns ratio
  • identification of voltage and current components of a phasor diagram for a transformer no-load and load
	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf
	UEEEL0077 Exercises

• principles of power transferred from the primary to the secondary when a load is connected using a phasor diagram neglecting impedance drops • selecting transformers for specific application/s • safety features specified in AS/NZS3000 with respect to transformers and isolating transformers • transformer resistance, reactance and impedance, including total equivalent values, referred to the primary and the secondary • equivalent circuit of a transformer • harmonics in transformers, including their generation, measurement, problems they cause and overcoming their impact • the purpose of tertiary windings • transformer losses, efficiency and cooling including: • power losses which occur in a transformer • tests which allow the power losses of a transformer to be determined • determination of transformer losses and efficiency using test results • efficiency for loads other than full load • relationship between transformer cooling and rating • methods used for natural and forced cooling of transformers • properties of transformer oil • tests conducted on transformer oil • transformer voltage regulation and percent impedance including: • voltage regulation as applicable to a transformer • reasons for voltage variation in the output of a transformer	

• determine the voltage regulation of a transformer from voltage and percentage impedance values • percentage impedance as applied to transformers • determine the percent impedance by using test results • determine percent impedance of a transformer by calculation • approximate voltage drop and exact voltage drop equations • parallel operation of transformers and transformer auxiliary equipment including: • determine polarity markings for an unidentified single phase double wound transformer • need for parallel operation of transformers • conditions/restrictions required before two transformers can be connected in parallel • vector grouping • connecting transformers in parallel to supply a single load • loading on transformers operating in parallel • the consequences/effect of an incorrect connection • auto-transformers and instrument transformers including: • identification of auto-transformers, voltage transformers and current transformers from their winding diagrams • determining voltage and current in the windings of an auto-transformer by calculation • advantages and disadvantages of an auto-transformer • AS/NZS3000 requirements with respect to transformers • construction and ratings of voltage transformers	

• construction and ratings of current transformers • precautionary measures taken to connect and disconnect instrument transformers • connection diagrams for instrument transformers • applications for auto-transformers and instrument transformers • alternating current rotating machines including: • operating principles of three phase induction motors including: • characteristics of the magnetic field produced by a single-phase, two-phase and three-phase windings • speed of rotation of a rotating magnetic field • relationship between the rotor speed, slip and rotor frequency • basic principle of operation of an induction motor • reversing the direction of rotation of a three-phase induction motor • three phase induction motor construction including: • basic component parts of a three-phase induction motor • types of rotors used in three-phase induction motors • connecting a three-phase induction motor in both star and delta • testing insulation resistance of a three-phase induction motor prior to connection to the supply • testing winding resistance (ohmic value and continuity) of a three-phase induction motor prior to connection to the supply • three phase induction motor characteristics including:	

• relationship between torque, speed, and power and interpretation of speed/torque curves of induction motors • squirrel cage motors operating characteristics conditions necessary for an induction motor to produce maximum torque • operating characteristics of an induction motor from name plate information and by measurement • induction motor efficiency and minimum energy performance standards (MEPS) • full load efficiency and power factor of induction motors • comparison of the advantages of squirrel cage and wound rotor induction motors • single-phase motors – split phase including: • common types of single-phase motors • principles of operation of split phase induction motors • construction and basic characteristics of split phase induction motors • applications of split phase induction motors • operation of split phase induction motors • single phase motors – capacitor including: • identification of single-phase induction motors including capacitor start, capacitor start/capacitor run and permanent split capacitor (PSC) • principles of operation • operating characteristics and typical applications • connection and running • reversing the direction of rotation	

• single phase motors –shaded pole including:
  • principles of operation
  • operating characteristics and typical applications
  • connection and running
  • reversing the direction of rotation
• single phase motors – universal including:
  • principles of operation
  • identification and functions of each of the basic parts
  • operating characteristics and typical uses
  • connecting, running and reversing
• motor protection including:
  • reasons why motor protection is required
  • requirements of the AS/NZS3000 Wiring rules with regards to motor protection
  • types of motor overload protection
  • operating principles of microtherm devices, thermal and magnetic motor protection devices
  • electrical features of motor protection HRC fuses
  • effects of under voltage and over voltage on motors and motor circuits
  • effects of repetitive starting and/or reversing on motors and motor circuits
  • special requirements for motor protection, in high humidity or moist environments, high temperature areas and corrosive atmospheres
  • operating principles of phase failure protection
  • selecting suitable protection devices for a given motor and starter combination	

• three phase synchronous machines- operation principles and construction including:
  • power transfer diagram of an a.c. synchronous machine
  • need for the generation of a sinusoidal waveform
  • principles of operation of a synchronous alternator
  • principles of operation of a synchronous motor
  • principles of operation of an asynchronous generator (induction generator)
  • identification of main parts of a synchronous alternator/motor
  • methods used to provide the excitation of a synchronous alternator/motor
  • block diagram of an alternator voltage regulator
  • advantages gained by the parallel operation of alternators
  • starting methods of synchronous motors
  • vee curves
  • the behaviour of synchronous motors at various excitation levels and their associated phasor diagrams
  • limits of stability for synchronous motors
• alternators and generators including:
  • effects on the generated voltage of variations in excitation
  • effects on generated voltage of variations in load
  • identification of characteristic curves of an alternator
  • types of prime movers used with single and three phase portable/standby alternators	

• manual operation of single and three phase portable/standby alternators • ratings of single and three phase portable/standby alternators • applications of single and three phase portable/standby alternators • construction details of single and three phase portable/standby alternators • common faults found in portable/standby alternators • limits of stability for synchronous alternators.	

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, equipment and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

Links

Companion Volume Implementation Guides are found in VETNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6

E029+G006 (G012+E-46)+ UEECD0004+ UEEEL0077

(1) Electric motor selection +application

Slide 1

Q1.What are the factors to be considered for selection and application of electric motor?

Slide 2

Q2.Sketch the characteristics of induction motor

Slide 3

Q3.Three voltages, phase to neutral are measured to be 230, 218 and 209 V on normal 415 V 50HZ supply. Determine the % voltage imbalance for 220V.

Slide 4

Q4.Sketch the graph for de-rating factor and % voltage imbalance.

Slide 5

Q5. Write the equation to calculate synchronous speed slip speed, motor current & voltage relation, motor torque & voltage relation.

Slide 6+7

Q6. Sketch the diagram for normal cage rotor.

Slide 8

Q7.Sketch the graph for power factor and efficiency.

Slide 9

Q8.Explain the duty cycle & class of rating of induction motor.

---

(2) Duty type of motor

Slide 1+2+3

Q9. Describe the duty type of motor

Q10. 3 phase 15 Kw 415 V 50Hz 1440 RPM squirrel cage induction motor has the designation H5 what does this designation indicate?

Q11.define the term " starting torque' as applicable to electric motor.

Q12.Interpret motor classification S2 & S 6

Slide 4+5+6

Q13.Describe the classification & types of motor enclosures

Slide 7+8+9

Q14. Describe the types of mounting and bearing for motors.

Q15.interpret the following motor classification symbol. IP22, IP 44, IC 01

Slide 9

Q16.Write the formula for calculation of motor acceleration torque.

Slide 10+11

Q17.A 15 Kw, 4 pole, 50Hz squirrel cage in induction motor is used to drive a machine having considerable inertia.

Motor rotor has moment of inertia 3.15 Kg-m^2 pulley has moment of inertia 0.3 Kg-m^2. Load has moment of inertia 70 Kg-m^2. Load is driven by a belt drive at half the speed of motor. Calculate (a) total moment of inertia (b) If motor full load speed is 1475 rpm, calculate the full load torque.

---

(3) Induction motor starting

Slide 1

Q18. To drive the following loads. Describe the required starting torque of electric motor compressing, belt conveyor drive , rock crushing.

Slide 2+3+4

Q19.A cyclic process has a starting load of 50KW rising in a linear ramp fashion in 15 sec to 260 KW. During the next 30 sec the load is constant at 320 Kw. If then falls abruptly to 60KW at which value , it remains constant for 60 sec. When the cycle repeats, determine a suitable size of motor for application.

Slide 5

Q20.The electrical power supply company set the requirement that 415V 3 ph motor starting current shall not exceed 53+3.3K where K is the output rating of the largest motor in Kw. If 3 ph 25 KW motor is connected to other motors in load group with similar capacity, calculate the permissible starting current.

Slide 6

Q21.Write the names of reduced voltage starters

Q22.Write the method of current interrupting

Slide 7+8

Q23. Sketch auto transformer starter and express the starting current and torque equation.

Slide 9+10

Q24. 30 KW, 4 poles 415V motor full load current in 30 amp starting current is 62% of rated current starting torque is 150% of full load torque. Determine the locked current & torque at starting for (a) Star/Delta starting (b) primary resistance starting (c) auto transformer starting at 70% tapping.

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(4) Induction & synchronous motor (E029+G006)

Slide 1+2

Q25.Sketch the diagram of induction motor and synchronous motor.

Slide 3

Q26.Sketch the installation diagram of synchronous motor in PF improvement.

Slide 4

Q27.Write down the starting current and torque of synchronous motor.

Slide 5

Q28.Describe the motor protection methods.

Slide 6+7+8+9

Q29.Sketch the pole connection diagram of 3 phase induction motor.

---

(5) Density, friction, linear motion

Slide 1+2+3

Q30.Determine the mass of air in room 15m x 7m x 3 m . Density of air = 1.325 kg/ m^3

Q31.750 ml sulphuric acid has a mass of 1.7 Kg. What is the density & relative density of sulphuric acid?

Q32.Determine specific volume of air at sea level and normal temperature?

Slide 4+5+6

Q33.A body mass 6 Kg rest on a horizontal surface and the coefficient of friction between two surfaces is 0.35. What horizontal force will be required to start the body moving?

Slide 7

Q34.A horizontal force 60N is required to start a 20Kg block moving in horizontal surface. What is the value of friction coefficient?

Slide 8+9

Q35.A 150 Kg block rests on a plane. The coefficient of friction between all surfaces is 0.25. Determine the force required to pull the plate from under the block.

Slide 10+11+12

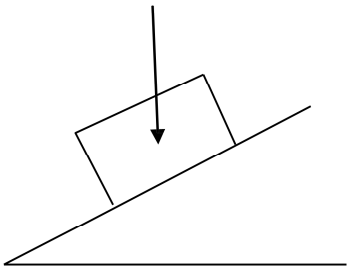
Q36.Find the total emergency stopping distance of a car and total time taken from the point where the driver sights the danger if the driver's reaction time before applying the brake is 0.9 sec. Initial velocity is 65 km/hr and retardation due to brake is 8 m/s^2

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(6) Force, mass , acceleration

Slide 1

Q37.



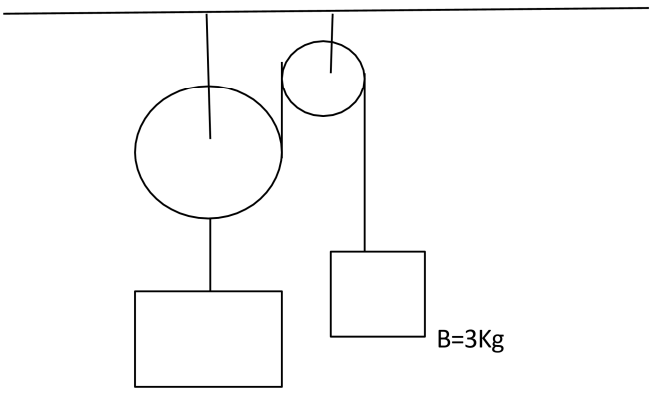
Determine the acceleration of a body sliding down a smooth plane inclined to horizontal at 30 degree.

Slide 2+3

Q38.A train of total mass 130 ton is travelling at 70 km/hr on level track. The tractive resistance is 90N/ton. Calculate the tractive effort required to accelerate the train to 130 km/hr in 35 second.

Slide 4

Q39.Determine the acceleration of bodies A & B and the force of tension in the cord for the system.



A = 6 Kg

Slide 7+8

Q40.A flywheel starts from rest and accelerates at the rate of 2.7 rad/ s^2 for 35 sec. Calculate angular velocity of 7 rad/sec, brakes are applied to the flywheel producing a retardation of 5 rad/s^2 . Determine the time taken to reduce it's angular velocity to 45 rad/sec

---

(7) Torque , work ,power energy

Slide 1+2

Q42.Determine the net torque required to give a flywheel with a mass moment of inertia 0.8kg-m^2 , angular acceleration is 18 rad/s^2 .

Q43.Determine the torque required to accelerate a turbine rotor under going a dynamic balancing test from rest to a speed of 16000 rpm in 8 sec. If the mass moment of inertia of rotor is 12 kg-m^2 .

Slide 3

Q44.Determine the centrifugal force acting on a passenger of mass 80 kg in a car travelling at 95 km/hr around a curve of 150 m radius.

Slide 4

Q45.Determine the work done by the force of 60N moving distance of 4 m in the direction of force.

Q46.A hoist lifts a load of 2 ton through a vertical distance of 28 m. Determine the amount of work done against gravity.

Q47.A flywheel makes zero revolution while the torque applied to it is 45N. Determine the workdone.

Slide 5+6+7+8

Q48.A hoist lifts a load of 2 ton through the vertical distance 25m in 30 sec. What is average power?

Q49.A train moving at 68 km/hr requires 45 KN of tractive effort at this speed . Determine the driving power.

Q50.An output shaft of an electric motor rotates at 1500 rpm and produces torque 85 N-m what is shaft power?

Slide 9+10

Q51.Calculate the potential energy of a drop hammer which has a mass of 1.5 ton and is raised 1.8 m above the pile head before being allowed to drop freely in order to drive it into ground.

Q52.Calculate the kinetic energy of a vehicle of 1800 Kg mass moving with velocity of 90 Km/hr .

Slide 11+12+13

Q53.Calculate the kinetic energy of mass moment of inertia of 65 kg-m^2rotating at 300 rpm.

Q54.A rocket of 3 ton mass is fired vertically upward with a velocity of 300 m/s what is momentum.

Q55.A block of mass 3 kg is freely suspended on a string. A bullet of mass 80 g is fired horizontally into the block. If the velocity of the bullet before the impact is 400m/s, calculate the velocity of block with the bullet embedded in it immediately after the impact.

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(8) Impulse

Slide 1+2

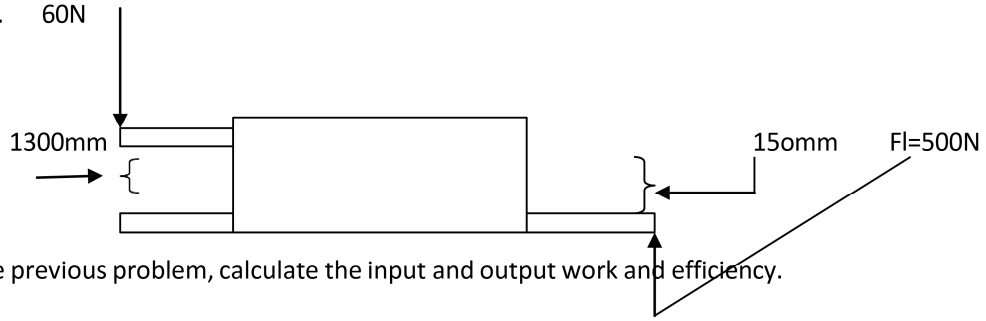
Q56.When a golf ball having a mass 60 g is struck by club. The ball and club are in intact for 0.002 sec immediately after the impact. The ball travels at 48 m/s. Determine the average force of collision.

Slide 3

Q57.The exhaust gas from a rocket have a velocity of 1300 m/s and flow at a rate of 7 Kg/s. Determine the trust produced by gas.

Slide 4

Q58.A simple machine is represented diagrammatically in given figure. The load is 500N. The effort is 60N. The distance moved by the load and effort are 150 mm and 1300 mm respectively. Calculate MA and VR.



Slide 5

Q59.For the previous problem, calculate the input and output work and efficiency.

Slide 6+7

Q60. A machine can lift 500N with velocity ratio 10. Actual force is 70N. Calculate the frictional effort.

---

(9) The law of machine.

Slide 1+2+3+4

Q61.The machine has to be tested under different load and the following effort.

Load Fl	0	100	200	300	500
Effort Fe	5	25	45	65	105

Plot load/ effort graph and determine the law of machine.

Slide 5

Q62.In previous problem, calculate the efficiency for each load and lifting efficiency.

Slide 6+7+8

Q63.The following question refers to the same machine.

(a) Given that effort required to lift a load of 8 ton is 400N. Calculate Mechanical advantage.

(b) If the effort moves 250 mm for every mm moved by the load, calculate output work and input work.

(c) If the load is lifted , a total distance of 1.87 m, calculate the output work and input work.

(d) Calculate the efficiency.

(e) Calculate fractional effort.

---

(10). Mechanical Drive System

Slide 1+2

Q64.The input shaft of a gear box rotates at 1480 rpm and transmit torque The output shaft rotates at 600 rpm and transmit the torque 170 N-m. Determine the input and output power and efficiency of the drive.

Slide 3+4

Q65.Determine the weight of a tabular steel column 130mm outside diameter 150mm inside diameter and 4.5 m high.

Slide 5+6+7

Q66.A steel test specimen, 15mm diameter ruptured under load 47 KN. What was the ultimate strength of the steel.

Q67.A portable testing machine for carrying out crushing tests on concrete applies an axial force of 483N which causes compression failure in a concrete specimen. 180mm diameter and 350 mm high. What is the ultimate compressive strength of concrete?

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(11) Power Factor measurement

Slide 1+2

Q68.Draw the circuit diagram to measure PF.

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(12) Stress and strain

Slide 1+2

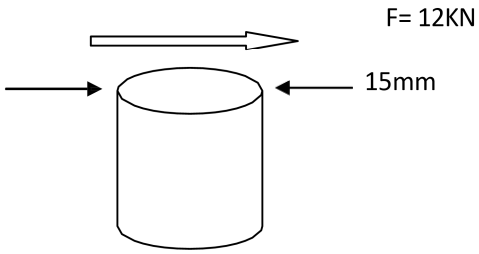
Q69.If a bar of mild steel 25 mm x 15 mm in CSA is subjected to trust force 20KN. Determine the stress in material.

Slide 3

Q70.Determine the minimum required diameter of the high tensile steel rod to carry a tensile load 30 KN with a safety factor 4.5

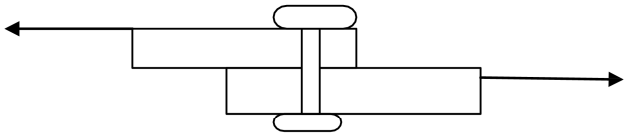
Slide 4+5

Q71.If the diameter of mild steel pin in given figure is 15 mm and the maximum force applied to the coupling is 12 KN. What is the shear stress in material of the pin and safety factor .



Slide 6+7

Q72.Determine the required diameter of a single mild steel belt , holding 2 overlapping strips of metal against a shear stress in force of 5 KN . If the allowable stress in shear is 120 Mpa



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(13) Power and machine

Slide 1

Q73.Study the questions and answers for slide.

Slide 2

Q74.A transformer has no load 3 KW & full load copper winding . Power loss is 5 Kw when it is delivering one third load current. Find total losses.

Slide 3

Q75.Study questions and answers.

Slide 4

Q76.If 4 pole alternator is producing electricity at 60Hz, find the speed.

Slide 5.

Q77. Study question and answer.

E050+ UEECD0049

(1) Power index + Graph

Slide 1

Q1. Solve $(8X^3=9X+1)$ $(8X^3-X^2-12)$

Q2.Expand $(7X-5)$ (X^2-5X+4)

Slide 2

Factorise

Q3.$2X^2+7X-9$

Q4.$8X+18$

Q5.$18-24a$

Q6.$ab+a$

Q7.$16XY-8X^2$

Q8.$15X^2Y-20aX^2+5X^2$

Q9.$3a^2b^2+6ab^2$

Slide 3

Q10.Factorise $16e^{4X}-4e^{3X}$

Q11. Solve $\frac{e^{2X}+3e^{3X}}{e^{-X}+3e^{X}}$

Slide 4+5+6+7

Q12 Factorise

(a) X^2+4X+3

(b) $2Q^2+16Q+24$

(c) $3Z^2+21Z+30$

(d) $X^2+8X+15$

(e) $E^2+11e+24$

Slide 8+9

Q13. Solve $\frac{16X^2+80X+96}{4X^2-36}$

UEEEL0079 Plan and analyse LV electrical apparatus

Elements and Performance Criteria

ELEMENTS		PERFORMANCE CRITERIA		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to plan and analyse single and three phase low voltage electrical apparatus**	**1.1**	Work, health and safety (WHS) / occupational health and safety (OHS) risk control measures are identified and applied	OHS in UEEEL0079 Practical
		1.2	Apparatus to be analysed, and scope of work to be undertaken are identified and confirmed	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises
		1.3	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety	Tools and equipment in UEEEL0079 Practical
2	**Plan and analyse single and three phase low voltage electrical apparatus**	**2.1**	Apparatus is confirmed as being isolated where necessary in accordance with WHS/OHS requirements	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises
		2.2	Apparatus is analysed using measured and calculated values as they apply to single and three-phase low voltage apparatus	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises

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		2.3	Apparatus problems are identified from analysis and solutions for rectification are recommended	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises
		2.4	The use of apparatus in a specified electrical installation is planned in accordance with requirements	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises
3	**Complete and document work**	**3.1**	Results of analysis are recorded	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises
		3.2	Justification for apparatus selection and installation planning is documented	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises
		3.3	Work completion is documented and stored in an appropriate location	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf UEEEL0079 Exercises

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:	
• analysing the operating parameters of existing apparatus • recommending alterations to existing apparatus to comply with specified operating parameters • determining the cause of problems in existing apparatus • recommending solutions for identified apparatus problems • determining conditions causing existing apparatus to be unsafe	Element 1 to 3

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• justifying selection of apparatus for a specified range of applications and operating parameters • planning apparatus installation in accordance with requirements.	

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• lighting including:
  • wiring diagrams for lighting circuits
  • switching methods for lighting circuits
  • cabling requirements for lighting circuits
  • correct operation of installed lighting circuits
  • required compliance testing
  • basic concepts, terminology, principles and standards relevant to lighting
  • types of luminaires and incandescent lamps
  • operation of different lamp types including their control equipment
  • expected lamp life, colour rendering and efficacy for different lamp types
  • lighting layout in terms of visual comfort and relevant Australian standards
  • types of low intensity discharge lamps
  • types of high intensity discharge lamps
  • LED lighting and its applications
  • Neon, Argon and Xenon lighting and their applications
  • power factor requirements
	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide.pdf
	UEEEL0079 Exercises

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• comparison of incandescent, low intensity discharge, high intensity discharge, LED and other types of lighting • emergency and evacuation lighting and lighting control including: • factors and requirements of emergency and evacuation lighting concerning illumination levels, luminaire positioning and operating period • characteristics of maintained, non-maintained and sustained emergency lighting systems • arrangement of batteries in point and central bank emergency lighting supply systems • lighting control methods • fire protection – residential fire and smoke alarms including: • types of fire and smoke alarms • regulations and standards requirements regarding residential fire and smoke alarms • locations for residential fire and smoke alarms • operation of typical residential fire and smoke alarms • electrical heating control devices including: • methods of manual heat control • methods of automatic heat control • types and application for common thermostats • operation of common thermostats • sensitivity and differential of thermostats • testing of a thermostat • applications and operation of simmerstats • electronic heat control (phase control and zero voltage switching) • fixed electrical heating appliances including:	

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• determining the heat energy in joules and kWh in a simple heating process • methods of heat transfer • determining the heat energy input and output of a heating process • operation of reverse cycle air conditioning • electrical water heater operation including: • types of water heaters (instantaneous and storage) and their methods of control • intrinsic safety (pressure relief and thermal cut-out) • testing of over temperature cut-out point of a thermostat • switchboard requirements to supply a controlled load water heater • internal circuit of a twin element water heater, and supply connections • solar heating system and its integration into an installation • alternative supplies including: • reasons for the installation of alternative supplies • types of alternative supply systems • characteristics and operation of uninterruptible power supplies (UPSs) • batteries including: • common types of primary cells and secondary batteries and typical applications • terminal voltage of common primary cells and secondary cells • correct storage, handling and disposal techniques for cells and batteries • charge/discharge cycle for a secondary cell • effect of internal resistance on a secondary cell • state of charge of a secondary cell • commissioning procedures for various secondary batteries	

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• safe working procedures when working with secondary cells and batteries.	

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, equipment and personal protective equipment (PPE) currently used in industry
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

Links

Companion Volume Implementation Guides are found in VETNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6

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UEEEL0080 Plan and analyse wiring systems, circuits, control and protection for electrical installations

Elements and Performance Criteria

ELEMENTS		PERFORMANCE CRITERIA		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to plan and analyse wiring systems, circuits, control and protection**	**1.1**	The scope and nature of the electrical installation is determined from job specifications	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		1.2	Load requirements for individual current using equipment are determined from job specifications and/or consultation with appropriate people	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		1.3	Cable routes, the route lengths of cable, and the conditions in which the wiring system is to operate is determined from job specifications or from consultation with appropriate people	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
2	**Evaluate and plan electrical circuits, control and protection**	**2.1**	Circuits, control and protective devices are planned to ensure safe and functional operation of the installation and to comply with relevant requirements	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		2.2	Earthing is planned to comply with the multiple earthed neutral (MEN) system requirements	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises

		2.3	Protective devices are selected to meet the required switching and tripping currents, coordination and discrimination for overload and short circuit protection in accordance with relevant industry technical standards	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		2.4	Residual current devices (RCDs) are planned to meet the required circuit switching and tripping currents, in accordance with relevant industry technical standards	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		2.5	Switchgear/control gear is planned to meet current and voltage requirements and confirmed suitable for environmental conditions (ingress protection (IP) ratings) and functional requirements	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		2.6	Switchboards are planned to accommodate control and protective devices, links, safety services and other distributor equipment in accordance with relevant industry technical standards	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
3	**Plan wiring systems and cables for general electrical installations**	**3.1**	Wiring system is planned and suitable for the environments in which it will operate	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		3.2	Cable conductor sizes are planned to meet current carrying capacity requirements and voltage drop and earth fault loop impedance limitations in accordance with relevant industry standards	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises

		3.3	Circuit protective devices are planned to meet requirements for co-ordination with conductor current carrying capacity in accordance with relevant industry standards	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		3.4	Earthing system components are planned to meet multiple earthed neutral (MEN) system in accordance with relevant industry standards	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
4	**Document electrical installation wiring systems, circuits, control and protection**	**4.1**	Rationale for device and wiring system planning and calculations are documented	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		4.2	Manufacturer data is referenced in planning of equipment to ensure materials comply with safety requirements and relevant industry standards	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises
		4.3	Electrical installation arrangement and specifications for all items are documented	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide UEEEL0080 Exercises

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:	

• calculating:
  • prospective fault current in accordance with fault levels specified by the local supply authority
  • earth fault loop impedance in a given circuit
  • expected voltage drop in a given circuit
  • maximum demand on consumer mains, submains and final subcircuits
• determining:
  • requirements for discrimination and back-up protection for coordination of protection devices
  • individual load requirements
  • cable routes, the route lengths of cables and the conditions in which the wiring system is to operate
  • the number and types of circuits required for a particular installation
  • current requirements for given final subcircuits
  • layout/schedule of circuits for given installations
  • maximum demand for consumer mains, submains and final subcircuits for an installation in accordance with industry and regulatory standards
  • suitability of the cable insulation
  • the control and protection for electrical installations
  • multiple earthed neutral (MEN) earthing system
  • control and protective devices to comply with requirements
	Elements 1 to 4

• selecting:
  • circuit protection devices and residual current devices (RCDs) that comply with all requirements
  • circuit protection devices to satisfy maximum demand and coordination
  • circuit protection devices to satisfy requirements for coordination, discrimination, fault protection and overcurrent
  • minimum size earthing conductors in accordance with relevant industry standards
  • circuit breakers to operate when the installation is in island mode
  • RCDs/residual-current circuit breaker with overcurrent protection (RCBO) to operate when installation is in island mode
  • equipment for damp situations
  • overcurrent protection devices, fuses, circuit breakers, RCDs/RCBOs, emergency controls, isolation devices, functional controls and shutdown devices
  • a device for fault current limiting protection
  • cables for consumer mains, submains and final subcircuits to meet maximum demand and installation conditions, including any derating factors
  • cables to satisfy fault loop impedance requirements in addition to current carrying capacity requirements and voltage drop requirements
  • conductor size based on the maximum current requirement for a given installation condition
  • cables to satisfy voltage drop requirements in addition to current carrying capacity requirements	

• isolation and control devices as required by the designed installation and in accordance with industry and regulatory requirements • dividing the installation into circuits • obtaining evidence of compliance for the equipment selected • drawing arrangements of circuit control and protection devices • documenting the installation arrangement, specification for items selected, reasons for the selections made and electrical installation design.	

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:	

• Standards philosophy and format, including:
  • performance versus prescriptive requirements
  • purpose of technical standards
  • arrangement and use of technical standards in relation to electrical and electronic work
  • how to read and apply a standard
  • standards and codes that apply to all types of electrical installations
  • standards mandated under regulation (e.g. Wiring Rules) or by an authority, deemed-to-comply standards and local service requirements (e.g. service rules)
  • codes applicable to electrical safe working practices and some aspects of the Building Code of Australia (BCA)
• AS/NZS 3000 requirements and safety principles related to wiring systems, circuits, control and protection for electrical installations
	UEEEL0077+79+80 LV Machine+Wiring+Apparatus Study Guide
	UEEEL0080 Exercises

• safety principles for electrical systems in buildings and premises
• WHS/OHS legislated requirements and hazards/risks in an electrical installation
• circuit and control arrangements, including:
  • requirements for the provision of the isolation of every circuit in an electrical installation
  • factors to be considered in determining the number and type of circuits required for an installation
  • number and types of circuits required for a particular installation
• methods of protection against direct and indirect contact
• earthing, including:
  • parts of an earthing system and the purpose of each
  • typical arrangement for a MEN system and for a range of installation arrangements of PE conductors
• requirements for equipotential bonding in a range of installation situations
• the effects of overload and short circuit current
• methods of protection against overload and short circuit current
• devices for automatic disconnection of supply, including:
  • operating principles of thermal/magnetic circuit breakers, common types of fuses and RCDs
  • tripping characteristics of various types of circuit breakers
  • time/current curves and fusing characteristics of various types of fuses
  • tripping characteristics of various types of RCDs
  • factors in a fault loop that will affect the impedance of the circuit	

• maximum impedance of an earth fault loop to ensure operation of a protection device
• methods of protection against over voltage and under voltage
• control of an electrical installation and circuits, including:
  • switch types
  • switching requirements
• switchboards including:
  • purpose, types and applications
  • equipment arrangement
  • whole current metering
  • current transformer metering
  • compliance requirements
  • tariff structures for the supply of electricity
  • single-phase metering
  • multi-phase metering
• design and safety performance requirements, including:
  • supply characteristic considerations when designing an electrical installation
  • external factors that may damage an electrical installation
  • methods to protect against risk of ignition of flammable materials and injury by burns from the thermal effects of current in normal service
  • likely sources of unwanted voltages and the methods for dealing with this potential hazard
  • requirements for protection against the harmful effects of faults between live parts of circuits supplied at different voltages
  • need for protection against injury from mechanical movement and how this may be achieved	

• features of 'fire rated construction' and how the integrity of the fire rating can be maintained in relation to the electrical installation
• maximum demand on consumer mains and submains, including:
  • methods for determining the maximum demand on an installation's consumer mains and submains
  • maximum demand for the consumer mains for given installations up to 400 amperes (A) per phase
• cable selection based on the following requirements:
  • current carrying capacity
  • voltage drop
  • fault loop impedance
• cable types including:
  • application of various cord and cable types, as defined by the properties of their insulation, sheathing, armouring and/or screening
  • Australian and international standard colour codes for cords and cables
  • identification of cords and cables by conductor size, type and rating
  • identification of hardware used in terminating cords and cables
  • requirements to protect and support cables adequately (protection against mechanical damage, protection from adverse temperatures and corrosion and protection from magnetic fields that may affect the performance of the cable)
  • structural components of cables and their purpose (conductor material, stranding, insulation type, voltage rating, screening, sheathing, armour and serving)
• wiring system features, applications, relevant industry standards and testing requirements for safe operation relating to:	

• cords, cables and plugs
• circular and flat TPS wiring systems
• TPI cables in non-metallic enclosures
• TPI cables in metallic enclosures
• fire protection cabling, including:
  • requirements when passing a wiring system through a fire rated wall or floor
  • techniques for recognising different fire protection cable types
• SWA cables
• trailing cables and catenary systems.	

UEERE0051 Apply electrical principles to renewable energy design

Elements and Performance Criteria

ELEMENTS		PERFORMANCE CRITERIA		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to contribute to renewable energy installation design**	**1.1**	WHS/OHS processes and procedures are identified and applied in accordance with workplace procedures	OHS in Renewable Energy Practical
		1.2	Drawings and diagrams are interpreted to determine the apparatus, cables and isolation device sizes and types	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises
		1.3	Renewable energy system regulations / legislation, Industry Standards, and Codes are identified, interpreted and applied	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises
		1.4	Additional expertise or approval required for execution of design is identified	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides

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				UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises
2	**Apply electrical principles to development of renewable energy design**	**2.1**	System energy production/yield is calculated in accordance with industry practice	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises
		2.2	Cable sizes are calculated in accordance with job requirements and industry standards	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises
		2.3	Isolator sizes are calculated in accordance with job requirements and industry standards	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises
		2.4	Protection device sizes are calculated in accordance with job requirements and industry standards	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises
		2.5	Calculated component sizes are checked against verified designs	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises

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		2.6	Renewable energy system designs are reviewed to check compliance with Industry Standards, guidelines and codes	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises	
		2.7	Documentation and record keeping is completed in accordance with workplace procedures and regulatory requirements	UEECD0044+0046+UEECD0051 +UEEEL0020+ UEECD0080 Studies Guides UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises	

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:	

• applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures and practices
• applying safety principles for electrical systems in buildings and premises
• reviewing renewable energy system designs for compliance with industry standards, guidelines and codes
• interpreting drawings and diagrams to determine the apparatus, cables and isolation device sizes and types
• identifying, interpreting, and applying relevant renewable energy system regulations / legislation, industry standards, and codes
• calculating:
  • cable sizes
  • isolator sizes
  • protection device sizes
	• Element 1 to 2

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• system energy production/yield • drawing block diagrams incorporating apparatus, cables, isolators and overcurrent protection • identifying any additional expertise or approval required for execution of design • verifying equipment and cable selected complies with standards and job specifications • completing necessary documentation and record keeping.	

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- safety and compliance including:
  - hierarchy of Acts, Regulation, Standards and Codes
  - Licensing restrictions
  - electrical isolation requirements and processes
- electrical theory including:
  - definitions of and units of measurement for:
    - voltage
    - current
    - resistance including conductors versus insulators
    - power
    - energy
  - Ohm’s law, including:
    - relationship between Voltage, Current and Resistance
    - basic direct current (d.c.) single path circuit
    - voltage and current levels in a basic d.c. single path circuit

UEECD0044+0046+UEECD0051 +UEEEL0020+

UEECD0080 Studies Guides

- UEERE0013+0060+0061+0063+0066 Studies Guides UEERE0013+0060+0061+0063+0066 Exercises

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        - effects of an open circuit, a closed circuit and a short circuit on a basic d.c. single path
        - relationship between voltage and current from measured values in a simple circuit
    - difference between power and energy, and when is each used
    - simple calculations including:
        - appliance loads
        - energy ratings
- the grid including:
    - high voltage (HV) and low voltage (LV)
    - distribution network service provider (DNSP)
    - electricity bills, tariff structures and demand charges
    - single, two and three phase
    - main switchboard and distribution boards
    - fault currents
- drawings including:
    - drawing types including:
        - single line diagram (SLD)
        - wiring
        - architectural
        - block
    - interpreting site plans
    - interpreting drawing symbols used for renewable energy designs/installations
- basic electrical circuits including:
    - elements of a simple electric circuit (supply, control switch, protection device and load)
    - purpose of each component in the circuit
    - effects of an open circuit, a closed circuit and a short circuit
- types of loads including:
    - resistive
    - inductive

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- alternating current (AC - both single and three phase) and direct current (DC), what each is, and dangers posed by each
- need for devices to afford electrical protection and the mechanisms used in protection devices including resetting
- symbols used to represent an electrical energy source, a load, a switch and a circuit protection device in a circuit diagram
- electrical power, including:
  - power ratings of devices
  - power dissipated in circuit from voltage, current and resistance values
  - definition of ‘power’ in electrical terms (for d.c. or resistive a.c. circuits)
  - using circuit readings determine power using the appropriate equations, symbols and unit abbreviations including the use of multiples and sub multiples
- series circuits, including:
  - circuit diagram of a single source d.c. series circuit
  - identification of the major components of a series circuit: power supply, loads, connecting leads and switch
  - relationship between voltage drops and resistance in a simple voltage divider network
  - effect of an open circuit on a series connected circuit
- parallel circuits including:
  - schematic diagram of a single source d.c. parallel circuit
  - identification of the major components of a parallel circuit (power supply, protection device, switch and loads)
  - applications where parallel circuits are used in the electrotechnology industry

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    - characteristics of a parallel circuit (load connection, current paths, voltage drops, power dissipation, and effects of an open circuit in a parallel circuit)
    - relationship between currents entering a junction and currents leaving a junction
    - relationship between branch currents and resistances in a two-branch current divider network
- series/parallel circuits including:
    - schematic diagram of a single source d.c. series/parallel circuit
    - identification of the major components of a series/parallel circuit (power supply, protection device, switch and loads)
    - applications where series/parallel circuits are used in the electrotechnology industry
    - characteristics of a series/parallel circuit (load connection, current paths, voltage drops, power dissipation, and effects of an open circuit in a series/parallel circuit)
    - relationship between voltages, currents and resistances in a bridge network
- calculation of the total:
    - resistance of a series/parallel circuit
    - current of a series/parallel circuit
    - voltage and the individual voltage drops of a series/parallel circuit
    - techniques for setting up and connecting a single source d.c. series/parallel circuit
- factors effecting resistance, including:
    - effect the change in the type of material (resistivity) has on the resistance of a conductor
    - effect the change in ‘length’ has on the resistance of a conductor

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    - effect the change in ‘cross-sectional area’ has on the resistance of a conductor
    - effects of temperature change on the resistance of various conducting materials
    - effects of resistance on the current-carrying capacity and voltage drop in cables
    - techniques for calculation of the resistance of a conductor from factors such as conductor length, cross-sectional area, resistivity and changes in temperature
- power factor
- basic measuring equipment including:
    - multi meter
    - AC/DC clamp meter
    - megohmmeter
- earthing systems including:
    - functional earthing
    - protective earthing and equipotential bonding
    - typical earthing arrangements for electrical installations, including installations with outbuildings
    - multiple earthed neutral (MEN) system including:
        - protective earth-neutral (PEN) conductor
        - main earthing conductor
        - MEN link
        - earth electrode
- switchboards and protection including:
    - switchboard types, application and construction
    - arrangement and identification of switchboard equipment
    - devices for functions of isolation, emergency, mechanical maintenance and functional control
    - circuit breakers including:
        - miniature circuit breaker (MCB)

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        - molded case circuit breaker (MCCB)
        - residual current device (RCD)
        - residual current breaker with overcurrent (RCBO)
    - fuses
    - coordination of overload and short circuit protection devices
    - device requirements for protection against over-voltage and under-voltage
    - signage
    - alternate supplies
    - ingress protection (IP) ratings
    - relevant industry standard requirements for switchboards and protection
- cabling including:
    - purpose, types and construction of cables used in renewable energy installations
    - current carrying capacity of cables
    - cable installation methods including:
        - in air
        - open
        - on surface
        - partially surrounded
        - fully surrounded
    - typical cable routes through buildings, structures and premises
    - mechanical cable protection methods
    - cable and conductor terminations
    - maintaining fire integrity rating
    - voltage drop
    - voltage rise
    - earth fault-loop impedance
    - short circuit performance consideration
    - methods to calculate/select cable sizes including:
        - AC and DC cables
        - earthing cables

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    - relevant industry standard requirements for cables
- techniques for the calculation of energy production/yield
- relevant safe work method statements (SWMS)/job safety assessments or risk mitigation processes.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in suitable simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or other simulations
- relevant and appropriate materials, tools, equipment and personal protective equipment (PPE) currently used in industry
- resources that reflect current industry practices in relation to applying electrical principles in renewable energy design
- applicable documentation, including workplace procedures, equipment specifications, regulations, relevant industry standards, codes of practice and operation manuals.

Links

Companion Volume Implementation Guides are found in VETNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6

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UEERE0063 Design off-grid photovoltaic/generating set systems

Elements and Performance Criteria

ELEMENTS		PERFORMANCE CRITERIA		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to design off-grid PV/genset system**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	OHS in Renewable Energy Practical
		1.2	Scope of the off-grid PV/genset system and electrical installation is determined from site survey report and design brief	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		1.3	Safety and regulatory requirements to which the electrical installation must comply are identified, obtained and applied	Safety regulatory practice in Renewable Energy Practical
		1.4	Design development work is planned to meet scheduled timelines in consultation with other person/s involved in the off-grid system installation or associated work	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
2	**Develop off-grid PV/genset system design**	**2.1**	Off-grid PV/genset system performance standards and compliance methods are applied to the design	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises

		2.2	Safety, functionality and budgetary considerations are incorporated in the off-grid PV/genset system design	Safety/ functionality practice in Renewable Energy Practical
		2.3	Power and energy management requirements are incorporated in design	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.4	Design aspects are verified by qualified person/s	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.5	Off-grid PV/genset system design is drafted and checked for compliance with the design brief and regulatory requirements	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.6	Off-grid PV/genset system design is documented and submitted in line with industry standards and regulations, job requirements and workplace procedures	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two occasions and include:	
• applying relevant workplace procedures and practices, work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures • developing off-grid PV/genset systems design based on site survey data and within safety and functional requirements and budget limitations and meet design brief • documenting and presenting final design	Element 1 to 3

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:	

• off-grid PV/genset system design, including:
  • power and energy usage analysis and projected use including maximum demand and surge demand
  • determining the available solar resource
  • incorporating fuel generating plant
  • selecting off grid PV system configuration
  • determining the system operation
  • component selection including:
  • selected system configuration and operation requirements
	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide
	UEERE0013+0060+0061+0063+0066 Exercises

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• matching component rating to required and projected power/energy usage • matching power, voltage and current of the individual system components • intended installation environment • maintenance and serviceability requirements • selecting cabling, circuit protection and switching requirements in accordance to relevant Australian standard • off grid PV system installation requirement in accordance with relevant Australian standards and manufacturers requirements • schematic and wiring diagrams for the off grid PV/genset system showing the general circuit layout and protection between the various system components • installed capital and life cycle costs of selected system configuration • energy storage design • system control requirements and configuration • fuel storage requirements • autonomy factors • solar resource including: • peak sun hours, irradiance, irradiation, latitude, azimuth and altitude angles, tilt angle • interpretation of solar irradiation data • how irradiation varies throughout the year on the surface of a fixed collector • effect on solar resource of tracking • PV modules, including: • cell, module, array • types, efficiencies and their typical applications • mechanical and electrical features necessary for the long life of a PV module	

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• module characteristics including:
  • I-V curve, operating point, maximum power point (MPP), power and voltage temperature co-efficient, Standard Test Conditions (STC), nominal operating cell temperature (NOCT)
  • major ratings of a PV module from manufacturer's information or nameplate data
  • configuration of a typical PV array
  • the effect of partial shading of a PV module or array
  • effect of temperature on module power output
  • function of blocking and bypass diodes
  • factors affecting the optimal tilt and orientation of PV arrays
• power conversion equipment (PCE) including:
  • types of PCEs used in renewable energy systems
  • the basic function of a PCE
  • PCE operation
  • PCE characteristics
• generating sets including:
  • types of generating sets
  • the basic function of a generating set
  • generating set operation
  • generating set characteristics
• batteries including:
  • meaning of the terms that define aspects of batteries including:
  • cell
  • battery
  • nominal voltage
  • amp hour capacity
  • watt hour capacity
  • charge and discharge rate
  • fault/short-circuit current
  • useable capacity	

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• depth of discharge (DOD) • state of charge (SOC) • cycle life • hazards associated with batteries and risk control measures • major features of batteries suitable for off-grid systems • factors affecting the life of batteries • common reasons for failure of batteries • charging regimes suitable for batteries • procedures for safe disposal and recycling of batteries • environmental considerations and required approvals • relevant WHS/OHS requirements, job safety assessments or risk mitigation processes • relevant manufacturer specifications.	

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UEERE0064 Design renewable energy heating systems

Elements and Performance Criteria

ELEMENTS		PERFORMANCE CRITERIA		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare to design RE heating system**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	OHS in Renewable Energy Practical
		1.2	Scope of the RE heating system electrical installation is determined from design brief	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		1.3	Safety and regulatory requirements to which the electrical installation must comply are identified, obtained and applied	Safety regulatory practice in Renewable Energy Practical

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		1.4	Design development work is planned to meet scheduled timelines in consultation with other person/s involved in the RE heating system installation or associated work	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
2	**Develop heating system design**	**2.1**	RE heating system performance standards and compliance methods are applied to the design	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.2	Safety, functionality and budgetary considerations are incorporated in the RE heating system design	Safety/ functionality practice in Renewable Energy Practical
		2.3	Power and energy management requirements are incorporated in design	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.4	Design aspects are verified by qualified person/s	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.5	RE heating system design is drafted and checked for compliance with the design brief and regulatory requirements	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises

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		2.6	RE heating system design is documented for submission to relevant person/s for acceptance and approval	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two occasions and include:	
• applying relevant workplace procedures and practices, work health and safety (WHS)/occupational health and safety (OHS) requirements, including using risk control measures • developing Renewable Energy (RE) system design based on site survey data and within safety and functional requirements and budget limitations and meet design brief • documenting and presenting final design.	• Element 1 to 2

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of the following. Additional advice and definitions for some items is provided in the UEE Training Package Companion Volume Implementation Guide (CVIG).	

• heating system technologies including:
  • types and their application
  • operating parameters of common systems
	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide
	UEERE0013+0060+0061+0063+0066
	• Exercises

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• system component parameters and specifications • system performance and requirements • installation specifications and requirements including commissioning • design of RE heating, including: • heat transfer including: • modes of heat transfer • conduction through a flat plate, series flat plates, thick and thin wall pipe, and composite pipes (e.g. lagged pipes and drums) • convection at a flat surface or tube • radiation from a flat surface or tube for black or grey bodies • combined conduction and convection through single or multiple flat plates or thin wall tubes • combined convection and radiation • combined conduction, convection and radiation such as fluid in a tank (convection to wall), through wall and/or insulation (conduction) to outside air (convection and radiation) • heat exchangers - parallel, counter flow and cross flow • combustion and fuels including: • the combustion process • fuels - desirable and undesirable characteristics, solid, liquid and gaseous types, their relative advantages and disadvantages and common methods of combustion • steam including: • importance of steam for heat transfer and power production	

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• steam/water properties and the interrelationship between the various properties for unsaturated or saturated water or steam either superheated, saturated or wet • saturation temperature and pressure, specific enthalpy, specific volume and dryness fraction • refrigeration/heat pump including: • basic principles and terminology • vapour compression cycle • performance criteria • types of refrigerant - designation, properties advantages and disadvantages • daily irradiation including: • definition of the terms: declination angle, reflectance, sunshine hours and extra-terrestrial irradiation • solar radiation data tables and contour maps • energy balance including: • definitions of the terms: transmittance, absorptance, emittance, specific heat, absorber, heat removal factor and stagnation temperature • ways to reduce heat losses from a collector • solar collector including: • five major factors that affect the selection of materials for solar collectors • features of collectors for low, medium and high temperature applications in terms of heat transfer, optical properties and materials of construction • solar collector performance including: • instantaneous efficiency of a solar collector for different inlet temperatures and flow rates	

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• effect of varying inlet temperature and flow rate on the performance of a solar collector • hydraulic circuits including: • definition of the terms: equivalent length, static head, dynamic head and heat exchanger • function of the components in the circuit • effects of water quality on the life and performance of components in the hydraulic circuit • suitable type and size components to minimise hydraulic and energy losses, including pipes, pumps, heat exchangers, expansion tanks, valves and filters for a hydraulic circuit with a given flow rate and head • safety requirements of the hydraulic circuit in terms of temperature, pressure and hydrogen gas release • requirements to balance flow through parallel/series combinations of collector arrays • suitable types and level of insulation for system components to minimise heat losses • domestic solar water heaters including: • definition of the terms: thermosiphon system, pumped storage system and sacrificial anode • function of the components in a domestic solar water heater, including the collector, storage tank, valves, piping, differential controllers, pumps, insulation and support frames	

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• schematic diagram of different types of system configurations showing collectors, storage tank, piping, pumps, filters, valves, heat exchangers and expansion tanks • factors which affect system performance, including storage tank and collector design, system location and collector orientation, water quality, hot water demand and usage pattern • safety requirements that prevent injury from high temperature water and hydrogen gas explosions during installation, maintenance and use of solar water heaters • demand for hot water and irradiation for a given location and collector tilt angle, orientation and shading • selection a suitably sized system for a given demand and location • consequences of under/oversizing of solar water heating systems in terms of the effect on system performance, • installation, commissioning and maintenance requirements for a given situation including location and mounting of collectors, storage tanks, valves, pumps, pipes and ancillary fittings • the capital cost, simple pay back and life cycle cost of solar and electric or gas hot water heaters according to Industry Standards • commercial solar hot water heaters including: • schematic diagrams for different types of system configurations showing collectors, storage tank, piping, pumps, filters, valves, heat exchangers and expansion tanks	

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• steps involved in the design of a commercial solar water heating system • assessment of the demand for hot water and irradiation for a given location and collector tilt angle, orientation and shading • selection of a suitably sized system for a given demand and location • consequences of under/oversizing of a solar water heating system in terms of system performance, • installation, commissioning and maintenance requirements for a given situation, including location and mounting of collectors, storage tanks, valves, pumps, pipes and ancillary fittings • the capital cost, simple payback time and life cycle cost of solar and electric or gas hot water heaters according to Industry Standards • pool solar hot water heaters including: • function of the components of solar pool heating systems • typical system configuration • two factors which affect system performance • installation specifications and requirements • WHS/OHS policy, workplace procedures and instructions • relevant manufacturer specifications • relevant Industry Standards.	

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

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Assessment must occur in suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated suitable workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- a range of relevant exercises, case studies and/or simulations
- resources that reflect current industry practices in relation to designing RE heating systems.

Links

Companion Volume Implementation Guides are found in VETNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6

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Australian Government

UEERE0066 Develop effective engineering strategies for energy reduction in buildings

Release: 1

UEERE0066 Develop effective engineering strategies for energy reduction in buildings

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

This unit replaces and is not equivalent to UEERE0012 Develop effective engineering strategies for energy reduction in buildings. Modifications include:

- Prerequisite removed
- Significant amendments made to Elements and Performance Criteria
- Range of conditions updated
- Updates to performance and knowledge evidence requirements and CVIG content developed.

Application

This unit involves the skills and knowledge required to develop effective engineering strategies for energy reduction in buildings.

It includes developing and documenting engineering strategies/methods to effectively reduce energy use in buildings. It also includes documenting and reporting engineering strategies for energy reduction in buildings.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Not applicable

Competency Field

Renewable Energy

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS	PERFORMANCE CRITERIA
Elements describe the essential	Performance criteria describe the performance needed to

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outcomes.	demonstrate achievement of the element.
1 Identify engineering energy strategies for a building	**1.1** Work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures are identified and applied
	1.2 Scope of engineering evaluation is determined from specifications of building, services, plant and machinery and in consultation with relevant person/s
	1.3 Advice is sought from work supervisor to ensure work is coordinated effectively with relevant person/s
	1.4 Tools, testing devices and materials needed to carry out work are obtained and checked for correct operation and safety
	1.5 Industry regulations, legal obligations and job requirements are identified and applied to work in accordance with workplace procedures
2 Develop engineering strategies for energy reduction in a building	**2.1** Inspection, tests and measurements are carried out in accordance with WHS/OHS requirements and workplace procedures
	2.2 Energy use of building, services, plant and machinery is obtained and applied to the engineering evaluation process
	2.3 Energy evaluation tests are set up in accordance with inspection and test methods and workplace procedures
	2.4 Engineering strategies to reduce energy use without compromising occupancy standards are developed in accordance with energy management techniques and evaluation test results
	2.5 Engineering evaluation is carried out without damage to systems, circuits, the surrounding environment or services using sustainable energy practices
	2.6 Worksite is cleaned and made safe in accordance with workplace procedures
	2.7 Results of energy use evaluation and recommended engineering strategies and their criterion for energy reduction are documented in accordance with workplace procedures

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2.8 Engineering energy reduction report is completed and forwarded to relevant person/s

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Developing engineering strategies for effective energy reduction must include at least the following:

- two different buildings.

Unit Mapping Information

This unit replaces and is not equivalent to UEERE0012 Develop effective engineering strategies for energy reduction in buildings.

Links

Companion Volume Implementation Guides are found in VETNet - https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6

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UEERE0066 Develop effective engineering strategies for energy reduction in buildings

Elements and Performance Criteria

ELEMENTS		PERFORMANCE CRITERIA	
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.	
1 **Identify engineering energy strategies for a building**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) requirements and workplace procedures are identified and applied	OHS in Renewable Energy Practical
	1.2	Scope of engineering evaluation is determined from specifications of building, services, plant and machinery and in consultation with relevant person/s	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
	1.3	Advice is sought from work supervisor to ensure work is coordinated effectively with relevant person/s	Safety regulatory practice in Renewable Energy Practical
	1.4	Tools, testing devices and materials needed to carry out work are obtained and checked for correct operation and safety	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises

		1.5	Industry regulations, legal obligations and job requirements are identified and applied to work in accordance with workplace procedures	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
2	**Develop engineering strategies for energy reduction in a building**	**2.1**	Inspection, tests and measurements are carried out in accordance with WHS/OHS requirements and workplace procedures	Safety/ functionality practice in Renewable Energy Practical
		2.2	Energy use of building, services, plant and machinery is obtained and applied to the engineering evaluation process	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.3	Energy evaluation tests are set up in accordance with inspection and test methods and workplace procedures	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.4	Engineering strategies to reduce energy use without compromising occupancy standards are developed in accordance with energy management techniques and evaluation test results	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
		2.5	Engineering evaluation is carried out without damage to systems, circuits, the surrounding environment or services using	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises

		sustainable energy practices	
	2.6	Worksite is cleaned and made safe in accordance with workplace procedures	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
	2.7	Results of energy use evaluation and recommended engineering strategies and their criterion for energy reduction are documented in accordance with workplace procedures	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises
	2.8	Engineering energy reduction report is completed and forwarded to relevant person/s	Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide UEERE0013+0060+0061+0063+0066 Exercises

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Developing engineering strategies for effective energy reduction must include at least the following:

- two different buildings.

Renewal Energy UEERE0013+0060+0061+0063+0066 Study Guide
UEERE0013+0060+0061+0063+0066 Exercises

UEE62122 Advanced Diploma in Engineering Technology - Electrical UEE62220 Advanced Diploma in Electrical Engineering

Assessment Mapping

Training Assessment Strategies

For the units beyond UEE30820 Certificate III in Electrotechnology-Electrician Course

Part 1

Assessment Mapping

Assessment Mapping - Template

(streamlined training package)

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Add rows and columns as required below.

This document is to be viewed concurrently with C007 Attached
Click HERE

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEENEEC007B Manage contract variations		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Test**	**Assignment Report**	**Role Play**
1.Ascertain the terms of the contract	1.1	OHS procedures for a given work area are identified & understood	Q1,2,3,4 (Page 1+2 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
	1.2	Established OHS risk control measures and procedures are followed.	Q5 (Page 3 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
	1.3	The extent of the work under the original contract price is ascertained from tender submission/acceptance documents and associated work specifications, plans and diagrams.		Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q2,15,17,21,29	**Task 1** Original estimate
	1.4	Arrangements under the contract for costing and claiming variations are ascertained from tender submission/acceptance and contract documents		Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q2,15,17,21,29	**Task 1** Original estimate
2.Manage contract variations.	2.1	The extent of a variation is determined and formal variation issued by the customer representative or other appropriate person.		Report the Task 2	Role Playing **Task 2** Activity -Change of technical requirement variation-Technical
	2.2	Variation is priced in accordance with the contract and established policies and procedures			
	2.3	Variation approvals are negotiated with reference to contract obligations of both parties and in accordance with established policies and procedures.		Report the Task 2	Role Playing **Task 2** Activity -Change of technical requirement

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Test**	**Assignment Report**	**Role Play**
					variation-Costing
	2.4	Variation resolution proceeding is initiated for variations not agreed to by the client representative		Report the Task 2	Role Playing **Task 2** Activity -Change of technical requirement variation-Costing
	2.5	Approved variations are submitted for payment promptly and in accordance with established policies and procedures.			Role Playing **Task 3** Activity –Contract Negotiation
	2.6	Variations documents are forwarded to appropriate person(s) within the organisation in accordance with established policies and procedures.		Report the Task 3 Final Report Preparation	

Performance Evidence	Test	Assignment Report	Role Play
Preparing the electrical technical documents, estimate		Report 1	Task 1
Re-preparing the electrical technical documents, estimate due to variation		Report 2	Task 2
Contract variation negotiation activity		Report 3	Task 3

Knowledge Evidence	Test	Assignment Report	Role Play
T1. Estimating electrotechnology projects	Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q2,15,17,21,29		

Knowledge Evidence	Test	Assignment Report	Role Play
T2. Format, responsibilities and obligations of a contract	Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q32,33,37,39,40		

Add rows to the following table as required

Assessment Conditions	Insert Assessment event 1	Insert Assessment event 2	Insert Assessment event 3
. Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the workplace. Noise levels, production flow, interruptions and time variances must be typical of those experienced in the administration – general administration field of work and include access to: • Electrical equipment and resources records relating to business resources	Test	Report 1,2,3	Role playing task 1,2,3

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

C007 Attached

Role Playing Activity

Task 1

Determine electrical installation plan, usage of equipment for the given circuit boards.

You need to determine

- Detailed electrical working diagram
- List of equipment and accessories
- List of hand tools
- Technical specifications
- Costing

Task 2

Then referring the original circuit board, prepare another plan for another circuit board

You need to re-estimate

0. Detailed electrical working diagram
1. List of equipment and accessories
2. List of hand tools
3. Technical specifications
4. Costing

Task 3

Then perform the role playing activity in

- Contract negotiation
- Variance of scope
- Variance of materials
- Variance of associated costs.

Advanced Diploma in Electrical Engineering

Exercises Click HERE

Electrical Risk Assessment
Project Specification 2
Power Project 2
Project Risk Management References
Report Writing
Electrical Contracting & Sopecification

E071+C003 Class notes.zip

Assessment Mapping - Template

(streamlined training package)

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3 Add rows and columns as required below.
4 **This document should be viewed concurrently with UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf**

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEECD0007 - Apply work health and safety regulations, codes and practices in the workplace		

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to enter a work area	1.1	Work area access permits are obtained from appropriate personnel according to established procedures	Q1,2,3,4 (Page 1+2 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf	Q5 (Page 2 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf	
	1.2	Safe work methods for controlling risk	Q5 (Page 3 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
	1.3	Preparations for electrical and non-electrical isolation are carried out to prevent creation of hazards from loss of machine/system/process control according to established procedures..	Q6+7 (Page 3 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
2 Apply safe working practices.	2.1	Safe work methods for controlling risk are followed accurately.	Q8 (Page 4 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
	2.2	Workplace procedures for dealing with accidents, fires and emergencies are followed according to work procedures and scope of responsibility and competencies	Q9 (Page 4 +5 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
3. Follow workplace procedures for hazard identification and risk control	3.1	Hazards are identified and control measures implemented and monitored through active participation in the consultation process with employer and other employees	Q11 (Page 5 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		

Disclaimer: Printed copies of this document are regarded as uncontrolled.

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.2	Hazards in the work area are recognised and reported to appropriate personnel according to established procedures.	Q12 (Page 6 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf	Q13 (Page 6 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf	Q13 (Page 6 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf
	3.3	OHS records of incidents are completed in accordance with regulatory requirements and established procedures.	Q14+15 (Page 7 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
	3.4	Workplace instructions and training are followed accurately within established procedures.	Q16(Page 7 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Interpret the OHS symbols/ Identify the persons who can hold OHS permit/ filling the attached ESH Thresold Review form	Q1,2,3,4 ,5,6,7 (Page 1+2 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		
Evidence of safe working methods		Q5 (Page 2 of UEENEEE101A Assessment Mapping+Question +Marking Guide+Observation .pdf	

this is the latest
version

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Risk assessment process in disconnecting & re-connecting of electrical equipments.	Q6+7 (Page 3 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		
Working at hazardous area & example of safe working procedure	Q8 (Page 4 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		
Highlight the notificable incidents	Q9+10 (Page 4 +5 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		
Classifications of workplace hazards	Q11 (Page 5 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		
Preparation of workplace hazardous report	Q12 (Page 6 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf	Q13 (Page 6 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf	Q13 (Page 6 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf
Safety management system	Q14+15 (Page 7 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Highlight the function of Health and Safety Representative	Q16(Page 7 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 The basic legal requirements covering occupational health and safety in the workplace encompassing: underlying principles of OH&S			Q1 (Page 8 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf
T2 The work environment encompassing: typical hazards associated with a range of work environments procedures used to control the risks associated with these hazards			Q2 (Page 9 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf
T3 Manual Handling encompassing: typical manual handling injuries and the effect they can have on lifestyle	Q3+4 (Page 9 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		
T4 Chemicals in the workplace encompassing: hazardous substances and dangerous goods.	Q5 (Page 10 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T5 Working at heights encompassing: dangers associated with working on ladders and scaffolds identification of work area as a height risk and use			Q 6,7,8,9,10 (Page 10 +11 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf
T6 Confined spaces encompassing: hazards associated with working in a confined space identifying workplace situations that could be classified as a confined space			Q 11 (Page 11 of UEENEEE101A Assessment Mapping+Question+ Marking Guide+Observation.pdf
T7 Physical and psychological hazards encompassing: short and long term effects of excessive noise and techniques to avoid damage to hearing due to excessive noise effects of vibration on the human body and work practices to protect against vibration			Q 112(Page 11 of UEENEEE101A Assessment Mapping+Question+ Marking Guide
T8 Working safely with electricity encompassing: effects of electric shock on the human body common causes of electrical accidents		Activity 1 Demonstrate the safe use of power drill.	
T9 Life support - CPR in the workplace encompassing: First Aid.		Activity 2 Demonstrate CPR	

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
1. Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	Q 1 to 16	Activity 1& 2	Assignment

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

Assessment Mapping - Template

(streamlined training package)

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3 Add rows and columns as required below.

This document should be viewed concurrently with E137A Assessment Mapping+Performance+Marking Guide.pdf Click HERE

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEECD0016 - Document and apply measures to control WHS risks associated with electrotechnology work		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1.Identify and document hazards and risks.	1.1	Hazards are identified the appropriate persons involved and in accordance with compliance procedures.	Q1 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 1)		
	1.2	Risks associated with identified hazards are determined in consultation with others and documented in accordance with compliance procedures	Q2 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 1)		
	1.3	Provision is made to accommodate changes to documentation should unforseen hazards be identified.	Q3+4 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 2)		
2.Assign levels of risk and develop and document control measures.	2.1	Level of risk is assigned for each identified hazard in accordance with the regulations and following compliance procedures.		Activity 1 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
	2.2	Control measures are developed for hazard, level of risk and activity to eliminate and/or mitigate the risk following compliance procedures.		Activity 2 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	2.3	Hazard, level of risk and control measures are agreed to and documented in consultation with all involved in accordance with compliance procedures		Activity 3 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
3. Monitor and review the control measures.	3.1	Documented control measures are made available for reference by all involved with the work.		Activity 4 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
	3.2	Control measures are modified where required in consultation with all involved with the work in accordance with compliance procedures.		Activity 5 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
	3.3	Documentation of hazards, risk control measures and their application are filed in accordance with compliance procedures.		Activity 6 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 5)	

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Identification of hazards	Q1 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 1)		
Types of hazards & risks	Q2 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 1)		
Risk assessment		Activity 1 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
Control of hazards		Activity 2 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
Risk control documentation .		Activity 3+4+5+6 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Risk management and assessment of risk T7 Determine the degree of the risk		Activity 1 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
T3 Hazards associated with extra-low voltage, low-voltage and high-currents	Q1 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 1)		
T4 Hazards and risks and control measures associated with high-voltage	Q2 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 1)		
T2 Hazards and risks and control measures in working on construction sites T5 Hazards and risks and control measures in working with low voltage equipment T6 Hazards and risks and control measures associated with harmful, devices,		Activity 2 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	
T8 Use control measures to eliminate or control the risk T9 Engaging in monitoring and reviewing processes to ensure control measures remain valid		Activity 3+4+5+6 of E137A Assessment Mapping+ Performance+ Marking Guide.pdf (Page 4)	

Add rows to the following table as required

Assessment Conditions	Assessment	Assessment	Assessment

	event 1 Written Test	event 2 Practical & Observation	event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	All test	All practical	

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEE137A Document and apply measures to control OHS risks associated with electrotechnology work

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1. Identify and document hazards and risks.

1.1 Hazards are identified the appropriate persons involved and in accordance with compliance procedures.

Q1.How can hazards be identified?

Marking Guide+Answers 4 Marks

0 Talk with workers (including contractors) who are or will be performing any tasks to identify all potential hazards and the best ways to eliminate or reduce risk.
1 Make sure you are aware of any high risk activities, work with new machinery or new work processes before they happen.
2 Understand the hazards associated with tasks you supervise and have risk controls in place before work starts. This could mean preventing work from being done while a safety issue is being resolved.
3 Take action to resolve health and safety issues as soon as possible. This includes escalating the issue to more senior management if necessary. Once agreement is reached on how to fix a problem, implement it as soon as possible.

1.2 Risks associated with identified hazards are determined in consultation with others and documented in accordance with compliance procedures.

Q2. Correctly match the appropriate Hazards & risks.

Workplace Hazard	Example of Hazard	Example of Harm Caused

Thing	Knife	Slips, falls
Substance	Benzene	Shock, electrocution
Material	Asbestos	Cut
Source of Energy	Electricity	Leukemia
Condition	Wet floor	Mesothelioma

Marking Guide+Answers 6 Marks

Workplace Hazard	**Example of Hazard**	**Example of Harm Caused**
Thing	Knife	Cut
Substance	Benzene	Leukemia
Material	Asbestos	Mesothelioma
Source of Energy	Electricity	Shock, electrocution
Condition	Wet floor	Slips, falls
Process	Welding	Metal fume fever
Practice	Hard rock mining	Silicosis

1.3 Provision is made to accommodate changes to documentation should unforseen hazards be identified.

Q3. How do you do a risk assessment?

Marking Guide+Answers 6 Marks

To be sure that all hazards are found:

0 Look at all aspects of the work.
1 Include non-routine activities such as maintenance, repair, or cleaning.
2 Look at accident / incident / near-miss records.
3 Include people who work "off site" either at home, on other job sites, drivers, teleworkers, with clients, etc.
4 Look at the way the work is organised or "done" (include experience and age of people doing the work, systems being used, etc).
5 Look at foreseeable unusual conditions (for example: possible impact on hazard control procedures that may be unavailable in an emergency situation, power outage, etc.).
6 Examine risks to visitors or the public.
7 Include an assessment of groups that may have a different level of risk such as young or inexperienced workers, persons with disabilities, or new or expectant mothers.

Q4. If you are a driver, fill out the following risk assessment table

Risk Assessment				
Task	**Hazard**	**Risk**	**Priority**	**Control**
Delivering product to customers	Drivers work alone	May be unable to call for help if needed		
	Drivers have to occasionally work long hours	Fatigue, short rest time between shifts		
	Drivers are often in very congested traffic	Increased chance of collision		
		Longer working hours		
	Drivers have to lift boxes when delivering product	Injury to back from lifting, reaching, carrying, etc.		

Marking Guide+Answers 4 Marks

Risk Assessment				
Task	**Hazard**	**Risk**	**Priority**	**Control**
Delivering product to customers	Drivers work alone	May be unable to call for help if needed	High	Communication

	Drivers have to occasionally work long hours	Fatigue, short rest time between shifts	Low	Rostering
	Drivers are often in very congested traffic	Increased chance of collision	Medium	Adjustment of time to drive
		Longer working hours		
	Drivers have to lift boxes when delivering product	Injury to back from lifting, reaching, carrying, etc.	High	Safe lifting

2. Assign levels of risk and develop and document control measures.

2.1 Level of risk is assigned for each identified hazard in accordance with the regulations and following compliance procedures.

Activity (1)

By using the attached risk assessment chart, E137A 2.1, find out the risks that can occur in K2.11 High Power Electrical Workshop & rate the risks.

2.2 Control measures are developed for hazard, level of risk and activity to eliminate and/or mitigate the risk following compliance procedures.

Activity (2)

Based on the outcome of the risk, plan to control the hazards.

2.3 Hazard, level of risk and control measures are agreed to and documented in consultation with all involved in accordance with compliance procedures.

Activity (3)

Perform the group discussion to finalise the risk control documentation.

3. Monitor and review the control measures.

3.1 Documented control measures are made available for reference by all involved with the work.

Activity (4)

Prepare the risk control documentation & file in the locker.

3.2 Control measures are modified where required in consultation with all involved with the work in accordance with compliance procedures.

Activity (5)

The new machine will be installed in K2.11, modify your current risk control plan accordingly. Undergo the group discussion , finalize the updated document & submit it

3.3 Documentation of hazards, risk control measures and their application are filed in accordance with compliance procedures.

Activity (6)

Prepare the risk control documentation & file in the locker.

ASSESSMENT SCHEDULE

E108+E137+G106 are concurrently assessed.

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	X
1.2		X	X
1.3	X		

2.1		X	X
2.2	X	X	
2.3	X		
3.1		X	
3.2		X	
3.3		X	
EKAS Assessment		X	X

Assessment Mapping - Template

(streamlined training package)

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Add rows and columns as required below.

This document should be viewed concurrently with E102A +E105A Assessment Mapping+Performance+Marking Guide.pdf

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEECD0019 - Fabricate, assemble and dismantle utilities industry components		

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1.Prepare for dismantling, assembling and fabrication work	1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.	Q1 (Page 1 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)	Q2 (Page 2 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)	
	1.2	Established OHS risk control measures and procedures	Q3 (Page 3 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)		
	1.3	Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor			Q4 (Page 3 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)
	1.4	The nature of the work is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.		Practical 1 (Page 4 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.		Practical 1 (Page 4 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.6	Materials required for the work are obtained in accordance with established routines and procedures.		Practical 5 (Page 5 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.7	Tools, equipment and measuring devices needed		Practical 6 (Page 6 of E102A +E105A	

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		to carry out the work are obtained and checked for correct operation and safety		Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.8	Cutting tools such as drills and chisels are sharpened to suit the material on which they are to be used.		Activity 1 (Page 6/7 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
2.Dismantle and assemble utilities industry apparatus	2.1	Established OHS risk control measures and procedures for carrying out the work are followed.	**As per 1.1/1.2/1.3**		
	2.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	2.3	Appropriate tools are selected and used correctly and safely in dismantling and assembling apparatus.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	2.4	Manufacturer apparatus dismantling and assembling guides are used where applicable.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	2.5	Components are marked or tagged during the dismantling to help ensure correct and efficient reassembly.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+	

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
				Marking Guide.pdf)	
	2.6	Dismantled components and parts are stored to protect them against loss or damage.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	2.7	Apparatus is dismantled and assembled efficiently without waste of materials and energy and/or damage to apparatus and the surrounding environment or services.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	2.8	Procedures for referring non-routine events to immediate supervisor for directions are followed		Evacuation & emergency activity Activity 1 of 2.7	
	2.9	Routine quality checks are carried out in accordance with work instructions		Quality check Activity 2 of 2.7	
	2.10	OHS risk control work completion measures and procedures are followed.		Inspection activity Activity 3 of 2.7	
	2.11	Work site is cleaned and made safe in accordance with established procedures.		Housekeeping Activity Activity 4 of 2.7	
	2.14	Work supervisor is notified of the completion of the work in accordance with established procedures.			Report submission activity Activity 5 of 2.7
3. Fabricate utilities industry components.	3.1	Established OHS risk control measures and procedures for carrying out the work are followed.	**As per activity 1.1,1.2,1.3**		

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures	**As per 2.2**		
	3.3	Appropriate tools are selected and used correctly and safely in fabricating components.		Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	3.4	Drawings and instruction for the fabrication of components are followed.		Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	3.5	Component dimensions are determined directly or by calculation from information given in job drawings and instructions.		Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	3.6	Components are fabricated efficiently without waste of materials and energy and/or damage to the surrounding environment or services.		Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	3.7	Procedures for referring non-routine events to immediate supervisor for directions are followed.		Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.8	Routine quality checks are carried out in accordance with work instructions		Quality checking activity Activity 5 of 3.7	
	3,9	OHS risk control work completion measures and procedures are followed.		Inspection activity Activity 6 of 3.7	
	3.10	Work site is cleaned and made safe in accordance with established procedures		Housekeeping Activity Activity 7 of 3.7	
	3.11	Work supervisor is notified of the completion of the work in accordance with established procedures.			Report submission activity Activity 8 of 3.7

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
<Insert performance evidence >	**Insert question number or task skill number** from assessment tool that address the specific, performance evidence.	**Insert question number or task skill number** from assessment tool that address the specific, performance evidence.	**Insert question number or task skill number** from assessment tool that address the specific, performance evidence.
E102A-OHS Sign Identification,Safety procedure,Hazards identifications of machines, Duty of care check list	Q1 +2 (Page 1 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf	Q2 (Page 2 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)	Q4 (Page 3 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
E102A-Dismantling of given circuit board & electric motor+General Hand Tools+ Dismantling a assembly techniques		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	Report submission activity Activity 5 of 2.7
E102A-Fabrication of given circuit board –Mechanical Drawing+Workshop planning and materials+Measuring and marking out+Holding and cutting E105A-Device for securing and mounting		Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	Report submission activity Activity 8 of 3.7

Add rows to the following table as required

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Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
<Insert knowledge evidence >	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.
E102A-Fasteners, E105A-Device for securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories to hollow walls	Q1 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
E102A-Types of screws+Tapping and threading+Joining techniques E105A-Device for securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories to hollow walls	Q2+Q5 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
E102A-Process of drilling+Joining techniques+ Drills and drilling	Q3 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
E102A-Process of fixing	Q4 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
E102A-Types of anchors	Q5 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
E102A-Housekeeping process	Q6 of E102+E105 Part of E101+102+105 Test Question		
E102A-Types of adhesives E105A - Securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories using fixing adhesives and tapes	Q9 of E102+E105 Part of E101+102+105 Test Question		
E102A-Assembly & fabrication operation+ Sheet metal work E105A-Device for securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories to metal fixing	Q10 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
1. Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	Q1 to 10 of E102+E105 Part of E101+102+105 Test Question	**Practical 1, 5, 6, 12, 13** **&** Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	Report submission activity Activity 5 of 2.7 + Report submission activity Activity 8 of 3.7

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with E102A +E105A Assessment Mapping+Performance+Marking Guide.pdf

Click HERE

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEECD0020 Fix and secure electrotechnology equipment*		

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to fix and secure equipment	1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.	Q1 (Page 1 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)	Q2 (Page 2 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)	
	1.2	Established OHS risk control measures and procedures	Q3 (Page 3 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)		Q4 (Page 3 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)
	1.3	The scope of work to be undertaken is obtained from documentation or from work supervisor		Practical 1 (Page 4 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.		Practical 1 (Page 4 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.5	Sources of materials that may be required for the work are identified and accessed in accordance with established procedure.		Practical 5 (Page 5 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.6	Fixing devices are selected for their suitable ability for the environment, the load they are to support and substratum's into which they are to be installed.		Practical 5 (Page 5 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.7	Supporting accessories/equipment is selected for suitability for the environment and ability to support and protect from damage that which they are intended to support.		Practical 5 (Page 5 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf) Practical 6 (Page 6 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	1.8	Cutting tools such as drills and chisels are sharpened to suit the material on which they are to be used.		Activity 1 (Page 6/7 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
2. Install fixing and support devices.	2.1	Electrical isolation is arranged where work is within arm's reach of exposed conductive parts, plant or machinery in strict accordance OHS requirements and procedures.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	2.2	Other OHS risk control measures relevant to the work site are followed.	**As per 1.1+1.2**		
	2.3	Appropriate tools are selected and used correctly and safely in dismantling and assembling apparatus.		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
	2.4	Fixing devices are installed in accordance with manufacturer instructions		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+	

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
				Performance+ Marking Guide.pdf)	
	2.5	Work is carried out efficiently without waste of materials or damage to apparatus, circuits, the surrounding environment or services and using sustainable energy principles..		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
3 Complete fixing and support work	3.1	OHS risk control work completion measures and procedures are followed.	**As per activity 1.1,1.2**		
	3.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures	**As per 2.2**		
	3.3	Appropriate personnel are notified of the work completion..			Report submission activity Activity 8 of 3.7

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
E102A-OHS Sign Identification,Safety procedure,Hazards identifications of machines, Duty of care check list	Q1 +2 (Page 1 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf	Q2 (Page 2 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)	Q4 (Page 3 of E102A +E105A Assessment Mapping+Performance+ Marking Guide.pdf)
E102A-Dismantling of given circuit board & electric motor+General Hand Tools+ Dismantling a assembly techniques		Practical Task 2 +Practical 12+13 (Page 7 +8 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	Report submission activity Activity 5 of 2.7
E102A-Fabrication of given circuit board –Mechanical Drawing+Workshop planning and materials+Measuring and marking out+Holding and cutting E105A-Device for securing and mounting		Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	Report submission activity Activity 8 of 3.7

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E102A-Process of drilling+Joining techniques+ Drills and drilling	Q3 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
E102A-Process of fixing	Q4 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
E102A-Types of anchors	Q5 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	
E102A-Housekeeping process	Q6 of E102+E105 Part of E101+102+105 Test Question		
E102A-Types of adhesives E105A - Securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories using fixing adhesives and tapes	Q9 of E102+E105 Part of E101+102+105 Test Question		
E102A-Assembly & fabrication operation+ Sheet metal work E105A-Device for securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories to metal fixing	Q10 of E102+E105 Part of E101+102+105 Test Question	Fabrication Practical Page 11 of E102A +E105A Assessment Mapping+ Performance+ Marking Guide.pdf)	

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Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEE102A Fabricate, assemble and dismantle utilities industry components+ UEENEEE105A Fix and secure electrotechnology equipment (Those two competencies are assessed concurrently)

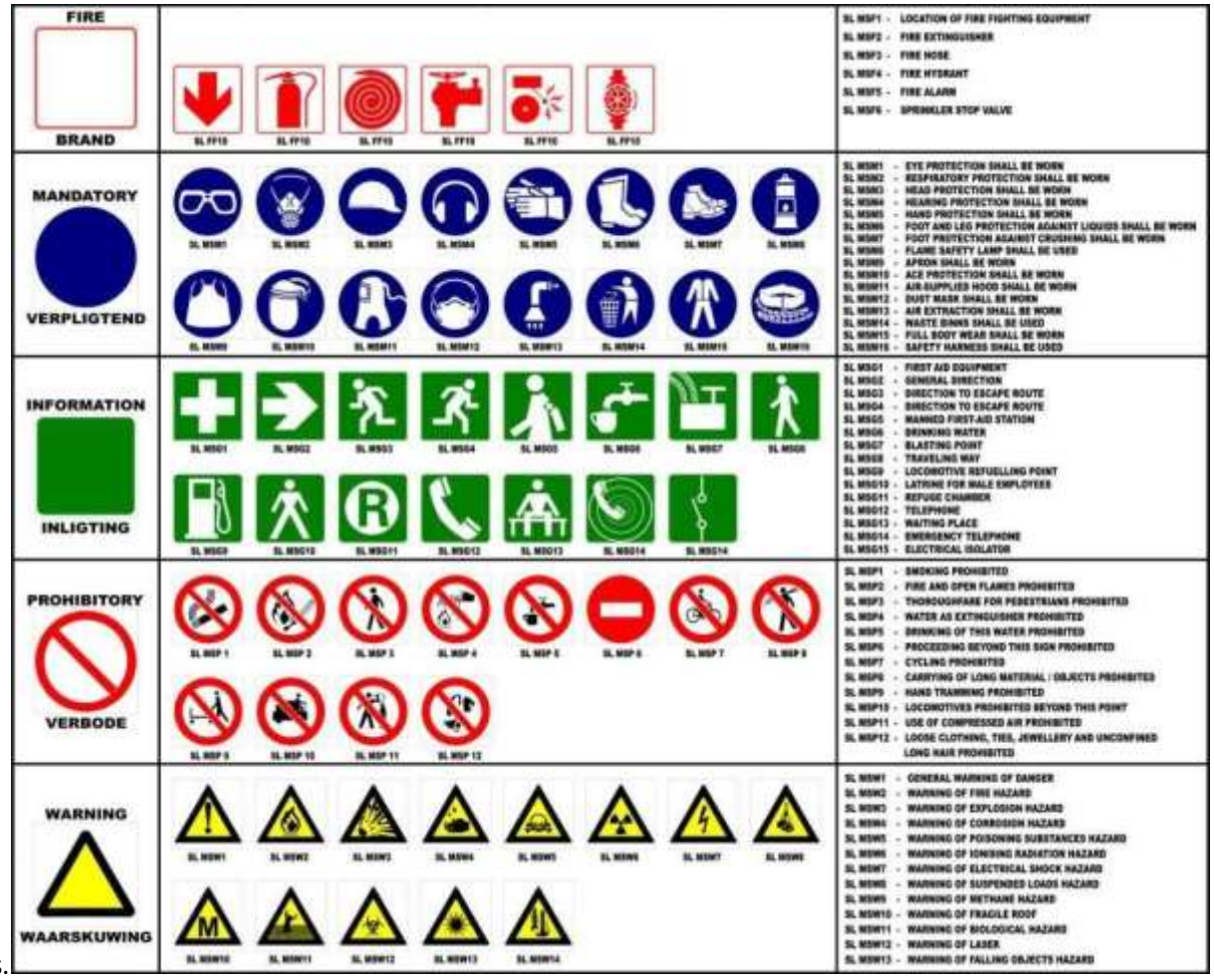
UNIT CAPSTONE ASSESSMENT

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1.Prepare for dismantling, assembling and fabrication work

1.1 OHS procedures for a given work area are obtained and understood through established routines and procedures.

Q1. Identify safety equipments & signs to be used when you are using fitting & machining process.



Answers +Marking Guide (2 marks)

Safety glass

Safety glove

Safety shoe

Ear protection

First aids sign

Q2 Write the safety procedure to operate the drilling machine

Answers +Marking Guide (5 marks)

PRE-OPERATIONAL SAFETY CHECKS

Check workspace and walkways to ensure no slip-hazards are present.
Check that the drill chuck guard is in position.
Ensure the chuck key (if used) has been removed from the drill chuck.
Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted).
Follow correct clamping procedures to ensure work is secure.
If the job obstructs the walkway erect a barricade.
Adjust spindle speed to suit drill or cutter diameter.
Faulty equipment must not be used. Immediately report suspect equipment.

OPERATIONAL SAFETY CHECKS

Never leave the Drill Press while it is running.
Before making adjustments or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
Feed downwards at a sufficient rate to keep the drill cutting.
Feed with care as the drill breaks through the underside of the work.
Use a safe working posture (beware of hair catching).

HOUSEKEEPING

Switch off the machine.
Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

Hair/clothing entanglement - rotating spindle/drill
Eye injuries
Flying swarf/chips
Sharp edges & burrs

1.2 Established OHS risk control measures and procedures

Q3 What are the main source of hazards to use the drilling machine?

Answers +Marking Guide (5 marks)

(1) Hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
drawing in or trapping hazards;
entanglement hazards;
shearing hazards;
cutting hazards;
impact hazards;

(2) hazards related to the location of the machine or plant, for example:
- its stability, for instance, whether it could roll or fall over;

(3) hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them.

To prevent the hazards, the above risks are to be identified & eliminated.

1.3 Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor

Q4.Write WHS Duty of Care Checklist for Managers/Supervisors

Answers +Marking Guide (8 marks)

WHS Duty of Care Checklist for Managers/Supervisors

Familiarise yourself with the organization Work Health & Safety Policy 2016 and Work Health and Safety Procedures to ensure you are aware of your personal responsibility for workplace health and safety (WHS) within your area of delegated authority.

Ensure that the work for which you are responsible is carried out in accordance with the University's WHS risk management steps to safeguard the health, safety and wellbeing of those involved and others who may be affected.

Demonstrate active and visible leadership in WHS risk management. Identify hazards or WHS risks associated with different jobs, tasks and projects and assess the risks to the health and safety of those involved. Conduct this risk identification and assessment in consultation with those involved or affected.

Implement suitable risk controls within agreed timeframes. These may include competency based training, adequate supervision and adoption of safe operating procedures. Choose these risk controls in consultation with those involved or affected.

Inform staff, students and contractors of WHS requirements and expectations, directing them to relevant information and risk control resources available. This may include local WHS induction (refer to the WHS induction checklist), on-the-job instruction and specific WHS training.

Promptly address WHS issues that are brought to your attention in consultation with those involved or affected.

Refer WHS issues that are beyond your control to the relevant manager(s) for their attention, but ensure that interim action is taken to reduce the risks in a practical way.

Investigate incidents, seeking to identify the causes and take steps to prevent recurrence.

1.4 The nature of the work is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

Organize the tools & equipments to do the following assembly task

Practical 1

UEENEE0028	Dismantle, assemble and fabricate pitch electrocology components
UEENEE0030	Fix and secure equipment

Practical Group (D) Disassembling & re-assembling the electrical equipments

Practical (1D) Disassembling & re-assembling the electrical equipments for movable switch board

- Note the original connection of movable switch board
- Remove the connection
- Take out the equipments
- Reinstall and reconnect the wire
- Do the safety test



Students performance in the practical is assessed.

1.5 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.

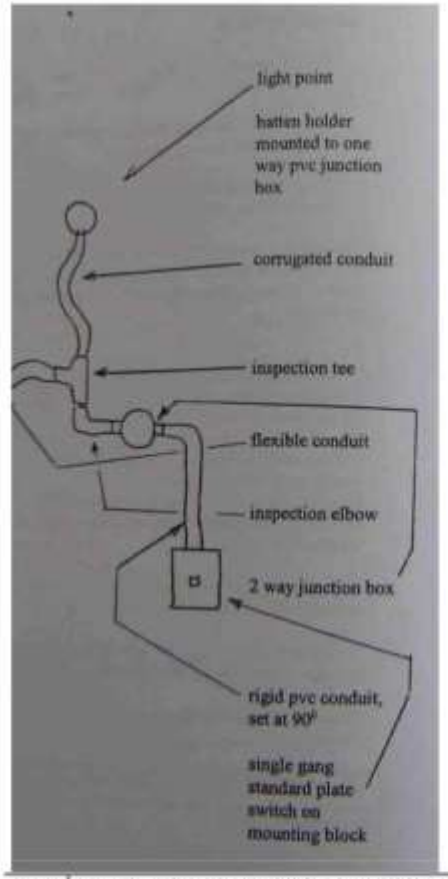
Students co-operation in the practical is evaluated.

1.6 Materials required for the work are obtained in accordance with established routines and procedures.

List the tools & materials to perform the following assembly task.

Practical (5) Conduit wiring circuit on timber board

You have to do the following wiring. Wiring to be done as enclosed wiring in conduit

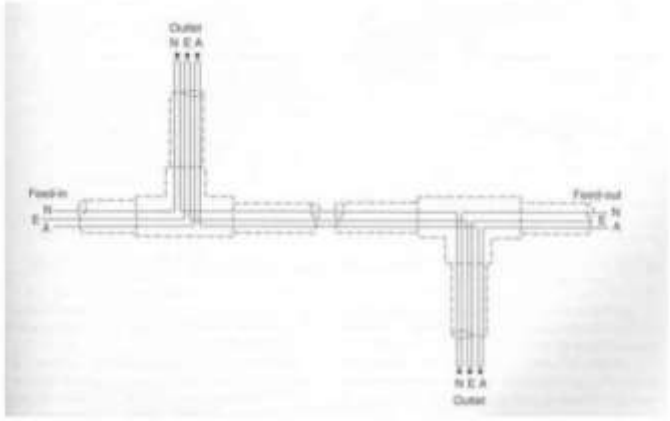


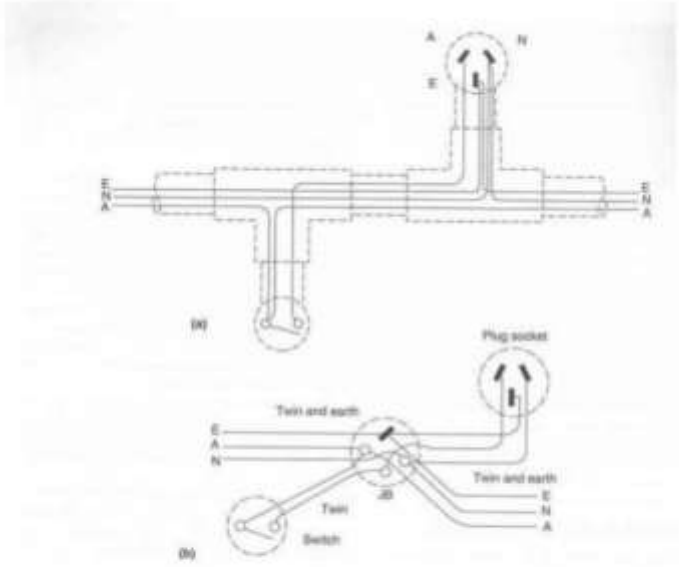
1.7	Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.

List the tools & materials to perform the following assembly task.

Practical (6) Wiring circuit for socket outlet on timber board

Do the following circuits on timber board





1.8	Cutting tools such as drills and chisels are sharpened to suit the material on which they are to be used.

Demonstrate the procedure to use the following hand drill to punch the timber board to install the electrical wiring equiipments.



2. Dismantle and assemble utilities industry apparatus	
2.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2 & 1.3

2.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS

requirements and procedures.

Practical tasks 2

You are required to dismantle the motor sets given in the picture. Demonstrate the followings

Isolating the supply
Checking the circuit
Checking the machine
Marking the original assembly.
Use of hand tools
Dismantle and keep the components systematically.
Reassembly.
Safety Checking

Practical (12) Disassembling & re-assembling the power supply to AC/DC motor

- Note the original connection
- Remove the connection
- Take out the equipments
- Reinstall and reconnect the wire
- Do the safety test



Practical Group (E) Disassembling & re-assembling the measuring electrical equipments

(Bring your own tools such as screw drivers (star/ flat, plier etc)

Practical (13) Disassembling & re-assembling the measuring devices

- Note the original connection
- Remove the connection
- Take out the equipments
- Reinstall and reconnect the wire
- Do the safety test

2.3	Appropriate tools are selected and used correctly and safely in dismantling and assembling apparatus.

Please check http://sitww.tafensw.edu.au/ to ensure this is the latest version

Observation

Collect the required tools to do dismantling

2.4	Manufacturer apparatus dismantling and assembling guides are used where applicable.

Observation

Note the information on the name plate & manufacturer's instruction.

2.5	Components are marked or tagged during the dismantling to help ensure correct and efficient reassembly.

Observation

Collect the boxes to put the components & mark.

2.6	Dismantled components and parts are stored to protect them against loss or damage.

Observation

Correctly putting the components into boxes to prevent the loss.

2.7	Apparatus is dismantled and assembled efficiently without

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waste of materials and energy and/or damage to apparatus and the surrounding environment or services.

Observation

Students' step by step dismantling tasks is observed & evaluated.

2.8 Procedures for referring non-routine events to immediate supervisor for directions are followed.

Observation

During the practical, emergency evacuation order or lock down order may be coming. In this case students will need to calmly step the works and follow the instruction . But they might put tools and components somewhere around and when they come back, they may not remember where they put them. In this case the students are to be instructed the step they reached before emergency situation and systematically place the tools and equipments before evacuation. Their interaction to such an simulated event is observed and evaluated.

2.9 Routine quality checks are carried out in accordance with work instructions.

Observation

Checking the re-assembled machine & assess the following aspects

- Proper alignment
- Proper fit
- No shortage or extra components
- Proper performance
- Do damage to body & components
- No loss of component

2.10	OHS risk control work completion measures and procedures are followed.

Observation

Risk control related to loose machine parts, no proper alignment, risk to mechanical & electrical damages are to be regarded & appropriate prevention is to be executed. The students' action in such activity is observed & evaluated.

2.11	Work site is cleaned and made safe in accordance with established procedures.

Observation

House keeping procedure in

Returning the tools and equipments
Cleaning the work place are to be assessed.

2.12	Work supervisor is notified of the completion of the work in accordance with established procedures.

Observation

Students report to completion
Checking of their job
Signing off in supervisor record are to be done.

Fabricate utilities industry components.

3.1	Established OHS risk control measures and procedures for carrying out the work are followed.

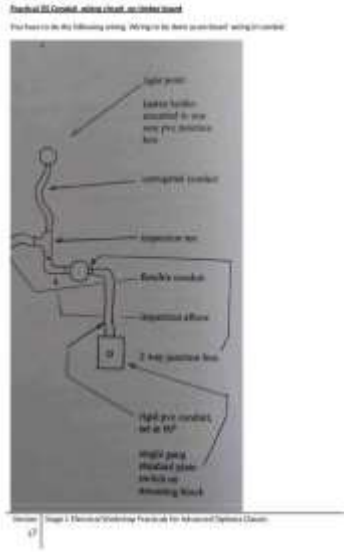
As per 1.1, 1.2, 1.3

3.2 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.

As per 2.2

3.3 Appropriate tools are selected and used correctly and safely in fabricating components.

Fabricate the following work diagram



3.4 Drawings and instruction for the fabrication of components are followed.

Observation

Interpretation of electrical & mechanical diagrams
Proper use of hand tool & components
Safe working procedure
No damage to tools and equipments

3.5	Component dimensions are determined directly or by calculation from information given in job drawings and instructions.

Observation

Exactly measure & note the dimension
Cutting the materials in accordance with the dimension
Forming the materials in accordance with dimension.

3.6	Components are fabricated efficiently without waste of materials and energy and/or damage to the surrounding environment or services.

Observation

Students performance in fabrication of the components are to be assessed.

3.7	Procedures for referring non-routine events to immediate supervisor for directions are followed.

Observation

Students' response to emergency situation such as evacuation & lock down need to be observed. Appropriate drill is to be executed & their response to such situation is to be evaluated.

3.8	Routine quality checks are carried out in accordance

with work instructions.

Observation

Checking the fabricated assembly is to be done to ensure the followings

Proper alignment
Proper fit
Meet the required dimension
No damage
No over use of materials

3.9	OHS risk control work completion measures and procedures are followed.

Observation

Risk control related to loose components, no proper alignment, risk to mechanical & electrical damages are to be regarded & appropriate prevention is to be executed. The students' action in such activity is observed & evaluated.

3.10	Work site is cleaned and made safe in accordance with established procedures.

Observation

House keeping procedure in

Returning the tools and equipments
Cleaning the work place are to be assessed

3.11	Work supervisor is notified of the completion of the work in accordance with established procedures.

Observation

Students report to completion
Checking of their job
Signing off in supervisor record are to be done.

EKAS Assessment

Refer Question & Marking Scheme for Tests

ASSESSMENT SCHEDULE

E101+E102+E105+E108 are concurrently assessed.

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	X
1.2		X	X
1.3	X		
1.4	X		
1.5	X		
1.6	X		
1.7	X		
1.8	X		
2.1	X		
2.2	X		
2.3	X		
2.4	X		
2.5	X		
2.6	X		
2.7	X		
2.8	X		
2.9	X		
2.10	X		
2.11	X		
2.12	X		

3.1			X
3.2	X		
3.3	X		
3.4		X	
3.5	X		
3.6	X		
3.7	X		
3.8	X		
3.9			X
3.10	X		
3.11	X		
EKAS Assessment		X	X

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		**ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students' work in own record	Summative Assessment- Formal Tests	Students Works Assessment 1/ E102 Assessment 1/Student Work

	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with E108A+G106A Assessment Mapping+Performance+Marking Guide.pdf Click HERE

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEECD0025 - Lay wiring/cabling and terminate accessories for extra-low voltage (ELV)		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1.Prepare to lay wiring/cabling and connect accessories for extra-low voltage circuits.	1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.	Q1+2 of E108A+G106A Assessment Mapping+ Performance +Marking Guide.pdf (Page 1+2)		
	1.2	Established OHS risk control measures and procedures	Q3 of E108A+G106A Assessment Mapping+ Performance +Marking Guide.pdf (Page 3)		
	1.3	Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor			Q4 of E108A+G106A Assessment Mapping+ Performance +Marking Guide.pdf (Page 3)
	1.4	The nature of the work is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.		**Practical 1 Task 1a**	
	1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.		**Practical 1 Task 1b**	
	1.6	Materials required for the work are obtained in accordance with established routines and procedures.		**Practical 1 Task 1c**	
	1.7	Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.		**Practical 1 Task 1d**	
2.Lay wiring/cabling	2.1	Established OHS risk control measures and procedures for	**As per 1.1+1.2+1.3**		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
and connect accessories for extra-low voltage circuits.		carrying out the work are followed.			
	2.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures		**Practical 1 Task 2**	
	2.3	Wiring and accessories are installed to comply standards and job specifications with sufficient excess to affect terminations.		**Practical 1 Task 3**	
	2.4	Accessories are installed straight and square in the required locations and within acceptable tolerances.		**Observation in practical task**	
	2.5	Cables and conductors are terminated at accessories in accordance with manufacture's specifications and regulatory requirements.		**Observation in practical task**	
	2.6	Cables installed for future service and marked in accordance with the cable identification scheme and terminated incompliance with regulatory requirements.		**Observation in practical task**	
	2.7	Procedures for referring non-routine events to immediate supervisor for directions are followed		**Activity 1- Reacting the emergency**	
	2.8	Cable installation and termination is carried out efficiently without waste of materials or damage to apparatus, circuits or the surrounding environment and using sustainable energy practices.		**Observation in practical task**	
3.Complete and report work activities.	3.1	Established OHS risk control measures and procedures for carrying out the work are followed.	**As per 1.1+1.2+1.3**		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.2	Work site is cleaned and made safe in accordance with established procedures.		**Activity 2- Housekeeping Activity**	
	3.3	Work supervisor is notified of the completion of the work in accordance with established procedures		**Activity 3- Testing**	**Activity 4- Reporting**

Add rows to the following table as required

		Performance Evidence	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
Cable colour coding			Q3 of E108+137+G108 Test Question		
Safety sign interpretation				**Practical 1 Task 1**	
Conduit wiring				**Practical 1 Task 1**	
Lighting wiring				**Practical 1 Task 1**	
Wiring the socket outlet				**Practical 1 Task 1**	
Cable termination/ connection				**Practical 1 Task 1**	
Testing				**Activity 3- Testing**	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Drawing the light control circuit T3 Installing cables in buildings, structures and premises T5 Technical standards, regulations and codes	Q1 of E108+137+G106 Test Question		
Drawing the power control circuit T3 Installing cables in buildings, structures and premises T5 Technical standards, regulations and codes	Q2 of E108+137+G106 Test Question		
Types of cables T2 Types of cables used in the electrotechnology industry	Q4 of E108+137+G106 Test Question		
Wiring accessories T1 Cable protection and support method and accessories	Q5 of E108+137+G106 Test Question		
Tools & equipments for wiring T6 Environmental and heritage regulation	Q6 of E108+137+G106 Test Question		
Cable termination tools T4 Basic cable and conductor terminations	Q7 of E108+137+G106 Test Question		
Wire crimping T4 Basic cable and conductor terminations	Q8 of E108+137+G106 Test Question		
Cable lugging tools+ Crimping tools	Q9 +10 of E108+137+G106 Test Question		
Continuity testing	Q11 + 12 of E108+137+G106 Test Question		
Insulation Resistance Test	Q13 of E108+137+G106 Test Question		
Interpretation of wiring diagram	Q14 of E108+137+G106 Test Question		

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical &	Assessment event 3 Assignment

		Observation	
. Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	Q 1 to 6 +13+14 of E108+E137+G106 Test	Practical 1 Task a to d Activities 1/2/3/4	

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEE108A Lay wiring/cabling and terminate accessories for extra-low voltage (ELV) circuits UEENEEG106A Terminate cables, cords and accessories for low voltage circuits

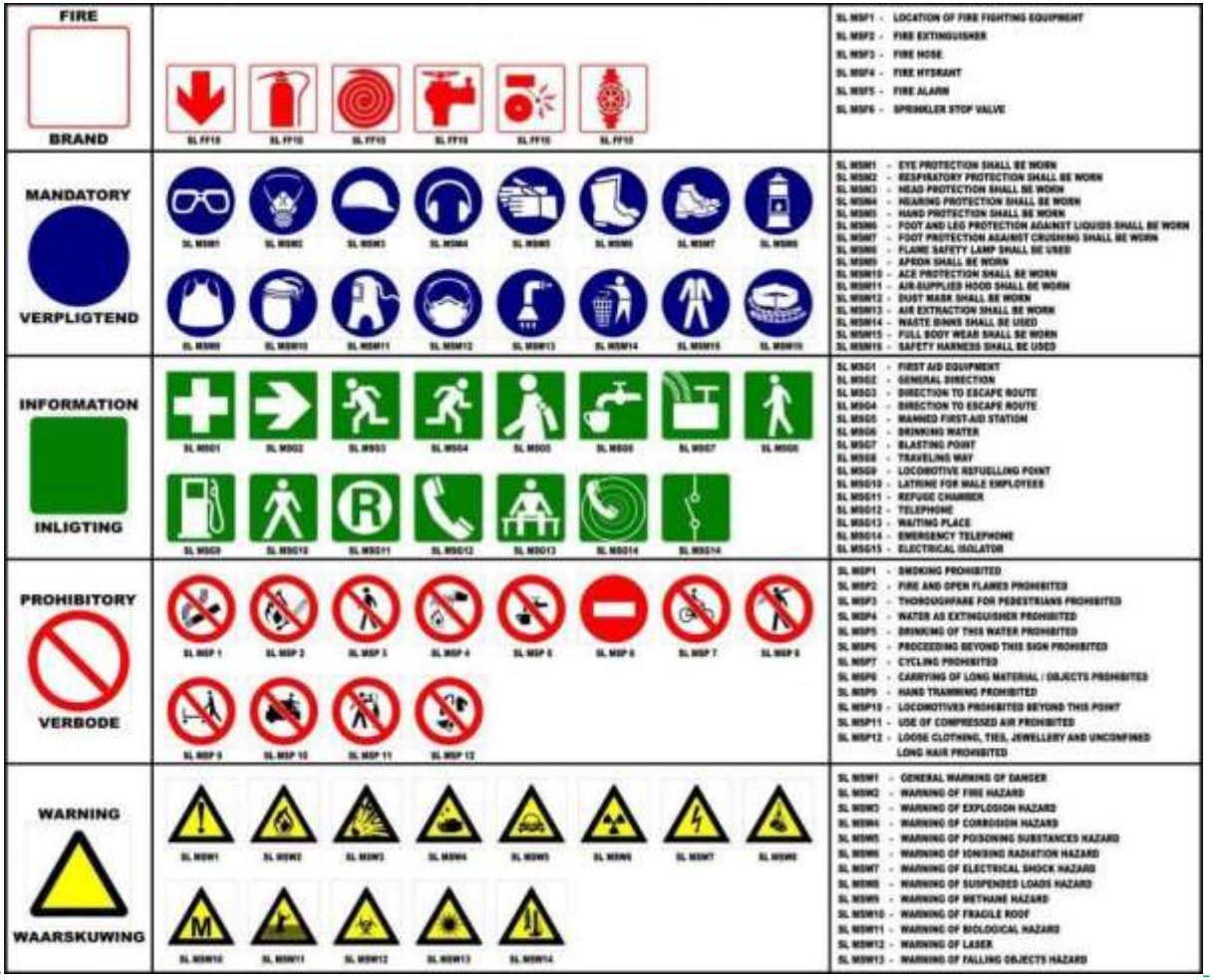
UNIT CAPSTONE ASSESSMENT

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1.Prepare to lay wiring/cabling and connect accessories for extra-low voltage circuits.

1.1 OHS procedures for a given work area are obtained and understood through established routines and procedures.

Q1. Identify safety equipments & signs to be used when you are using fitting & machining process.



Answers +Marking Guide (2 marks)

Safety glass

Safety glove

Safety shoe

Ear protection

First aids sign

Q2 Write the safety procedure to operate the drilling machine

Answers +Marking Guide (5 marks)

PRE-OPERATIONAL SAFETY CHECKS

Check workspace and walkways to ensure no slip-hazards are present.
Check that the drill chuck guard is in position.
Ensure the chuck key (if used) has been removed from the drill chuck.
Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted).
Follow correct clamping procedures to ensure work is secure.
If the job obstructs the walkway erect a barricade.
Adjust spindle speed to suit drill or cutter diameter.
Faulty equipment must not be used. Immediately report suspect equipment.

OPERATIONAL SAFETY CHECKS

Never leave the Drill Press while it is running.
Before making adjustments or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
Feed downwards at a sufficient rate to keep the drill cutting.
Feed with care as the drill breaks through the underside of the work.
Use a safe working posture (beware of hair catching).

HOUSEKEEPING

Switch off the machine.
Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

Hair/clothing entanglement - rotating spindle/drill
Eye injuries
Flying swarf/chips
Sharp edges & burrs

1.2 Established OHS risk control measures and procedures

Q3 What are the main source of hazards to use the drilling machine?

Answers +Marking Guide (5 marks)

(1) Hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
drawing in or trapping hazards;
entanglement hazards;
shearing hazards;
cutting hazards;
impact hazards;

(2) hazards related to the location of the machine or plant, for example:
- its stability, for instance, whether it could roll or fall over;

(3) hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them.

To prevent the hazards, the above risks are to be identified & eliminated.

1.3 Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor

Q4.Write WHS Duty of Care Checklist for Managers/Supervisors

Answers +Marking Guide (8 marks)

WHS Duty of Care Checklist for Managers/Supervisors

- Familiarise yourself with the organization Work Health & Safety Policy 2016 and Work Health and Safety Procedures to ensure you are aware of your personal responsibility for workplace health and safety (WHS) within your area of delegated authority.
- Ensure that the work for which you are responsible is carried out in accordance with the University's WHS risk management steps to safeguard the health, safety and wellbeing of those involved and others who may be affected.
- Demonstrate active and visible leadership in WHS risk management. Identify hazards or WHS risks associated with different jobs, tasks and projects and assess the risks to the health and safety of those involved. Conduct this risk identification and assessment in consultation with those involved or affected.

Implement suitable risk controls within agreed timeframes. These may include competency based training, adequate supervision and adoption of safe operating procedures. Choose these risk controls in consultation with those involved or affected.

Inform staff, students and contractors of WHS requirements and expectations, directing them to relevant information and risk control resources available. This may include local WHS induction (refer to the WHS induction checklist), on-the-job instruction and specific WHS training.

Promptly address WHS issues that are brought to your attention in consultation with those involved or affected.

Refer WHS issues that are beyond your control to the relevant manager(s) for their attention, but ensure that interim action is taken to reduce the risks in a practical way.

Investigate incidents, seeking to identify the causes and take steps to prevent recurrence.

1.4	The nature of the work is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

Organize the tools & equipments to do the following assembly task

Practical 1

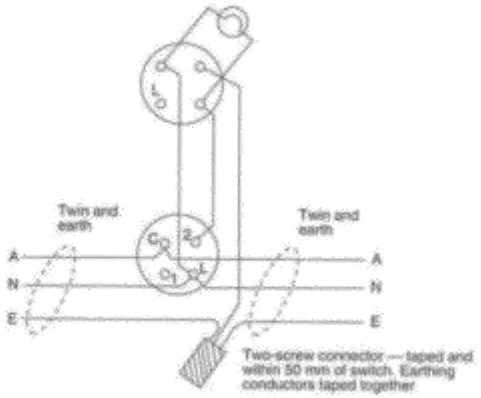
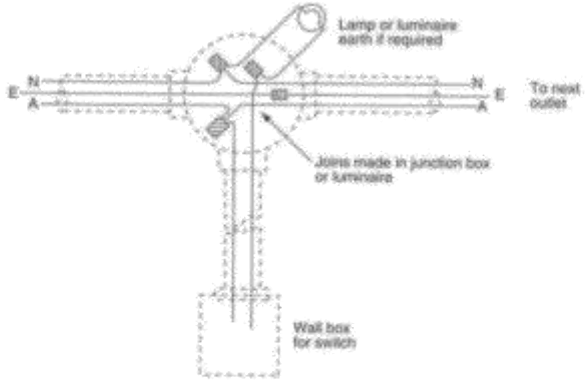


Fig. 6.8 *Looping at switch using twin and earth cable*



Equipments

In addition to above tools & equipments, you need to purchase & bring the following additional equipments & wiring accessories.

Students performance in the practical is assessed.

1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.

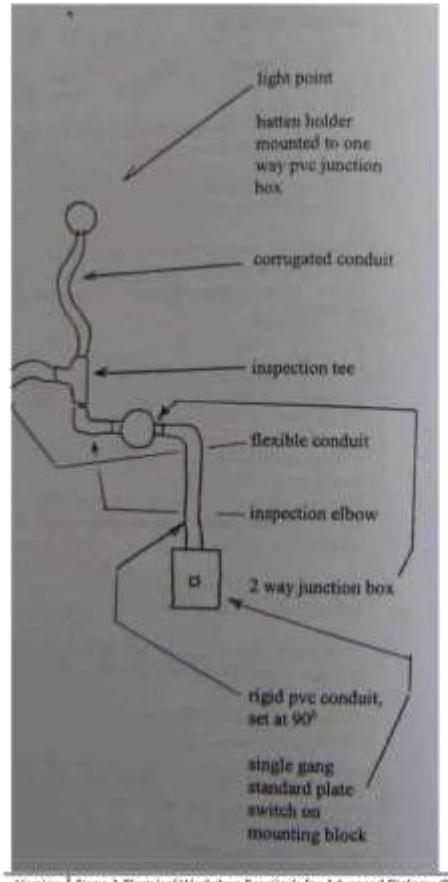
Students co-operation in the practical is evaluated.

1.6	Materials required for the work are obtained in accordance with established routines and procedures.

List the tools & materials to perform the following assembly task.

Practical (5) Conduit wiring circuit on timber board

You have to do the following wiring. Wiring to be done as enclosed wiring in conduit

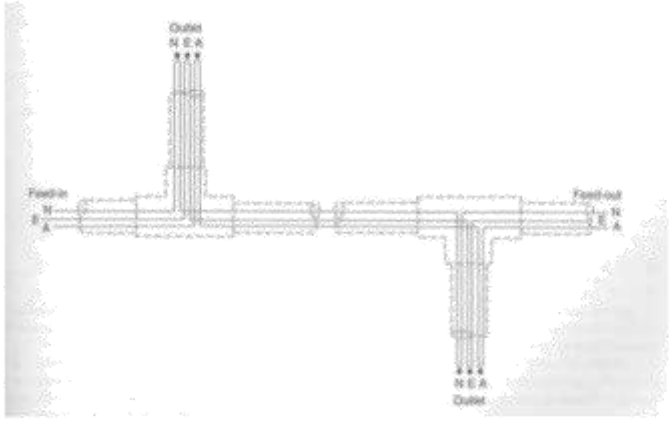


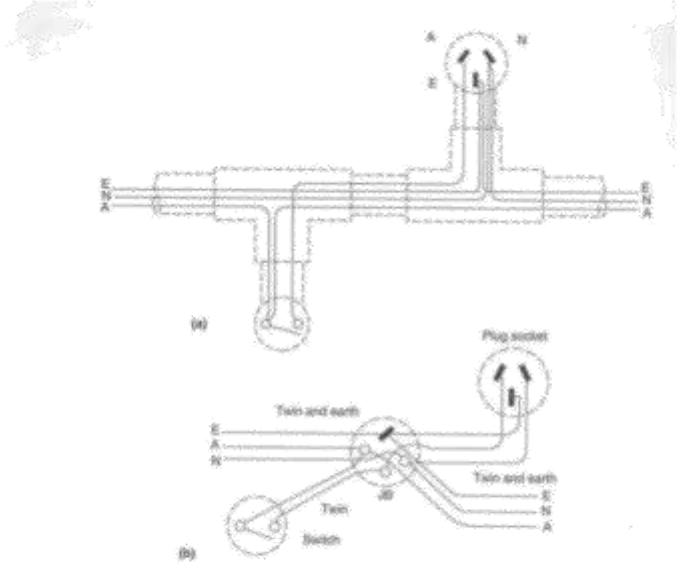
1.7 Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.

List the tools & materials to perform the following assembly task.

Practical (6) Wiring circuit for socket outlet on timber board

Do the following circuits on timber board





1.4	The junction box/ terminal enclosures and terminal types are inspected to select the type and size of cable and conductor termination devices needed.

Activity

Select the appropriate junction to make the connection

UEENEEG106A

1.5	Tools, materials and testing devices needed to for terminating cables and cords are obtained in accordance with established procedures and checked for correct operation and safety.

As per 1.7

2.Lay wiring/cabling and connect accessories for extra-low voltage circuits.

2.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2 & 1.3

2.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.

Practical tasks 2

You are required to energize the wiring circuit that you have already done on the work board given in the picture. Demonstrate the followings

- Isolating the supply
- Checking the circuit
- Checking the machine
- Marking the original assembly.
- Use of hand tools
- Dismantle and keep the components systematically.
- Reassembly.
- Safety Checking

2.3	Wiring and accessories are installed to comply standards and job specifications with sufficient excess to affect terminations.
	.
2.3 G106	Cable/cord ends are cut and sheath/insulation stripped with sufficient length to prevent stain on terminations and without undue waste.

Observation

Observed students performance in

Cutting the wire
Cable termination
Installing the components
Wire up
Checking the polarity & continuity
Compliance with AS3000 standard

2.4 Accessories are installed straight and square in the required locations and within acceptable tolerances.

2.4 G106 Cable glands/retaining devices are fitted and secured to ensure cable/cord cannot be pulled out of entry into junction box/ terminal enclosure

Observation

Simplication of wire lines
Systematic arrangement of components
Neat & accurate worksmanship are to be evaluated.

2.5 Cables and conductors are terminated at accessories in accordance with manufacture's specifications and

regulatory requirements.

2.5 G106 Conductors are prepared to suit the type of terminal at which there are to be connected

Observation

Cutting the wire
Cable termination
Installing the components
Wire up
Checking the polarity & continuity
Compliance with AS3000 standard

2.6 Cables installed for future service and marked in accordance with the cable identification scheme and terminated incompliance with regulatory requirements.

2.6 G106 Conductors are terminated to ensure continuity across the terminal.

Observation

How to allocate the cable for future expansion is observed.

2.7 Procedures for referring

non-routine events to immediate supervisor for directions are followed.

Observation

During the practical, emergency evacuation order or lock down order may be coming. In this case students will need to calmly step the works and follow the instruction . But they might put tools and components somewhere around and when they come back, they may not remember where they put them. In this case the students are to be instructed the step they reached before emergency situation and systematically place the tools and equipments before evacuation. Their interaction to such an simulated event is observed and evaluated.

2.8 Cable installation and termination is carried out efficiently without waste of materials or damage to apparatus, circuits or the surrounding environment and using sustainable energy practices.

Observation

Checking the fabricated assembly is to be done to ensure the followings

Proper alignment
Proper fit
Meet the required dimension
No damage
No over use of materials

3. Complete and report work activities.

3.1 Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2, 1.3

3.2	Work site is cleaned and made safe in accordance with established procedures.

Observation

House keeping procedure in

Returning the tools and equipments
Cleaning the work place are to be assessed

3.3	Work supervisor is notified of the completion of the work in accordance with established procedures.
3.2 G106	Terminated cables are tested to ensure continuity

Observation

Students report to completion
Checking of their job
Signing off in supervisor record are to be done.

EKAS Assessment

Refer Question & Marking Scheme for Tests

ASSESSMENT SCHEDULE

E101+E102+E105+E108 +G106 are concurrently assessed.

Performance Criteria	Assessment 1 Assessment 2 Theory Practical	

	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	X
1.2		X	X
1.3		X	
1.4	X		
1.5	X		
1.6	X		
1.7	X		
2.1	X		
2.2	X		
2.3	X		
2.4	X		
2.5	X		
2.6	X		
2.7	X		
2.8	X		
2.9	X		
3.1			X
3.2	X		
3.3	X		
EKAS Assessment		X	X

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking		

Guide/ Assessment Cover/ Feedback own record		
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for		

audit	
Students' work to be presented for audit	In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

Assessment Mapping for E104A (streamlined training package)

Faculty:				**College:**	
Teaching Section:			Electrical Engineering		
Unit of Competency Number and Name:			UEECD0044 Solve problems in multiple path circuits+ UEECD0046 Solve problems in single path circuits		

Elements & Performance Criteria			**Assessment event(s)**		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Practical Assess 1 or 2**	**Written Test 1**	**Written Test 2**
1. Prepare to work on d.c. electrical circuits.	1.1	OHS procedures for a given work area are identified, obtained and understood.	*AOC 1.1.a to f*		
	1.2	OHS risk control work preparation measures and procedures are followed.	*AOC 1.2.a,b*		
	1.3	The nature of the circuit problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.	*AOC 1.3.a*		
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.	*AOC 1.4.a*		
	1.5	Sources of materials that may be required for the work are identified and accessed in accordance with established procedures.	*AOC 1.5.a*		
	1.6	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.	*AOC 1.1.a to d*		

Elements & Performance Criteria			**Assessment event(s)**		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Practical Assess 1 or 2**	**Written Test 1**	**Written Test 2**

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Practical Assess 1 or 2**	**Written Test 1**	**Written Test 2**
2. Solve d.c. circuit problems.	2.1	OHS risk control work measures and procedures are followed.	***AOC 2.1.a***		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.	***AOC 2.2.a***		
	2.3	Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures.	***AOC 2.3.a***		
	2.4	Established methodological techniques are used to solve d.c. circuit problems from measure and calculated values as they apply to electrical circuit.	***AOC 2.3.a***		
	2.5	Unexpected situations are dealt with safely and with the approval of an authorised person.	***AOC 2.4.a***		
	2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.	***AOC 2.5.a***		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Practical Assess 1 or 2**	**Written Test 1**	**Written Test 2**
3. Complete work and document problem solving activities.	3.1	OHS work completion risk control measures and procedures are followed.	***AOC 3.1.***a		
	3.2	Work site is cleaned and made safe in accordance with established procedures.	***AOC 3.2.a***		
	3.3	Justification for solutions used to solve circuit problems is documented.	***AOC 3.3.a***		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Practical Assess 1 or 2**	**Written Test 1**	**Written Test 2**
	3.4	Work completion is documented and appropriate person(s) notified in accordance with established procedures.	*AOC 3.4.a*		

Assessment Requirements		Assessment event(s)		
	Performance Evidence	**Practical Assess 1 or 2**	**Written Test 1**	**Written Test 2**
• Implement Occupational Health and Safety workplace procedures and practices, including the use risk control measures as specified in the performance criteria and range statement		*AOC Document*		
• Apply sustainable energy principles and practices as specified in the performance criteria and range statement		*Pracs 1 and 2*		
• Apply sustainable energy principles and practices as specified in the performance criteria and range statement.			*Test1*	*Test2*
• Demonstrate an appropriate level of skills enabling employment		*Pracs 1 and 2*		
Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures		*AOC Document*		

Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 1 Basic electrical concepts encompassing:			
1.1 Electro-technology industry		Qs. 1,7,8,9	
1.2 Static and current electricity		Qs. 4,6	
1.3 Production of electricity by renewable and non-renewable energy sources		Qs. 3,5	
1.4 Transportation of electricity from the source to the load via the transmission and distribution system		Q. 2	
1.5 Utilisation of electricity by the various loads			
1.6 Basic calculations involving quantity of electricity of electricity, velocity and speed with relationship to the generation and transportation of electricity		Qs. 10,11	
T 2 Basic electrical circuit encompassing:			
2.1 Symbols used to represent an electrical energy source, a load, a switch and a circuit production device in a circuit diagram			
2.2 Purpose of each component in the circuit		Qs. 14	
2.3 Effects of an open-circuit, a closed-circuit and a short-circuit		Qs. 12,18,19	
2.4 Multiple and sub-multiple units		Qs. 16,17	
Basic Units of measurement encompassing: ***These points are not directly assessable however are essential in moving forward***			
Fundamental units/Scientific and Engineering notation/ Transposition		Qs. 13,15	
<u>TRANSPOSITION MUST BE ENPHASISED</u>			
T 3 Ohm's Law encompassing:			
3.1 Basic d.c single path circuit.		Q. 20	
3.2 Voltage and current levels in a basic d.c single path circuit		Q. 21	
3.3 Effects of an open-circuit, a closed-circuit and a short-circuit on a basic d.c. Single path relationship between voltage and current from measured values in a simple circuit		Q. 24	
3.4 Determining voltage, current and resistance in a circuit given any two of these quantities		Q. 27	
3.5 Graphical relationship of voltage, current and resistance		Qs. 25,26	
3.6 Relationship between voltage, current and resistance		Qs. 22,23	

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Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 4 Electrical power encompassing:			
4.1 Relationship between force, power, work and energy	See Practical Test 1	Q. 29	
4.2 Power dissipated in circuit from voltage, current and resistance values		Qs. 28,30	
4.3 Power ratings of devices		Qs. 31,33,35	
4.4 Measurement electrical power in a d.c. Circuit			
4.5 Effects of power rating of various resistors		Q. 34	
T 5 Effects of electrical current encompassing:			
5.1 Physiological effects of current and the fundamental principles (listed in AS/NZS 3000) for protection against the effect		Qs. 36,37,38,41	
5.2 Basic principles by which electric current can result in the production of heat; the production of magnetic fields; a chemical reaction		Qs. 42,44,45	
5.3 Typical uses of effects of current		Qs. 39,43,38,41	
5.4 Mechanisms by which metals corrode		Q. 40	
5.5 Fundamental principles (listed in AS/ANZ3000) for protection against the damaging effects of current		Q. 41	
T 6 EMF sources, energy sources and conversion electrical energy encompassing:			
6.1 Basic principles of producing a emf from the interaction of moving a conductor in a magnetic field		Q. 49	
6.2 Basic principles of producing an emf from the heating of one junction of a thermocouple		Qs. 48,52,55,57	
6.3 Basic principles of producing an emf by the application of sunlight falling on the surface of photovoltaic cells		Qs. 53,56	
6.4 Basic principles of generating an emf when a mechanical force is applied to a crystal (piezo electric effect)		Qs. 51,54	
6.5 Principles of producing an electrical current from primary, secondary and fuel cells		Qs. 50,58	
6.6 Input, output, efficiency or losses of electrical systems and machines		Qs. 59,61	
6.7 Effect of losses in electrical wiring and machines		Q. 60	
6.8 Principle of conservation of energy			

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Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 7 Resistors encompassing:			
7.1 Features of fixed and variable resistors types and typical applications			
7.2 Identification of fixed and variable resistors		Q. 60	
7.3 Various types of fixed resisters used in the Electro technology Industry e.g. Wire-wound, carbon film, tapped resistors		Q. 61	
7.4 Various types of variable resistors used in the Electro technology Industry e.g. Adjustable resistors, potentiometer and rheostat, light dependent resistor (LDR), voltage dependent resistors (VDR) and temperature dependent resistors (NTC, PTC)		Q. 72 to 76	
7.5 Characteristics of temperature, voltage and light dependent resistors and typical application of each		Q. 72 to 76	
7.6 Power ratings of a resistor		Q. 60,61,64	
7.7 Power loss (heat) occurring in a conductor			
7.8 Resistance of a colour coded resistor from colour code tables and confirm the value by measurement		Q. 66 to 70	
7.9 Measurement of resistance of a range of variable resistors under varying conditions of light, voltage, temperature conditions.	See Practical Test 1		
7.10 Specifying a resistor for a particular application		Q. 71	
T 8 Series circuits encompassing:			
8.1 Circuit diagram of a single-source d.c. 'series' circuit			Q.6&7
8.2 Identification of the major components of a 'series' circuit: power supply, loads, connecting leads and switch			Q. 1
8.3 Applications where 'series' circuits are used in the Electro technology industry			Q.4&5
8.4 Characteristics of a 'series' circuit-connection of loads, current path, voltage drops, power dissipation and effects of an open circuit in a 'series' circuit			Question 5
8.5 The voltage, current, resistance or power dissipated from measured of given values of any two of these quantities			Question 8
8.6 Relationship between voltage drops and resistance in a simple voltage divider network			Question 8
8.7 Setting up and connecting a single-source series circuit	See Practical Test 2 in Section A		
8.8 Measurement of resistance, voltage and current values in a single source series circuit			
8.9 Effect of an open-circuit on a series connected circuit			

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Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 9 Parallel circuits encompassing:			
9.1 Schematic diagram of a single-source d.c. 'parallel' circuit			Q. 13
9.2 Major components of a 'parallel' circuit (power supply, loads, connecting leads and switch)			Qs. 9 & 15
9.3 Applications where 'parallel' circuits are used in the Electro-technology industry.			Qs. 12 & 15
9.4 Characteristics of a 'parallel' circuit (load connection, current paths, voltage drops, power dissipation, effects of an open circuit in a 'parallel' circuit			Q. 15
9.5 Relationship between currents entering a junction and currents leaving a junction			Q. 13
9.6 Relationship between branch currents and resistance in a two branch current divider network			Q. 14
9.7 Calculation of the total resistance of a 'parallel' circuit			Q. 14-3
9.8 Calculation of the total current of a 'parallel' circuit			Q. 14-2
9.9 Calculation of the total voltage and the individual voltage drops of a 'parallel' circuit			Q. 14-1
9.10 Setting up and connecting a single source d.c. parallel circuit			
9.11 Resistance, voltage and current measurement in a single source parallel circuit	See Practical Test 2 in Section B		
9.12 Voltage, current, resistance or power dissipated from measured values of any of these quantities	See Practical Test 2 in Section B		
9.13 Output current and voltage levels of connecting cells parallel			
T 10 Series/parallel circuits encompassing:			
10.1 Schematic diagram of a single source d.c. 'series/parallel' circuit			Qs. 16 to 19
10.2 Major components of a 'series/parallel' circuit (power supply, loads, connecting leads and switch)			Q. 20
10.3 Applications where 'series/parallel' circuits are used in the Electrotechnology industry			Qs.16 to 20
10.4 Characteristics of a 'series/parallel' circuit (load connection, current paths, voltage paths, voltage drops, power dissipation, effects of an open circuit in a 'series/parallel' circuits)			Q. 19
10.5 Relationship between voltages, currents and resistance in a bridge network			Q. 20
10.6 Calculation of the total resistance of a 'series/parallel/ circuit			Q. 19-1
10.7 Calculation of the total current of a 'series/parallel' circuit			Q. 19-2
10.8 Calculation of the total voltage and the individual voltage drops of a 'series/parallel' circuit			Q. 19-3
10.9 Setting up a connecting a single source d.c. series/parallel circuit			
10.10 Resistance, voltage and current measurements in a single source d.c.	See Practical Test 2 in Section C		
10.11 Series/parallel circuit. The voltage, current, resistance or power dissipated from measured values of any two of these quantities	See Practical Test 2 in Section C		

Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 11 Factors affecting resistance encompassing:			
11.1 Four factors that affect the resistance of a conductor (type of material, length, cross sectional area and temperature			Qs. 21 to 28
11.2 Effect the change in the type of material (resistivity) has on the resistance of a conductor			.
11.3 Effect the change in 'length' has on the resistance of a conductor			Qs. 21,25,28
11.4 Effect the change in 'cross-sectional area' has on the resistance of a conductor			Qs. 22,23,27
11.5 Effect of temperature change on the resistance of various conducting materials			
11.6 Effect of resistance on the current-carrying capacity and voltage drop in cables			Qs. 23,26,28
11.7 Calculations of the resistance of a conductor from factors such as conductor length, cross-sectional area, resistivity and changes in temperature			Q. 23
11.8 Using digital and analogue ohmmeter to measure the change in resistance of different type of conductive materials, copper, aluminium, nichrome, tungsten when those materials undergo a change in type of material length, cross-sectional area and temperature	Practical Test 2 Section D		

Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 12 Effects of meters in a circuit encompassing:			
12.1 Selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application.			Qs. 29,32,34
12.2 Measuring resistance using direct, volt-ammeter and bridge methods.			Qs. 29&30
12.3 Instruments used in the field to measure voltage, current, resistance and insulation resistance and the typical circumstances in which they are used.	***See Assessment Observation points 2.1 to 2.6***		Qs. 29 to 31
12.4 Hazards involved in using electrical instruments and the safety control measures that should be taken.			
12.5 Operating characteristics of analogue and digital meters.			Q. 41
12.6 Correct techniques to read the scale of an analogue meters and how to reduce parallax error.			
12.7 Types of voltmeters used in the Electro technology industry – bench type, clamp meter, Multimeter, etc			Q. 32
12.8 Purpose and characteristics (internal resistance, range, loading effect and accuracy) of a voltmeter.			Qs. 35&36
12.9 Types of voltage indicator testers. E.g. LED, neon, solenoid, volt-stick, series tester, etc. And explain the purpose of each voltage indicator tester.			
12.10 Operation of various voltage indicator testers.			
12.11 Advantages and disadvantages of each voltage indicator tester.			
12.12 Various types of ammeters used in the Electro technology industry –bench, clamp meter, multimeter, etc.			Qs. 32&33
12.13 Purpose of an ammeter and the correct connection (series) of an ammeter into a circuit.			Q. 34
12.14 Reasons why the internal resistance of an ammeter must be extremely low and the dangers and consequences of connecting an ammeter in parallel and/or wrong polarity.			Q. 34
12.15 Selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application			
12.16 Connecting an analogue/digital voltmeter into a circuit ensuring the polarities are correct and take various voltage readings.	Practical Test 2 Section E		
12.17 Loading effect of various voltmeters when measuring voltage across various loads.			Q. 35
12.18 Using voltage indicator testers to detect the presence of various voltage levels.			
12.19 Connecting analogue/digital ammeter into a circuit ensuring the polarities are correct and take various current readings	Practical Test 2 Section E		

Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 13 Resistance measurement encompassing:			
13.1 Identification of instruments used in the field to measure resistance (including insulation resistance) and the typical circumstances in which they are used.			Qs. 38-40,42
13.2 The purpose of an Insulation Resistance (IR) Tester.			Q. 37
13.3 The parts and functions of various analogue and digital IR Tester (selector range switch, zero ohms adjustment, battery check function, scale and connecting leads).			Q. 39
13.4 Reasons why the supply must be isolated prior to using the IR tester.			Q. 37
13.5 Where and why the continuity test would be used in an electrical installation.			Q. 40
13.6 Where and why the insulation resistance test would be used in an electrical installation.			Q. 37
13.7 The voltage ranges of an IR tester and where each range may be used E.g. 250V d.c, 500Vd.c and 1000Vd.c			Q. 42
13.8 AS/NZS3000 Wiring Rules requirements – continuity test and insulation resistance (IR) test.			
13.9 Purpose of regular IR tester calibration.			
13.10 The correct methods of storing the IR tester after use			
13.11 Carry out a calibration check on a IR Tester	Practical Test 2 Section F		
13.12 Measurement of low values of resistance using an IR tester continuity functions.			
13.13 Measurement of high values of resistance using an IR tester insulation resistance function.			
13.14 Volt-ammeter (short shunt and long shunt) methods of measuring resistance.			Q. 29
13.15 Calculation of resistance values using voltmeter and ammeter reading (long and short shunt connections)			
13.16 Measurement of resistance using volt-ammeter methods			Q. 29

Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 14 Capacitors and Capacitance encompassing:			
14.1 Basic construction of standard capacitor, highlighting the: plates, dielectric and connecting leads			Qs. 44&46
14.2 Different types of dielectric material and each dielectric's relative permittivity.			Q. 48
14.3 Identification of various types of capacitors commonly used in the Electrotechnology industry (fixed value capacitors -stacked plate, rolled, electrolytic, ceramic, mica and Variable value capacitors – tuning and trimmer)			
14.4 Circuit symbol of various types of capacitors: standard; variable, trimmer and polarised terms: Capacitance (C), Electric charge (Q) and Energy (W)			Qs. 59,61-63
14.5 Unit of: Capacitance (Farad), Electric charge (Coulomb) and Energy (Joule)			Qs. 44-48
14.6 Factors affecting capacitance (the effective area of the plates, the distance between the plates and the type of dielectric) and explain how these factors are present in all circuits to some extent.			Q. 44
14.7 How a capacitor is charged in a d.c. Circuit.			Qs. 53,54,55
14.8 Behaviour of a series d.c. Circuit containing resistance and capacitance components. - charge and discharge curves			Q. 59
14.9 The term 'Time Constant' and its relationship to the charging and discharging of a capacitor.			Q. 59
14.10 Calculation of quantities from given information: Capacitance (Q = VC); Energy (W=½CV2); Voltage (V = Q/C)			Qs. 56,58,59
14.11 Calculation one time constant as well as the time taken to fully charge and discharge a Given capacitor. (τ = RC)			Q. 59
14.12 Connection of a series d.c. Circuit containing capacitance and resistor to determine the time constant of the circuit			Q.59

Knowledge Evidence	Practical Assess 1 or 2	Written Test 1	Written Test 2
T 15 Capacitors in Series and Parallel encompassing: 15.1 Hazards involved in working with capacitance effects and the safety control measures that should be taken. 15.2 Safe handling and the correct methods of discharging various size capacitors 15.3 Dangers of a charged capacitor and the consequences of discharging a capacitor through a person 15.4 Factors which determine the capacitance of a capacitor and explain how these factors are present in all circuits to some extent. 15.5 Effects of capacitors connected in parallel by calculating their equivalent capacitance. 15.6 Effects on the total capacitance of capacitors connected in series by calculating their equivalent capacitance. 15.7 Connecting capacitors in series and/or parallel configurations to achieve various capacitance values. 15.8 Common faults in capacitors. 15.9 Testing of capacitors to determine serviceability. 15.10 Application of capacitors in the Electro technology industry.	***See Assessment Observation points 2.1 to 2.6***		Qs. 63,64,66 Qs. 62,65,67

Assessment Conditions	Practical Assess 1 or 2	Written Test 1	Written Test 2
1. Demonstrated consistent performance across a representative range of contexts from the prescribed items below: • Solving problems in d.c. circuits and including: A. Using methodological techniques to solve d.c. circuit problems from measure and calculated values. B. Determining the operating parameters of an existing circuit. C. Altering an existing circuit to comply with specified operating parameters. D. Developing circuits to comply with a specified function and operating parameters. E. Dealing with unplanned events	.		.
2. Assessors must satisfy NVR/AQTF assessor requirements. (*Insert Hyperlink to evidence*)	Faculty- BF_Tas/ Admin Property WHS/ Admin/ Qualifications/CIV Bus Admin/teachers skill matrix		

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	

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Signature		**Date modified**	

Assessment Mapping - Template

(streamlined training package)

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This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEECO0003 - Manage contract variations		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Test**	**Assignment Report**	**Role Play**
1.Ascertain the terms of the contract	1.1	OHS procedures for a given work area are identified & understood	Q1,2,3,4 (Page 1+2 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
	1.2	Established OHS risk control measures and procedures are followed.	Q5 (Page 3 of UEENEEE101A Assessment Mapping+Question+Marking Guide+Observation.pdf		
	1.3	The extent of the work under the original contract price is ascertained from tender submission/acceptance documents and associated work specifications, plans and diagrams.		Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q2,15,17,21,29	**Task 1** Original estimate
	1.4	Arrangements under the contract for costing and claiming variations are ascertained from tender submission/acceptance and contract documents		Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q2,15,17,21,29	**Task 1** Original estimate
2.Manage contract variations.	2.1	The extent of a variation is determined and formal variation issued by the customer representative or other appropriate person.		Report the Task 2	Role Playing **Task 2** Activity -Change of technical requirement variation-Technical
	2.2	Variation is priced in accordance with the contract and established policies and procedures			

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Test**	**Assignment Report**	**Role Play**
	2.3	Variation approvals are negotiated with reference to contract obligations of both parties and in accordance with established policies and procedures.		Report the Task 2	Role Playing **Task 2** Activity -Change of technical requirement variation-Costing
	2.4	Variation resolution proceeding is initiated for variations not agreed to by the client representative		Report the Task 2	Role Playing **Task 2** Activity -Change of technical requirement variation-Costing
	2.5	Approved variations are submitted for payment promptly and in accordance with established policies and procedures.			Role Playing **Task 3** Activity –Contract Negotiation
	2.6	Variations documents are forwarded to appropriate person(s) within the organisation in accordance with established policies and procedures.		Report the Task 3 Final Report Preparation	

Add rows to the following table as required

Performance Evidence	Test	Assignment Report	Role Play
Preparing the electrical technical documents, estimate		Report 1	Task 1
Re-preparing the electrical technical documents, estimate due to variation		Report 2	Task 2
Contract variation negotiation activity		Report 3	Task 3

Knowledge Evidence	Test	Assignment Report	Role Play

Knowledge Evidence	Test	Assignment Report	Role Play
T1. Estimating electrotechnology projects	Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q2,15,17,21,29		
T2. Format, responsibilities and obligations of a contract	Advanced Diploma in Electrical Engineering Exercises Page 65 to 71 Q32,33,37,39,40		

Add rows to the following table as required

Assessment Conditions	Insert Assessment event 1	Insert Assessment event 2	Insert Assessment event 3
. Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the workplace. Noise levels, production flow, interruptions and time variances must be typical of those experienced in the administration – general administration field of work and include access to: • Electrical equipment and resources records relating to business resources	Test	Report 1,2,3	Role playing task 1,2,3

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Approved by (Name)		**Date approved**	
Signature		**Date modified**	

Assessment Mapping - Template

(streamlined training package)

Faculty:		**College:**	
Teaching Section:	**Electrical Engineering**		
Qualification Number and Name:	**Advanced Diploma of Electro technology- Electronics**		
Unit of Competency Number and Name:	UEECS0003 - Assemble, set up and test computing devices		

Elements & Performance Criteria			**Assessment event(s)**		
Element(s)	**PC No**	**Performance Criteria (PC)**	**A1-Theory Test**	**A2-Practical**	**A3-Projects**
1.Assemble computing devices.	1.1	OHS procedures for a given work area are identified, obtained and understood through established routines and procedures.			Class Observation
	1.2	Established OHS risk control measures and procedures in relation to computer and keyboard use are followed.			Class Observations
	1.3	Advice is sought from the work supervisor to ensure the work is co-ordinated effectively with others.		**Acceptance test On Assignment**	Assignment 1
	1.4	Computer, components, operating system and application software are obtained in accordance with established routines and checked as meeting requirements.		**Acceptance test On Assignment**	Assignment 2
	1.5	Computer components are assembled and connected in accordance with manufacturer's instructions.			Simulated

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**A1-Theory Test**	**A2-Practical**	**A3-Projects**
	1.6	Routine quality checks are carried out in accordance with work instructions.			Class Observations
	1.7	Procedures are followed for referring non-routine events to immediate supervisor for directions.			Class Observations
2.Install operating system and application software.	2.1	Established OHS risk control measures and procedures for carrying out the work are followed.			Assignments 1-4 Observation
	2.2	Minimum hardware requirements are established that are appropriate for the operating system that will be installed.		**Acceptance test On Assignment**	Assignment 2
	2.3	Computer is started up and on-screen instructions for the installation of the operating system to default configuration are followed, including drivers and network interfaces.		**Acceptance test On Assignment**	Assignments 2/4
	2.4	Application software is installed to default configuration following on-screen installation instruction.		**Acceptance test On Assignment**	Assignment 2/4
	2.5	Ensure authentication and data security and integrity is implemented on a computing device which may include antivirus and logins.			Class observation
	2.6	Computer shutdown procedures are followed and computer switched off.			Class Observation
	2.7	Routine quality checks are carried out in accordance with work instructions.			Assignment 2/3
	2.8	Procedures for referring non-routine events to immediate supervisor for directions are followed.			Simulated
3.Test computer operation.	3.1	Established OHS risk control measures and procedures for carrying out the work are followed.		**Acceptance test On Assignment**	Assignments 1-4 Routine Check
	3.2	Computer is switched on and start-up procedures are followed and checked.			Observation

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**A1-Theory Test**	**A2-Practical**	**A3-Projects**
	3.3	Operating system and application programs are checked to be opening and operating correctly.		**Acceptance test On Assignment**	Assignment 2
	3.4	Faults are identified as being the result of faulty hardware or software.			Simulated
	3.5	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.			
	3.6	Faults are rectified in accordance with computer hardware, operating system and application instructions.		**Acceptance test On Assignment**	Assignment 2
	3.7	Procedures for referring non-routine events to immediate supervisor for directions are followed.			Assignments 2-4
	3.8	Computer shutdown procedures are followed and computer switched off.			Observation
	3.9	Work is carried out efficiently without waste of materials or damage to apparatus, circuits, the surrounding environment or services and using sustainable energy principles.			Routine check Observation
4.Complete work and report.	4.1	OHS risk control work completion measures and procedures are followed.			Routine check Observation
	4.2	Work area is cleaned and made safe in accordance with established procedures.			Routine check Observation
	4.3	Work supervisor is notified of the completion of the work in accordance with established procedures.			

Performance Evidence	A1-Theory Test	A2-Practical	A3-Projects

Performance Evidence	A1-Theory Test	A2-Practical	A3-Projects
Knowledge Evidence	**A1-Theory Test**	**A2-Practical**	**A3-Projects**
T1 Sub-assemblies architecture and their function Note: Examples include motherboards, memory modules, video modules, connecting buses, storage devices and other components. T2 Assembling and dismantling techniques T3 Hardware faults and troubleshooting techniques Note: Confined to subsystem level eg. PCI –E Cards or similar, T4 Basic network hardware and components T5 Connection of network media T6 Set up of standard network configuration T7 Sub-assemblies faults and troubleshooting techniques T8 Repair techniques T9 Operating systems in use. T10 Operating System installation and configuration T11 Basic authentication and file and directory security T12 Occupational health and safety fundamentals as they relate to computing device assembly/disassembly.	.Q.A1-A9 Q.B1-B4 Q.B5 Q.B7	Prac 2 Acceptance test On Project 2	. Project 1- research Project 3-research Project 2- O/S

	Assessment Conditions		A1-Theory Test	A2-Practical	A3-Projects

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Approved by (Name)		**Date approved**	
Signature		**Date modified**	

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Add rows and columns as required below.

This document should be viewed concurrently with UEENEEG063A- Assessment Mapping+Question+Marking Guide+Observation.pdf

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Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0003 Arrange circuits, control and protection for electrical installations		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to arrange electrical installations circuits, control and protection	1.1	The extent and nature of the electrical installation is determined from job specifications.		Practical 1 to 5 of UEENEEG063A-Assessment Mapping+ Question+ Marking Guide+ Observation (Page 1 to 3)	
	1.2	Safety and other regulatory requirements to which the electrical installation shall comply are identified, obtained and understood.	Q 1 to 7 of UEENEEG063A-Assessment Mapping+ Question+ Marking Guide+ Observation (Page 4 to 6)		
	1.3	Load requirements for individual current-using equipment is determined from job specificationsor from consultation with appropriate persons.		Practical 6 of UEENEEG063A-Assessment Mapping+ Question+ Marking Guide+ Observation (Page 6)	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
2 Arrange electrical installations circuits, control and protection	2.1	Circuits, control and protective devices are arranged to ensure safe and functional operation of the installation and to comply with technical standards and job specifications and requirements.		Practical 7 to 10 of UEENEEG063A- Assessment Mapping+ Question+ Marking Guide+ Observation (Page 7 to 9)	
	2.2	Not included in Training Package		As above	
	2.3	Earthing is arranged and terminated to comply with the MEN system requirements.		As above	
	2.4	Protective devices are selected to meet the required switching and tripping currents, co-ordination and discrimination for overload and short-circuit protection.		As above	
	2.5	Residual current devices are selected to meet the required circuit, switching and tripping currents required.		As above	
	2.6	Switchgear/control gear is selected to meet current, voltage and IP ratings and functional requirements.		As above	
	2.7	Switchboards are arranged to accommodate control and protective devices, links, safety services, and other distributor equipment in accordance with requirements		Practical 11 to 15 of UEENEEG063A- Assessment Mapping+ Question+	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
				Marking Guide+ Observation (Page 10 to 13)	
3 Document electrical installation circuits, control and protection arrangements	3.1	Evidence is obtained from manufacturers/suppliers that electrical equipment selected complies with safety requirements.		Practical 16 of UEENEEG063A- Assessment Mapping+ Question+ Marking Guide+ Observation (Page 14)	
	3.2	Reasons for selections made, including calculations, are documented in accordance with established procedures.	**Test 1** G033+G063 Question + Marking Guide 1 All Questions		
	3.3	Electrical installation arrangement and specifications for all selected items are documented in accordance with established procedures and forwarded to appropriateperson(s).	**Test 1** G033+G063 Question + Marking Guide All Questions		

Add rows to the following table as required

		Performance Evidence	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		<Insert performance evidence >	**Insert question number or task skill number** from assessment tool that address the specific, performance evidence.	**Insert question number or task skill number** from assessment tool that address the specific, performance evidence.	**Insert question number or task skill number** from assessment tool that address the specific, performance evidence.

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Connection of meter		Practical 1	
Connection of transformers in three phase system		Practical 2	
Home electrical wiring system model- Investigating the connection		Practical 3/4	
Supply switch board meter connection points		Practical 5	
Hazardous assessment/ Risk assessment/ Safety Practice	Q 1 to 7 of UEENEEG063A-Assessment Mapping+ Question+ Marking Guide+ Observation (Page 4 to 6)		
Home wiring supply RCD Connection		Practical 7	
Wiring circuit tresting		Practical 8/9/10	
Electrical Wiring Protection System		Practical 11/12/ 13	
Control Wiring -Motor Starter		Practical 14/15	
Specification collection			Practical 16 Assignment work

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
<Insert knowledge evidence >	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.
T1 Safety principles to which electrical systems	Q 1 to 7 of UEENEEG063A-Assessment Mapping+ Question+ Marking Guide+ Observation (Page 4 to 6)		
T2 Circuit and control arrangements		Practical 1 to 5	
T3 Hazards and risks in an electrical installation	Q 1 to 7 of UEENEEG063A-Assessment Mapping+ Question+ Marking Guide+ Observation (Page 4 to 6)		
T4 Protection against indirect contact	**Test 1** G033+G063 Question + Marking Guide 1 Part A Q4+5+7		
T5 Earthing	**Test 1** G033+G063 Question + Marking Guide 1 Part A Q 15+16	Practical 11/12/ 13	

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T6 Protection against overload and short circuit	**Test 1** G033+G063 Question + Marking Guide 1 Part B Q4		
T7 Devices for automatic disconnection of supply	**Test 1** G033+G063 Question + Marking Guide 1 Part B Q8		
T8 Protection against over voltage and under voltage	**Test 1** G033+G063 Question + Marking Guide 1+ Part A Q 10 + **Test 2** G033+G063 Question + Marking Guide 2+ Q 2		
T9 Control of an electrical installation and circuits	**Test 2** G033+G063 Question + Marking Guide 2+ Q 1		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T10 Switchboards / distribution boards	**Test 2** G033+G063 Question + Marking Guide 2+ Q 1		

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	Test 1 + 2	Practical 1 to 16	

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

The following assessments questions are arranged in Test 1 & 2

1 Prepare to arrange electrical installations circuits, control and protection

.

1.1 The extent and nature of the electrical installation is determined from job specifications.

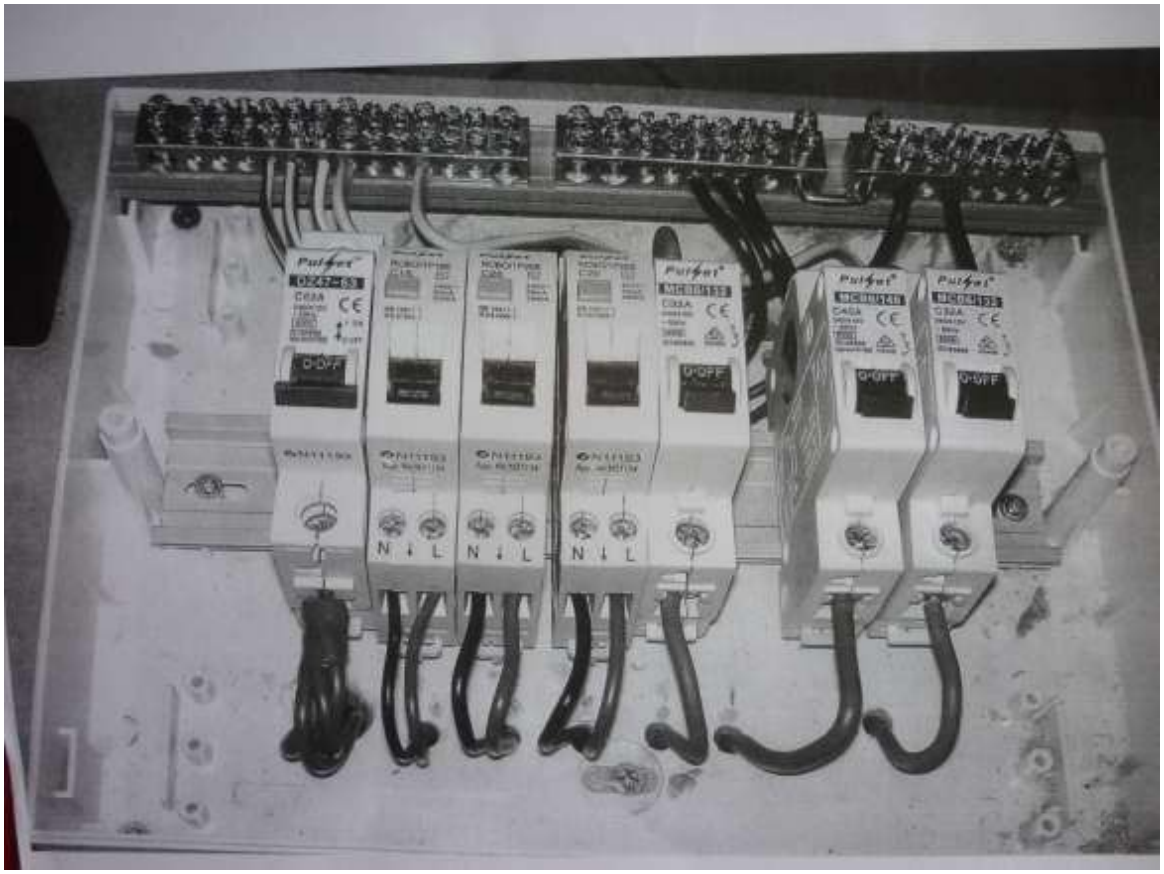
Determine the appropriate equipments to do the following tasks

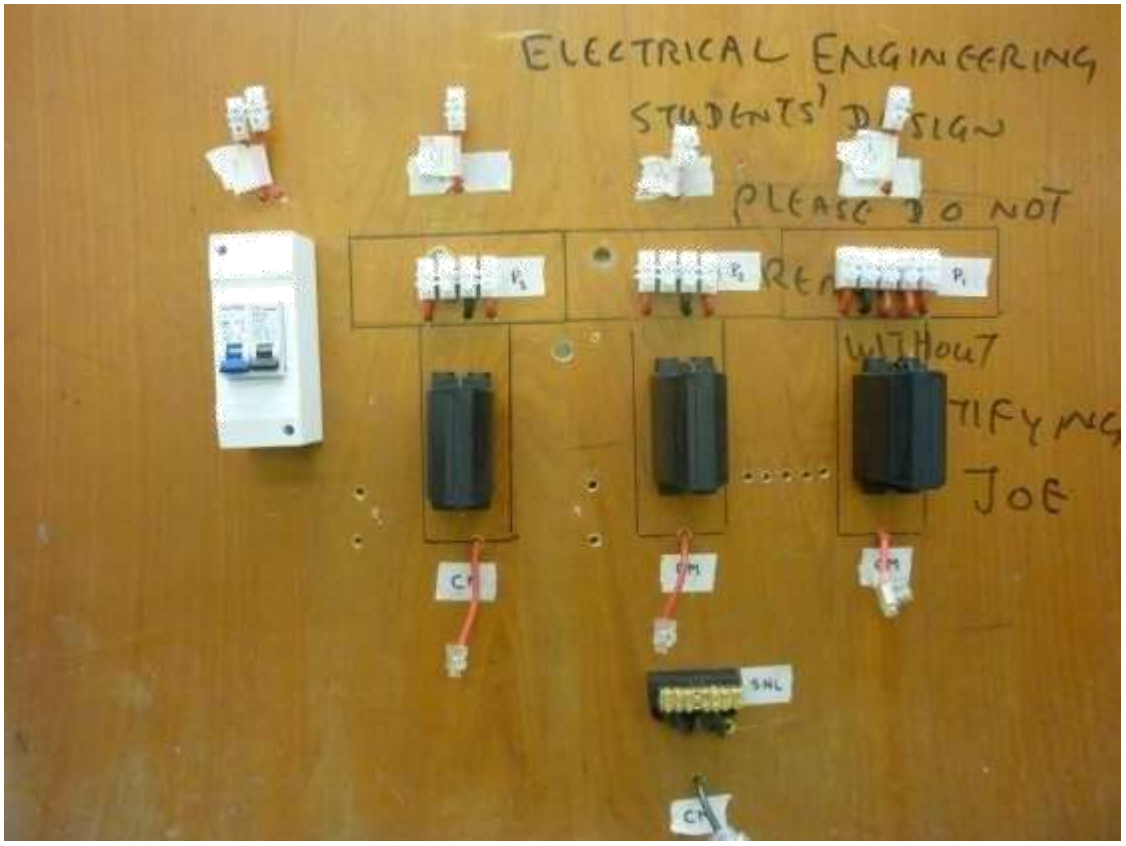
Practical 1 to 5- Students' performances in the practicals are assessed.






STUDENTS DESIGN
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(IN H2-11)
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Theory knowledge

1.2 Safety and other regulatory requirements to which the electrical installation shall comply are identified, obtained and understood.

Q1 Interpret the following symbols (4 marks)









Answer+Marking Guide—Each 1 mark

Eye Safety Glass must be worn

Biochemmical Hazard warning

Electrical Hazard

Head Protection must be worn

Practical Action

Questions

Q2 Who can hold a WHS entry permit?

Q3 Who can hold a Fair Work entry permit?

Q4 Who is Fit & proper person?

ANSWER & MARKING GUIDE Each 2 marks

Who can hold a WHS entry permit

Under the *Work Health and Safety Act 2011* (the WHS Act) a permit holder must be:

an elected officer of the union, or
an employee of the union,

And must:

have satisfactorily completed prescribed training, and
hold an entry permit under the *Fair Work Act 2009* (the Act).

Who can hold a Fair Work entry permit

Under the Act a permit holder must be:

an elected officer of the union, or
an employee of the union, and
a fit and proper person to hold a Fair Work entry permit, as determined by the Fair Work Commission.

Fit & proper person

The Delegate of the Commission must be satisfied that the proposed permit holder is a 'fit and proper person' before a Fair Work entry permit can be issued. Section 513 of the Act details criteria for assessing whether a proposed permit holder is a 'fit and proper person' to hold a permit.

Practical Action 2 marks

Questions

Q5. You are a project manager of the worksite, provide your instruction to your workers to fill the attached ESH Thresold Review form.

Questions

Q5. If you want to lift a heavy item, what steps will you follow? (2 marks)

Answer

Do not bend the back.

Bend the kneel.

Hold the item with two hands.

Place the body upright.

Lift them by using kneel force

Q6. What are the risk assessment process in disconnecting & re-connecting of electrical equipments? (2 marks)

Answer+Marking Guide

Risk assessments must be based on relevant factors including:
Operating and storage environment;
Usage (particularly the movement of the equipment and flexing of the supply cord);
Equipment / characteristics (function, make and model);
Experience with the equipment;
Age of the equipment;
Electrical safety knowledge of typical users; and
Previous inspection and testing results.

Q7. Write down the procedure to connect an electric motor to power supply.

Answer+Marking Guide

Check motor rating, voltage and current by looking at the nameplate
Check the type of motor whether AC or DC
Measure supply voltage by meter.
Test motor insulation resistance by megger
Check any damage on body.
Check the terminal / plug
Use insulation glove to handle the motor.
Join the supply.
Observe noise and vibration of the motor

1.3 Load requirements for individual current-using

equipment is determined from job specifications
or from consultation with appropriate persons.

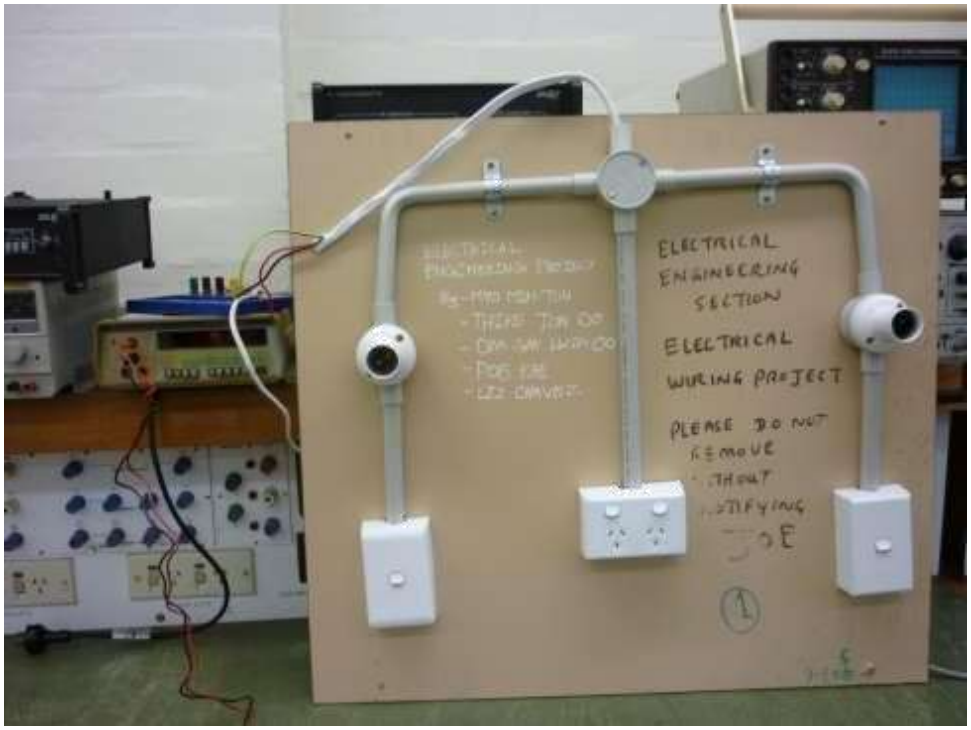
The students are asked to do Maximum demand calculation of K2.11 & record the ratings of equipments Practical activity 6

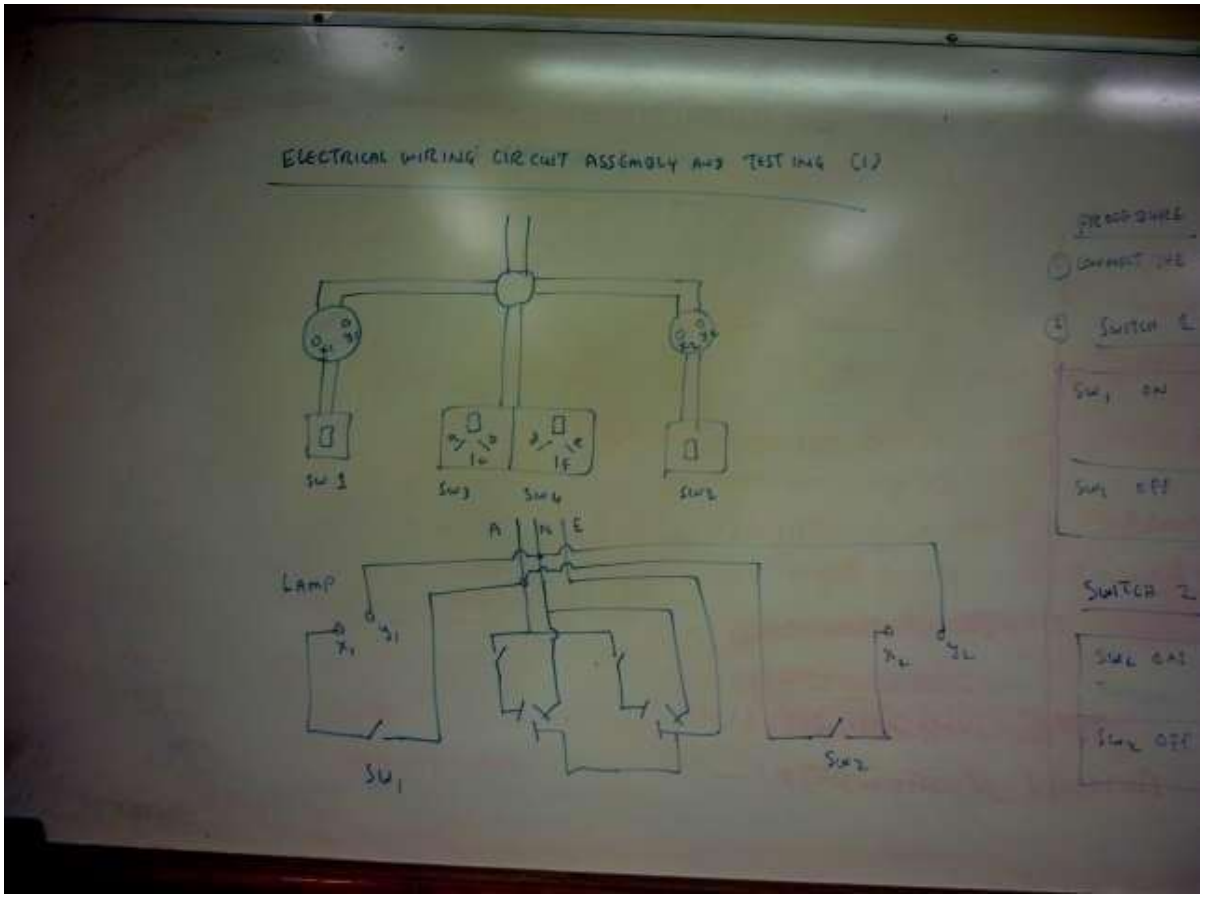
Students' performance is assessed

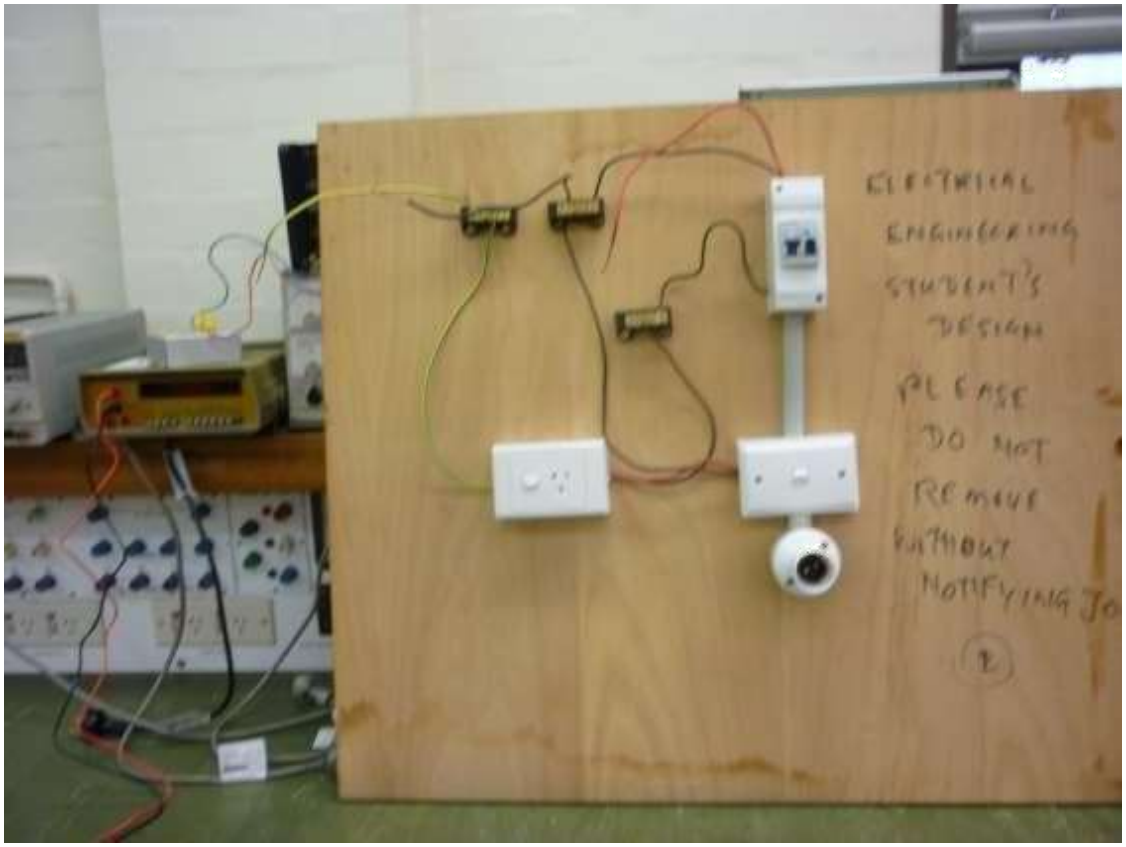
Arrange electrical installations circuits, control and protection

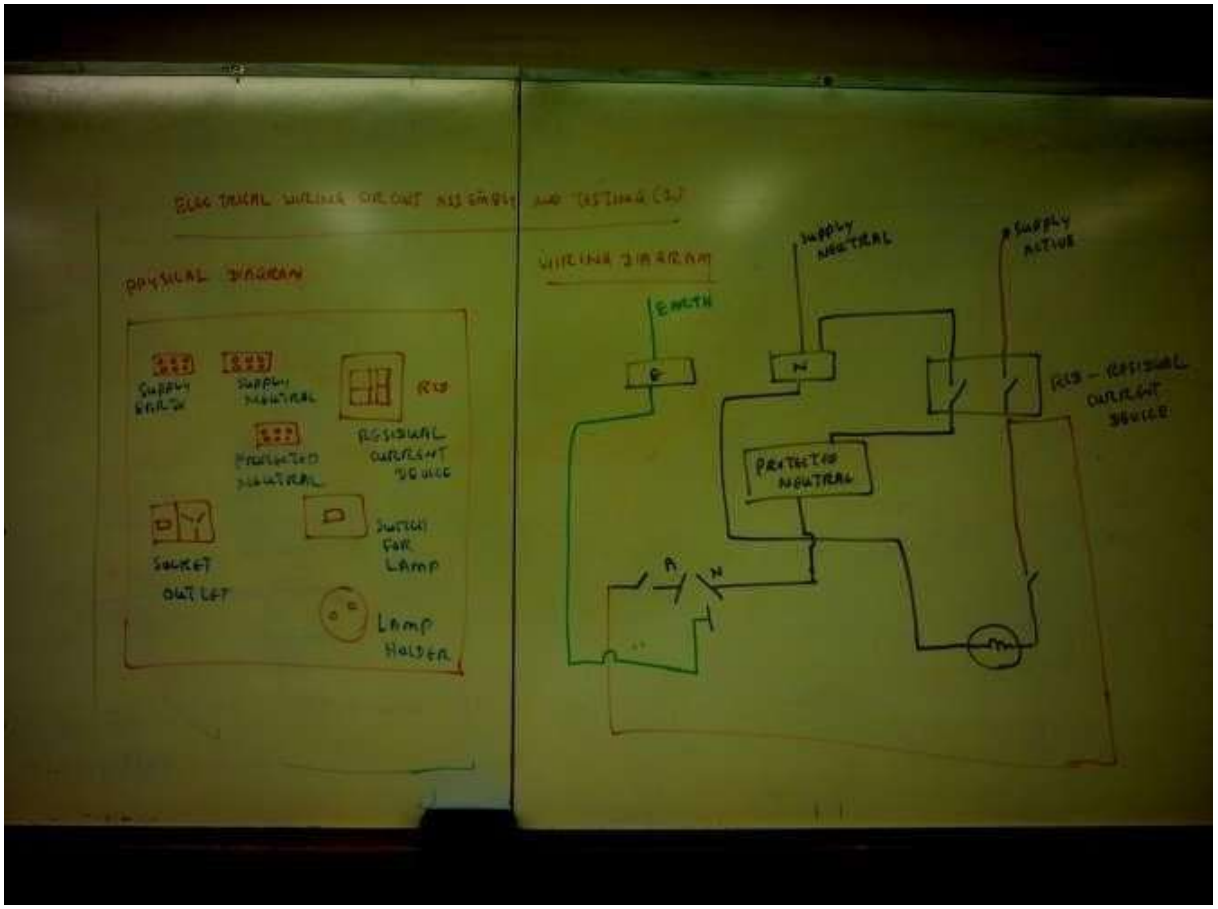
2.1 Circuits, control and protective devices are arranged to ensure safe and functional operation of the installation and to comply with technical standards and job specifications and requirements.
2.3 Earthing is arranged and terminated to comply with the MEN system requirements.
2.4 Protective devices are selected to meet the required switching and tripping currents, co-ordination and discrimination for overload and short-circuit protection.
2.5 Residual current devices are selected to meet the required circuit, switching and tripping currents required.
2.6 Switchgear/control gear is selected to meet current, voltage and IP ratings and functional requirements.
Installation of the following circuit control equipments are to be assembled by the students & their performances are assessed. Practical 7 to 10


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SECTION
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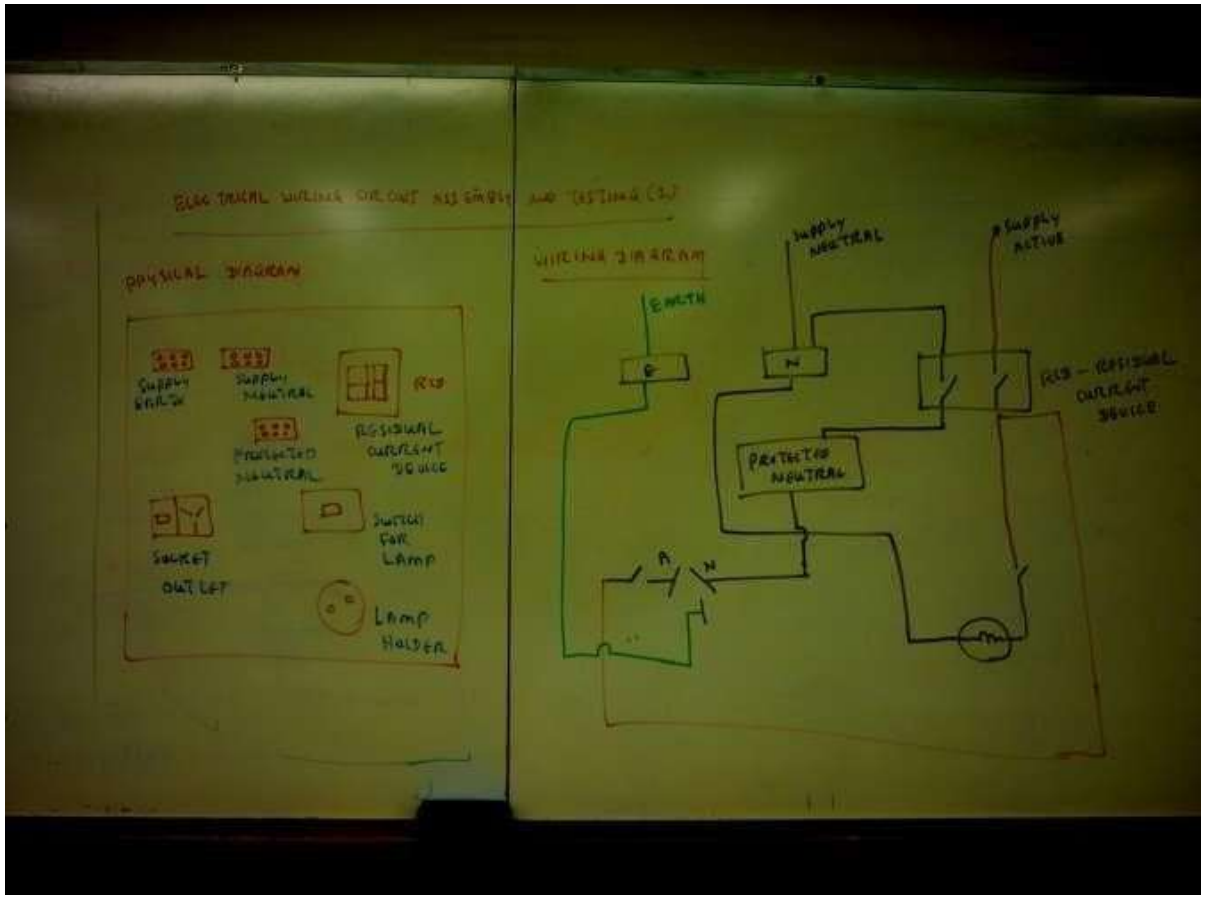

ELECTRICAL WIRING CIRCUIT ASSEMBLY AND TESTING (1)
SW 1
SW3
SW4
SW2
A
B
E
LAMP
SW1
SW2

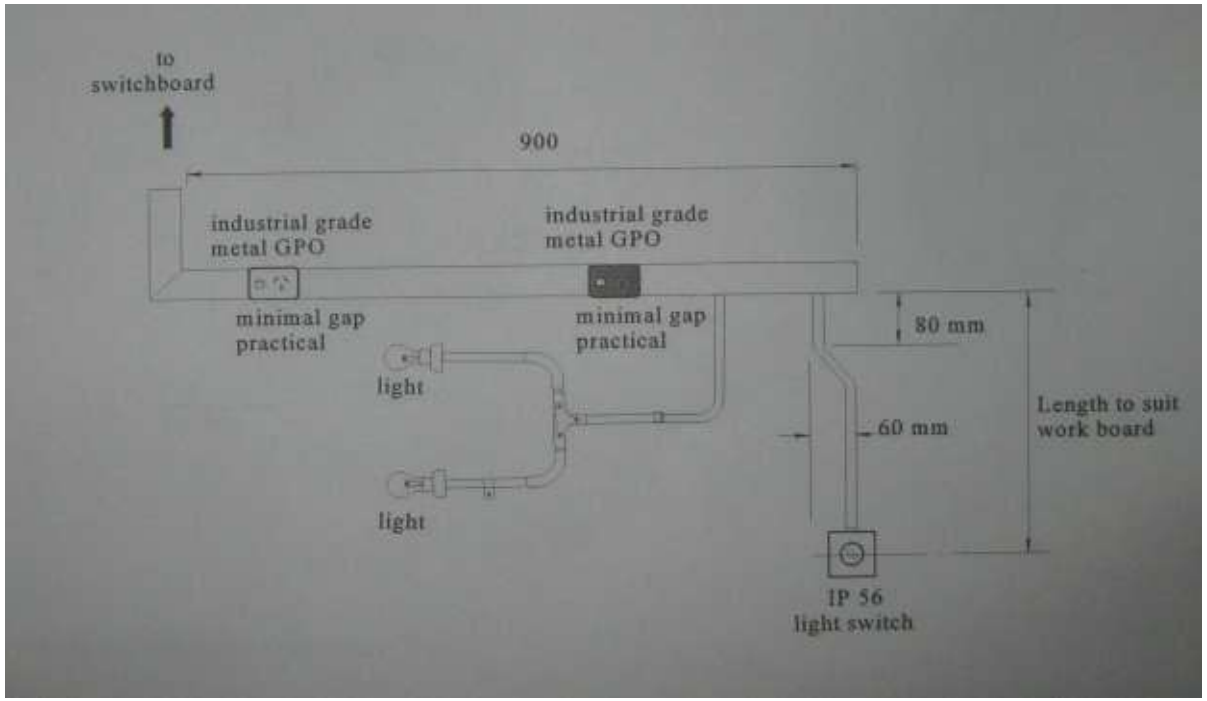

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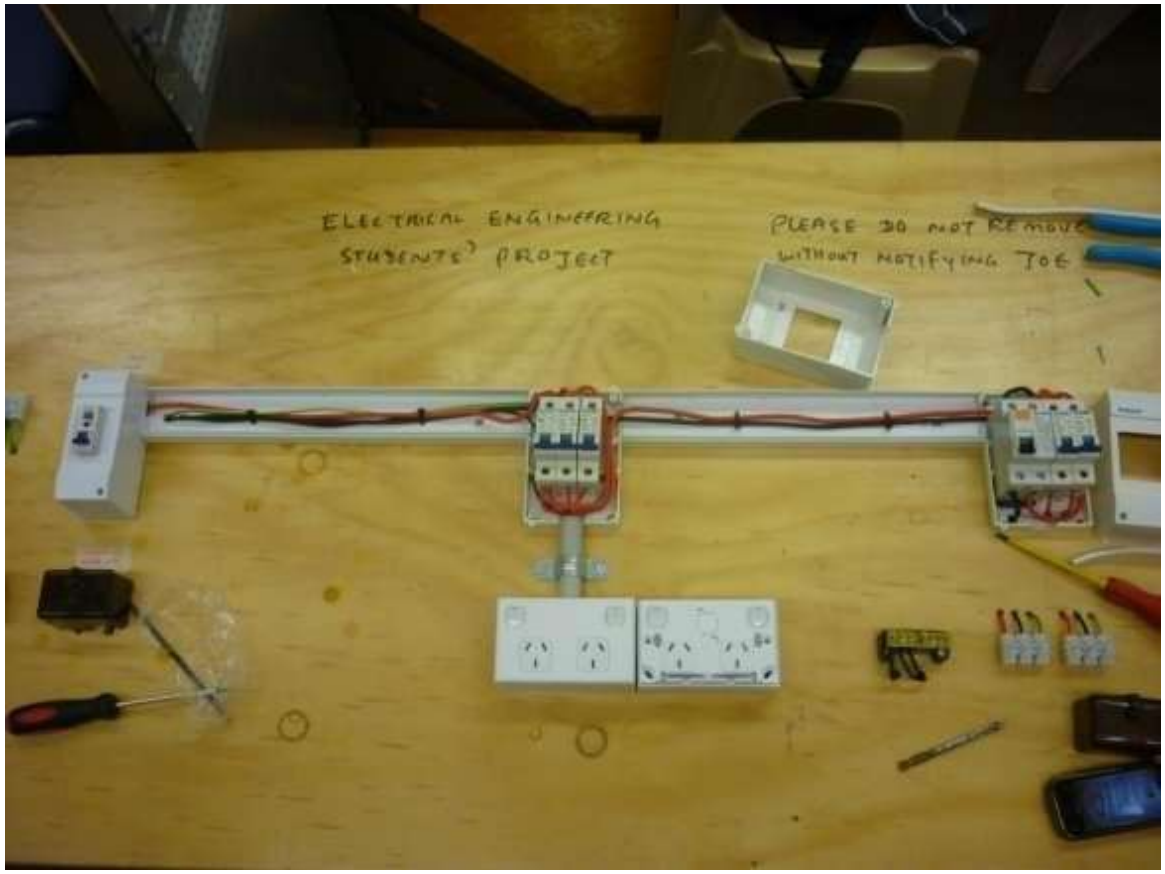


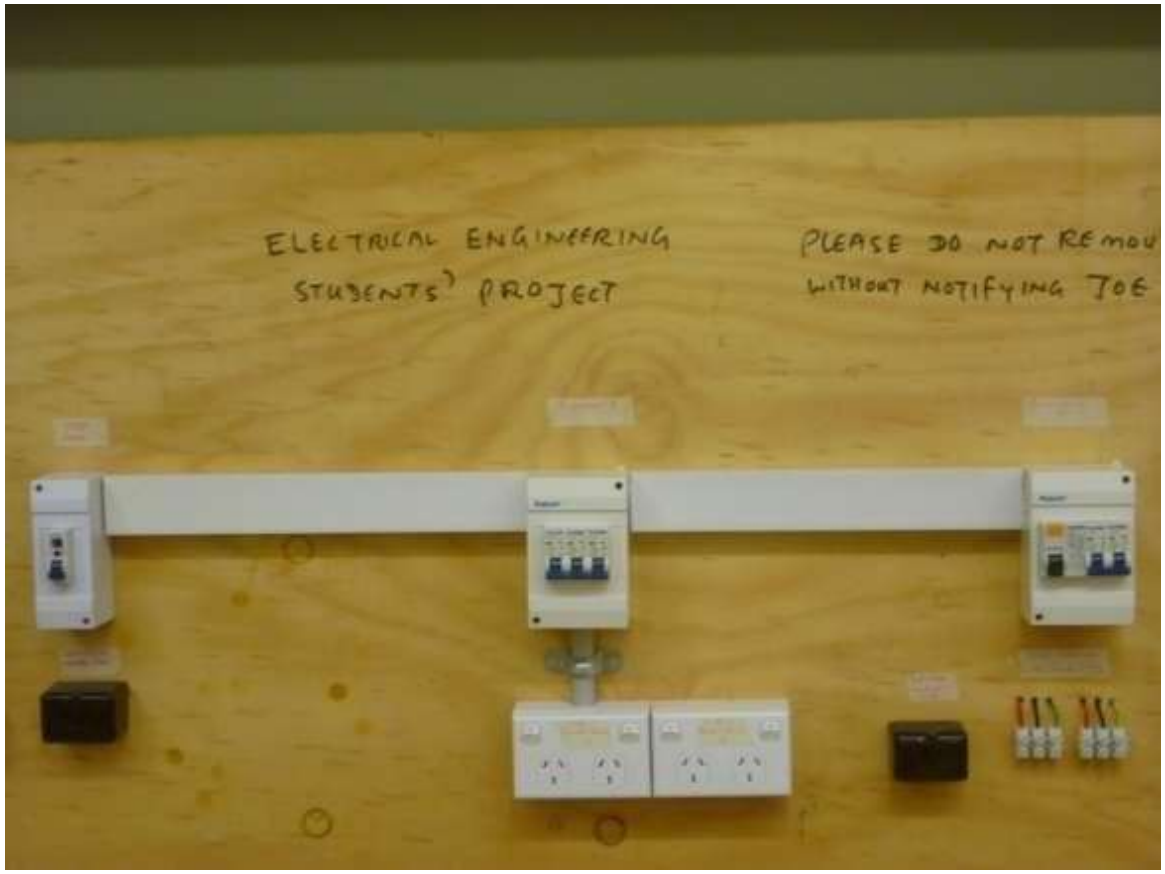
2.7 Switchboards are arranged to accommodate control and protective devices, links, safety services, and other distributor equipment in accordance with requirements.Perform the following circuit testing & students' practical performance is assessed.

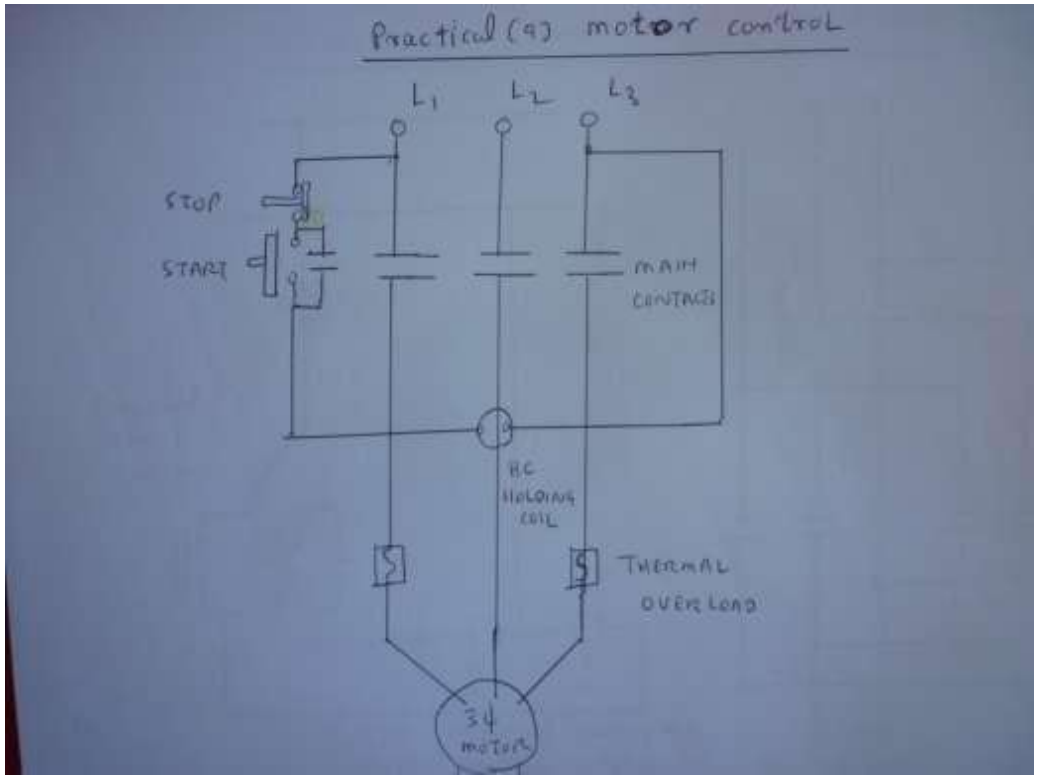
Practical 11 to 15


ELECTRICAL WIRING CIRCUIT ASSEMBLY AND TESTING (2)
PHYSICAL DIAGRAM
SUPPLY BRANCH
SUPPLY NEUTRAL
RCD
RESIDUAL CURRENT DEVICE
PROTECTED NEUTRAL
SOCKET OUTLET
SWITCH FOR LAMP
LAMP HOLDER
WIRING DIAGRAM
EARTH
SUPPLY NEUTRAL
SUPPLY ACTIVE
E
N
RCD - RESIDUAL CURRENT DEVICE
PROTECTED NEUTRAL
A
N

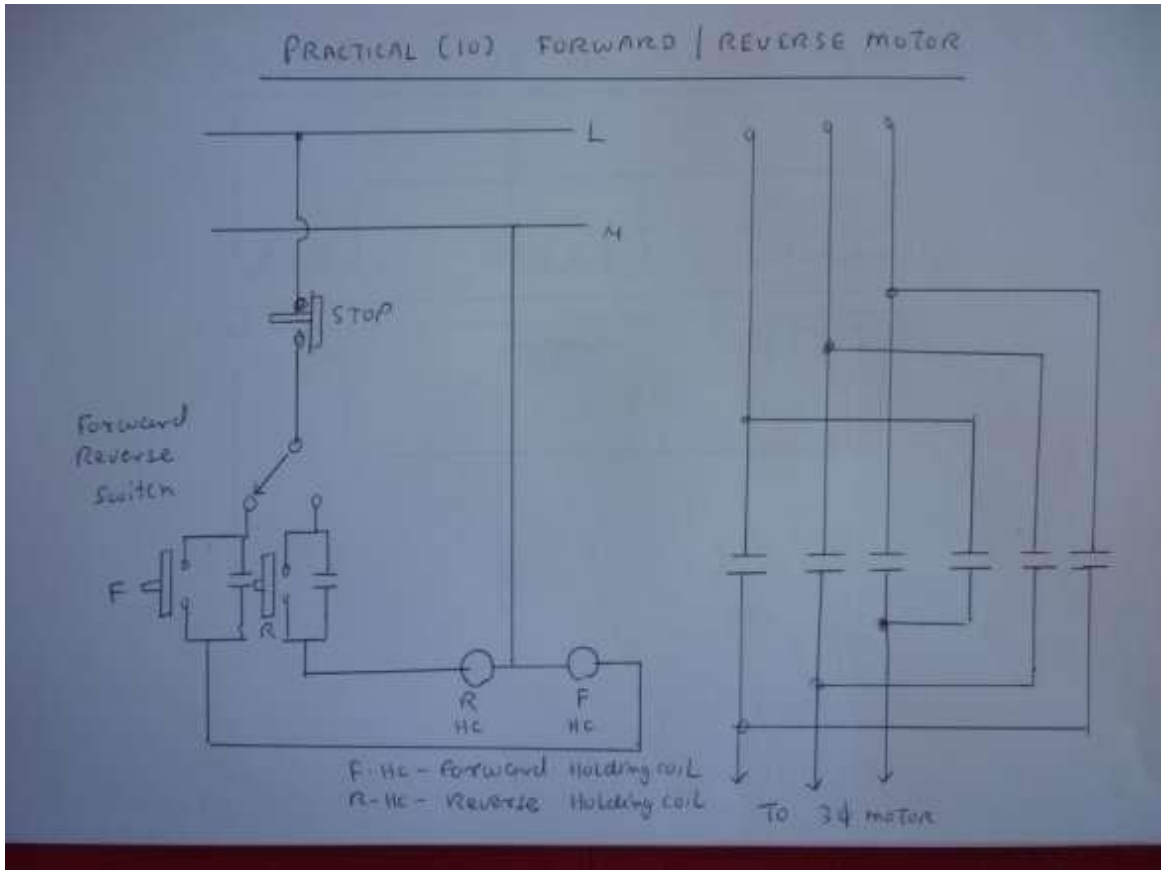

to
switchboard
900
industrial grade
metal GPO
industrial grade
metal GPO
minimal gap
practical
minimal gap
practical
light
light
80 mm
60 mm
Length to suit
work board
IP 56
light switch

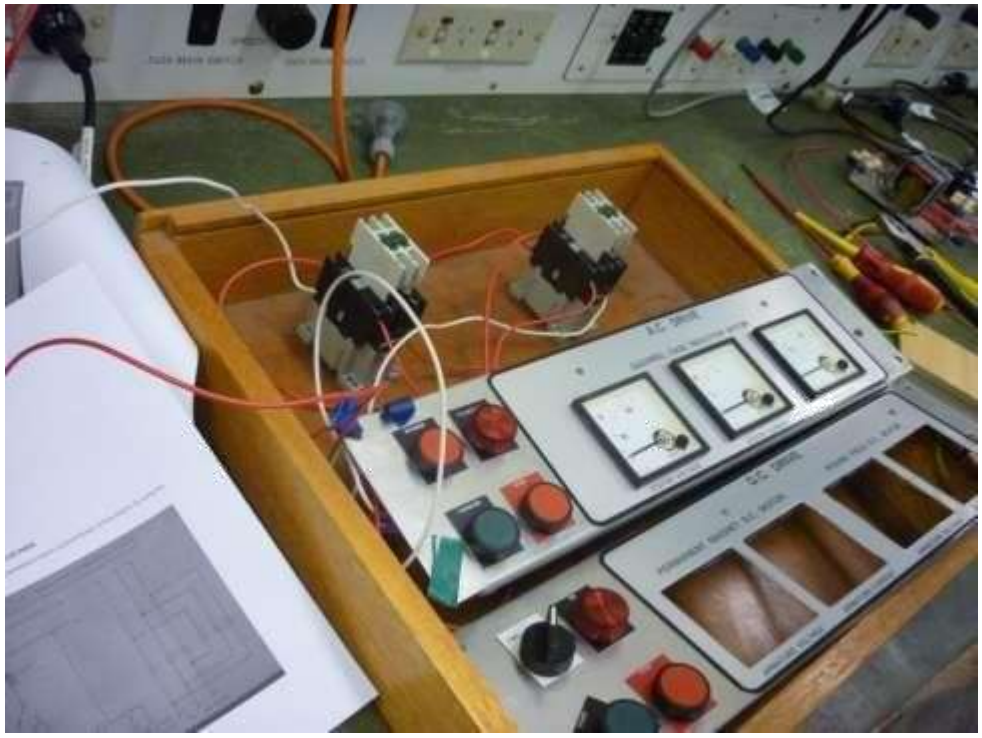

ELECTRICAL ENGINEERING
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Practical (9) motor control
L1
L2
L3
STOP
START
MAIN CONTACTS
HC HOLDING COIL
THERMAL OVER LOAD
3ϕ MOTOR

PRACTICAL (10) FORWARD / REVERSE MOTOR





3 Document electrical installation circuits, control and protection arrangements

3.1 Evidence is obtained from manufacturers/suppliers that electrical equipment selected complies with safety requirements.

Practical 16

The students are instructed to collect the specifications related to usage of equipments from manufacturers.

PRACTICALS

www.electricaldiploma2013.webs.com

Study Option (1)
Guided study (Online)Resources+Online exercises+Online Practicals
Click HERE

Then the students are instructed to download the followings resources to get the specifications

Stage 1 Electrical Workshop Update

Stage 1 Electrical Workshop

Advanced Wiring Download Link

Stage 1 to 3 Practicals

Electrical Machine Practicals

Electrical Wiring Equipment

Estimating & specification preparation practice is assessed.

3.2 Reasons for selections made, including calculations, are documented in accordance with established procedures.

3.3 Electrical installation arrangement and specifications for all selected items are documented in accordance with established procedures and forwarded to appropriateperson(s).

Assessment Test 1-

SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/G033 Assessment Mapping/G033+G063 Question + Marking Guide 1

The students' performance is assessed by test.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/		

Feedback own record		**THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

EKAS	Assessment
KS01-EG063A Electrical installations — arrangement, control and protection Evidence shall show an understanding of circuit arrangements, control and protection of electrical installations that comply with the Wiring Rules and Service Rules to an extent indicated by the following aspects: T1 Safety principles to which electrical systems in building and premises shall comply. ☐ Safety principles are given in Part1 (Section 1) of the Wiring Rules AS/NZS 3000 with deemed-to-comply requirements given in Sections 2 to 8. ☐ Compliant methods for providing protection - include those for providing protection against direct and indirect contact; thermal effects; unwanted voltages; overcurrent; fault currents; overload; overvoltage; injury from mechanical movement. ☐ Requirements for installation design and selection of equipment - includes compliant protection arrangements; correct functioning; compatibility with supply; estimation of maximum demands; voltage drop considerations; arrangement of circuits and the like T2 Circuit and control arrangements encompassing: ☐ reason for dividing electrical installations into circuits ☐ factors that shall be considered in determining the number and type of circuits required for an installation.	Test 1 & Test 2 Online Practical Support www.electricaldiploma2013.webs,com G033+G063+G107 (Week 1 to 6 Lessons)(G033) G063 Wk 7+8 G033 Hot Water System G106 Cable Termination (UG Cable) G106 Cable Termination G106+G033 Practical G033+G063+G107 Week 10 to 15 **Youtube Videos for Electrical Engineering Lessons** **Australian Electrician Training** **AS3000** **AS3000:2016** **AS3008**

daily and seasonal demand for lighting power, heating and other loads in a given installation. number and types of circuits required for a particular installation. diagrams/schedules of circuits for given installations. application and arrangements of SELV and PELV circuits application and arrangement of an isolated supply T3 Hazards and risks in an electrical installation encompassing: effects on the human body of various levels of a.c. and d.c. current and duration of current flow for various current paths. risk of ignition of flammable materials due the thermal effects of current or electric arcs in normal service of an electrical installation. risk of injury from mechanical movement of electrically actuated equipment. Protection against direct contact (basic protection) acceptable methods use of extra-low voltage T4 Protection against indirect contact encompassing: indirect contact with live parts of an electrical installation may occur. methods and devices that comply with the Wiring Rules for providing protection against indirect contact. components of the 'automatic disconnection of supply' method of protection against indirect contact.	**NSW Electrical Services Rule** Electrician Capstone unit **Electrician Capstone Test Old Questions** Electrician Capstone Unit Study Guide.zip Online practical Work performance practical PLUS Online reference resources are provided to the students to acquire the competencies needed in this unit

☐ the terms ‘touch voltage’ and ‘touch current’. ☐ the current path when a short circuit fault to exposed conductive parts of an appliance occurs. ☐ protection against indirect contact is by the use of Class II equipment and by electrical separation. ☐ additional protection by use of Residual Current Devices (RCDs) ☐ protection against indirect contact by use of extra-low voltage and electrical separation. ☐ Protection requirements for damp situations. T5 Earthing encompassing: ☐ the terms: earthed, earthed situation, earth electrode, equipotential bonding, multiple earthed neutral (MEN) system, protective earth-neutral (PEN) conductor, main earthing conductor, protective earthing (PE) conductor, functional earthing, MEN link. ☐ selection of minimum size-earthing conductor for a range of active conductor sizes and materials. ☐ parts of an earthing system and the purpose of each. ☐ typical arrangement for a MEN earthing system. ☐ arrangements of protective earthing conductors that comply with the Wiring Rules. ☐ requirements for equipotential bonding in a range of installation situations. ☐ Installation of a MEN earthing system for a single phase installation T6 Protection against overload and short circuit current encompassing:	

overload current or fault currents in an electrical installation. equivalent circuit of an earth fault-loop level of fault current possible at a given point in an installation from the fault-loop impedance and data from the electricity distributor. methods and devices that comply with the Wiring Rules AS/NZS 3000 for providing protection against the damaging effects of overload and fault current requirements for co-ordination between protective devices and conductors requirements for co-ordination of protection devices for discrimination and back-up protection. T7 Devices for automatic disconnection of supply encompassing: operating principles of thermal/magnet circuit breakers. operating principles of common types of fuses. operating principles of residual current devices (RCD). time/current curves tripping characteristics of various types of circuit breakers that comply with the requirements of the Wiring Rules. time/current curves fusing characteristics of various types of fuses that comply with the requirements of the Wiring Rules. time/current curves tripping characteristics of various types of RCDs that comply with the requirements of the Wiring Rules. factors in a fault loop that will affect the impedance of the circuit. maximum impedance of an earth fault-loop to ensure operating of a protection	

device. selecting a fuse for fault current limiting protection. drawing switchboard wiring arrangements of 2-pole RCDs, 4-pole RCDs, combination RCD/MCBs. T8 Protection against over voltage and under voltage encompassing: causes of over voltage and how this may affect the electrical system. methods for protection against over voltage. causes of under voltage and how this may affect the electrical system. methods for protection against under voltage. T9 Control of an electrical installation and circuits encompassing: switch types, current and voltage ratings and IP rating and where these apply. switching requirements for isolation, emergency, mechanical maintenance and functional control. control arrangement for complete installations with and without safety services and an alternative supply. T10 Switchboards / distribution boards encompassing: Purpose, types and applications. Physical and circuit arrangements for whole current and CT metering. Physical and circuit arrangements of main switches, circuit protection devices, fault-current limiters and metering equipment and other distributor equipment. compliance requirements (includes location and access, arc fault protection,	

identification, construction suitability, equipment marking, wiring, fire protection and arc-fault protection).	

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

G033+G063 are concurrently assessed.

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	X
1.2		X	X
1.3	X		
1.4	X		
1.5	X		
1.6	X		
1.7	X		
2.1	X		
2.2	X		
2.3	X		
2.4	X		
2.5	X		
2.6	X		
2.7		X	X
3.1	X		
3.2	X		
3.3			X
3.4			X
EKAS Assessment		X	X

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with UEENEEG033A- Assessment Mapping+Question+Marking Guide+Observation.pdf

Click HERE

Faculty:		**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0008 Evaluate and modify low voltage heating equipment and controls+ UEEEL0009 Evaluate and modify low voltage lighting circuits, equipment and control+ UEEEL0010 Evaluate and modify low voltage socket outlets circuits		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve single and three phase low voltage electrical apparatus/ circuit problem	1.1	1.1 OHS procedures for a given work area are identified, obtained and understood.	Q1 to 5 of UEENEEG033A-Assessment Mapping+Question+ Marking Guide+Observation.pdf (Page 1,2)		
	1.2	1.2 Established OHS risk control measures and procedures in preparation for the work are followed.	Q5 to 7 of UEENEEG033A-Assessment Mapping+Question+ Marking Guide+Observation.pdf (Page 2,3)		
	1.3	1.3 Safety hazards, which have not previously been identified, are noted and established risk control measures are implemented	Q5 to 7 of UEENEEG033A-Assessment Mapping+Question+ Marking Guide+Observation.pdf (Page 2,3)		
	1.4	The nature of the work is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.		**Practical 1** of UEENEEG033A-Assessment Mapping+Question+ Marking Guide+Observation.pdf (Page 4)	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.5	Advice is sought from the work supervisor to ensure the work is coordinated		**Observation Practical 1** of UEENEEG033A-Assessment Mapping+Question+Marking Guide+Observation.pdf (Page 4)	
	1.6	Materials required for the work are obtained in accordance with established routines and procedures.		**Practical 2 to 5** of UEENEEG033A-Assessment Mapping+Question+Marking Guide+Observation.pdf (Page 5 to 8)	
	1.7	Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.		**Practical 6 to 9** of UEENEEG033A-Assessment Mapping+Question+Marking Guide+Observation.pdf (Page 8 to 10)	
2 Solve single and three phase low voltage electrical apparatus/circuit problems.	2.1	OHS risk control measures and procedures for carrying out the work are followed.	As per 1.1 to 1.3		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary			

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		conducted within established safety procedures.			
	2.3	Apparatus/circuits/plant is checked as being isolated where necessary in strict accordance OHS requirements and procedures.		**Practical 10** UEENEEG033A-Assessment Mapping+Question+ Marking Guide+Observation.pdf (Page10)	
	2.4	Established methods are used to solve apparatus/circuit problems from measure and calculated values as they apply to single and three-phase low voltage apparatus/circuit.	Test 1 G033+G063 Question + Marking Guide 1+2 Part (A) Q 1 to 20 Part (B) Q1 to 10		
	2.5	Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.	As above		
	2.6	Unexpected situations are dealt with safely and with the approval of an authorised person.	As above		
	2.7	Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.	As above		
3 Complete work and document problem solving activities.	3.1	OHS work completion risk control measures and procedures are followed.	Q 8 to 10 of UEENEEG033A-Assessment Mapping+Question+ Marking Guide+Observation.pdf (Page 12,13)		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.2	Work site is cleaned and made safe in accordance with established procedures	As above		
	3.3	Justification for solutions used to solve apparatus/circuit problems is documented.	Test 2 G033+G063 Question + Marking Guide 2 Q 1 to 5		
	3.4	Work completion is documented and an appropriate person or persons notified in accordance with established procedures.	As above		

Add rows to the following table as required

Performance Evidence	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
Following OHS Procedures/ OHS Sign Interpretation/ Risk Assessment & Control/ OHS Report	Q1 to 7 of UEENEEG033A-Assessment Mapping+Question+ Marking Guide+Observation.pdf (Page 1,2)		
Lighting & Power Point Wiring		Practical 1	
Switch board & Main supply installation		Practical 2 to 5	
Circuit Safety Testing- Polarity/ Continuity/ Transposition		Practical 6 to 9	
Life testing		Practical 10	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Lighting circuits	Test 1 Part B -Q1		
T2 Circuits for socket outlets	Test 1 Part B -Q2		
T3 Final sub-circuits and segregation	Test 1 Part B-Q4		
T4 Electrical heating control devices+ T5 Fixed electrical heating appliances+ T6 Electrical water heater operation	Test 1 Part B-Q9		
T7 Alternative supplies+ T8 Installation of batteries+ T9 Fire protection+ T10 Emergency and evacuation lighting	Test 1 Part B-Q6/7		
T11 Lighting concepts+ T12 Fluorescent low intensity+ T13 High intensity discharge lighting	Test 1 Part B -Q3		
Understanding of Electrical Wiring Technical Terms+ Respective AS3000 Rules	Test 1 Part A- Q 1 to 20		

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	Test 1 + 2	Practical 1 to 10	

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEG033A Solve problems in single and three phase low voltage electrical apparatus and circuits

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

The following assessments questions are arranged in Test 1 & 2

Prepare to solve single and three phase low voltage electrical apparatus/ circuit problem

1.1 OHS procedures for a given work area are identified, obtained and understood.

Theory knowledge

Q1 Interpret the following symbols (4 marks)









Answer+Marking Guide—Each 1 mark

Eye Safety Glass must be worn

Biochemmical Hazard warning

Electrical Hazard

Head Protection must be worn

Practical Action

Questions

Q2 Who can hold a WHS entry permit?

Q3 Who can hold a Fair Work entry permit?

Q4 Who is Fit & proper person?

ANSWER & MARKING GUIDE Each 2 marks

Who can hold a WHS entry permit

Under the *Work Health and Safety Act 2011* (the WHS Act) a permit holder must be:

an elected officer of the union, or
an employee of the union,

And must:

have satisfactorily completed prescribed training, and
hold an entry permit under the *Fair Work Act 2009* (the Act).

Who can hold a Fair Work entry permit

Under the Act a permit holder must be:

an elected officer of the union, or
an employee of the union, and
a fit and proper person to hold a Fair Work entry permit, as determined by the Fair Work Commission.

Fit & proper person

The Delegate of the Commission must be satisfied that the proposed permit holder is a 'fit and proper person' before a Fair Work entry permit can be issued. Section 513 of the Act details criteria for assessing whether a proposed permit holder is a 'fit and proper person' to hold a permit.

Practical Action 2 marks

Questions

Q5. You are a project manager of the worksite, provide your instruction to your workers to fill the attached ESH Thresold Review form.

1.2 Established OHS risk control measures and procedures
in preparation for the work are followed.

1.3 Safety hazards, which have not previously been identified, are noted and established risk control measures are implemented

Questions

Q5. If you want to lift a heavy item, what steps will you follow? (2 marks)

Answer

Do not bend the back.
Bend the kneel.
Hold the item with two hands.
Place the body upright.
Lift them by using kneel force

Q6. What are the risk assessment process in disconnecting & re-connecting of electrical equipments? (2 marks)

Answer+Marking Guide

Risk assessments must be based on relevant factors including:
Operating and storage environment;
Usage (particularly the movement of the equipment and flexing of the supply cord);
Equipment / characteristics (function, make and model);
Experience with the equipment;
Age of the equipment;
Electrical safety knowledge of typical users; and
Previous inspection and testing results.

Q7. Write down the procedure to connect an electric motor to power supply.

Answer+Marking Guide

Check motor rating, voltage and current by looking at the nameplate
Check the type of motor whether AC or DC
Measure supply voltage by meter.
Test motor insulation resistance by megger
Check any damage on body.
Check the terminal / plug
Use insulation glove to handle the motor.
Join the supply.
Observe noise and vibration of the motor

1.4 The nature of the work is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

Organize the tools & equipments to do the following assembly task

Practical 1

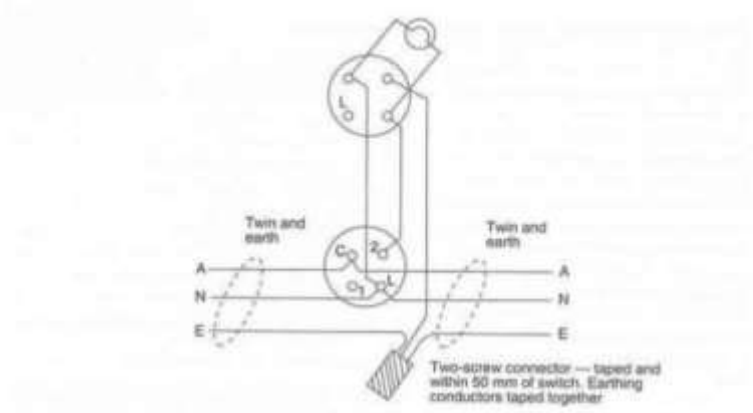
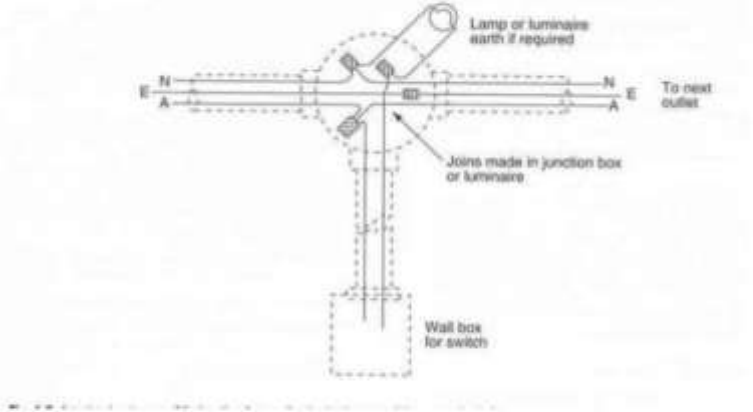


Fig. 6.8 *Looping at switch using twin and earth cable*



Equipments

In addition to above tools & equipments, you need to purchase & bring the following additional equipments & wiring accessories.

Disclaimer: Printed copies of this document are regarded as uncontrolled.

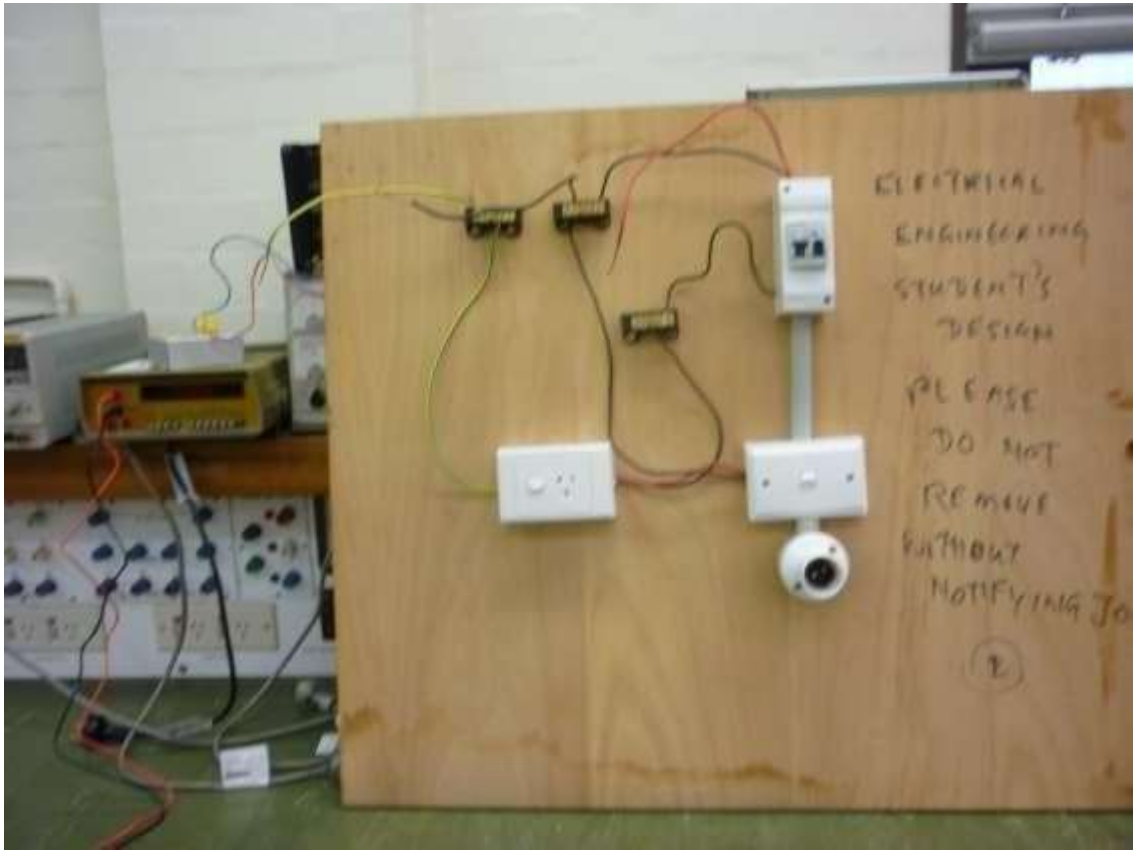
1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.

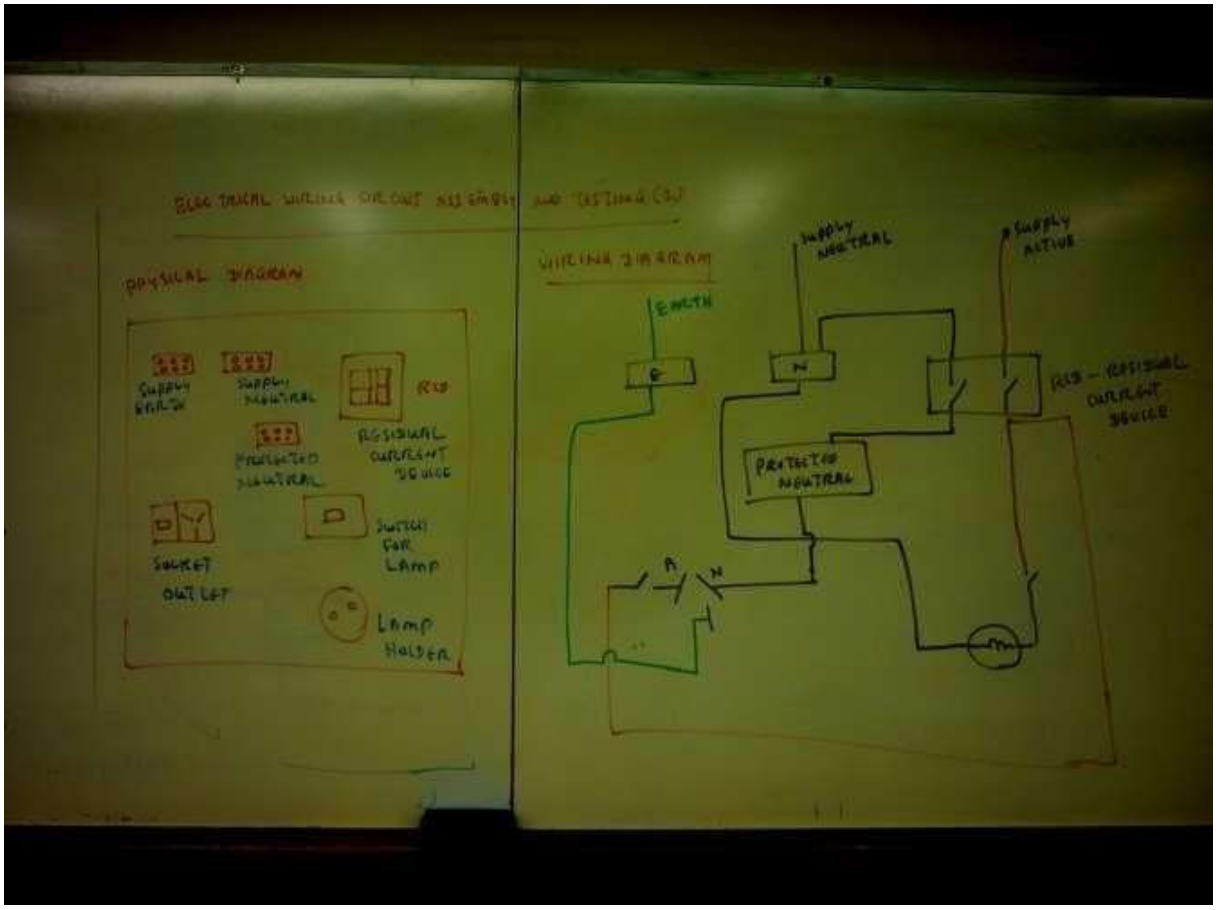
Students co-operation in the practical is evaluated.

1.6	Materials required for the work are obtained in accordance with established routines and procedures.

List the tools & materials to perform the following assembly task.

Practical 2 to 5

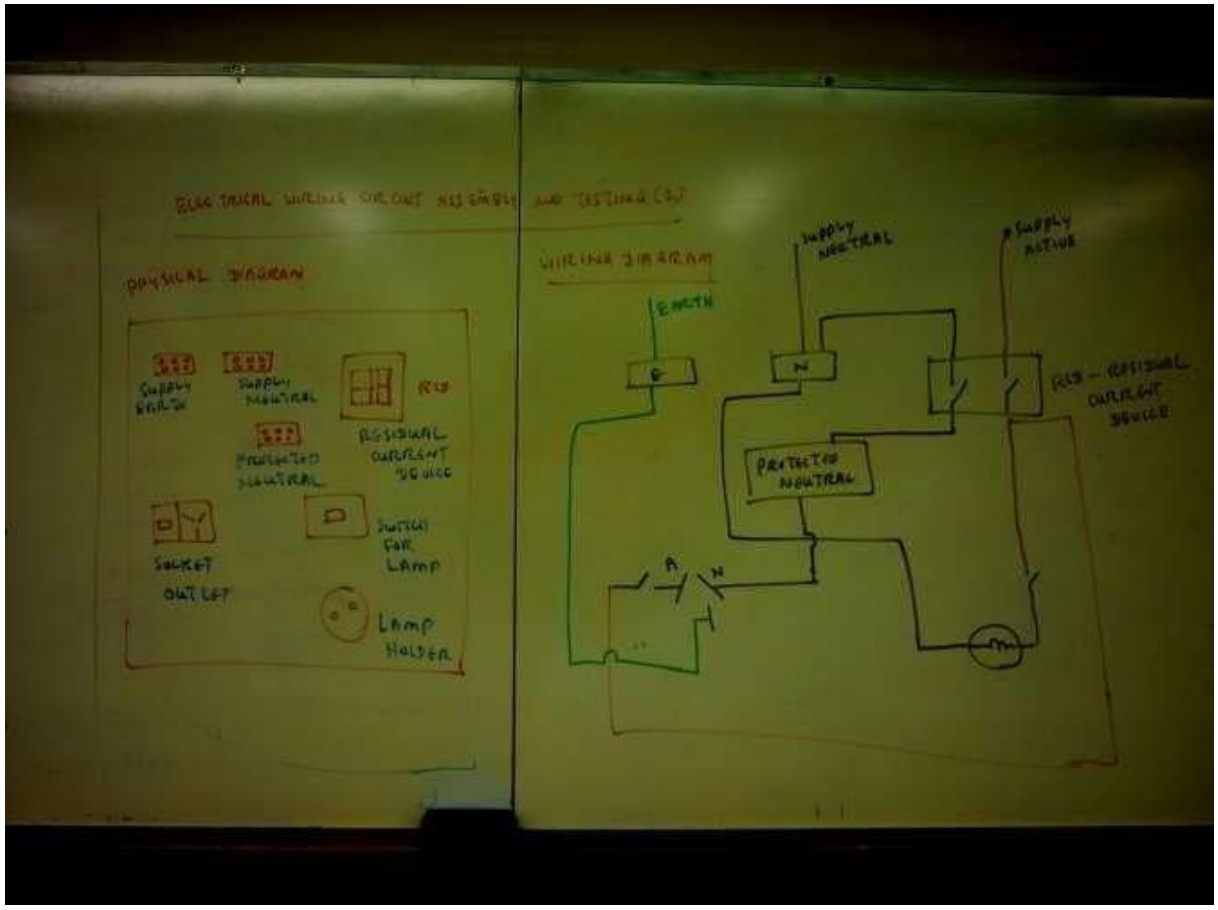

ELECTRICAL
ENGINEERING
STUDENT'S
DESIGN
PLEASE
DO NOT
REMOVE
WITHOUT
NOTIFYING



1.7 Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.

Perform the following circuit testing & students' practical performance is assessed.

Practical 6 to 9



2 Solve single and three phase low voltage electrical apparatus/circuit problems.

2.1 OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

2.3 Apparatus/circuits/plant is checked as being isolated where necessary in strict accordance OHS requirements and procedures.

Practical tasks 10

You are required to energize the wiring circuit that you have already done on the work board given in the picture. Demonstrate the followings

Isolating the supply

Checking the circuit

Checking the machine
Marking the original assembly.
Use of hand tools
Dismantle and keep the components systematically.
Reassembly.
Safety Checking

2.4 Established methods are used to solve apparatus/circuit problems from measure and calculated values as they apply to single and three-phase low voltage apparatus/circuit.
2.5 Established methods for dealing with unexpected
situations are discussed with appropriate person or persons and documented.
2.6 Unexpected situations are dealt with safely and with the approval of an authorised person.
2.7 Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.
Assessment Test 1-
SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/G033 Assessment Mapping/G033+G063 Question + Marking Guide 1
The students' performance is assessed by test.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		**ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students'	Summative	

work in own record	Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

3 Complete work and document problem solving activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is cleaned and made safe in accordance with established procedures

Q8. If you are working in patrol station, what safe method to be followed to avoid the risk of explosion & fire?

(1)Prevent the risk

No bare conductor.

No battery charger

No discharge light

Follow the hazard principles in AS3000:2007

Isolate the risk

Remove all ignitionable substances from the petrol storage

Remove all power points that can start the ignition

Reduce the risk

Allocate CO2 fire extinguisher

Q9 What are notificable incidents? (2 marks)

Answer+Marking Guide

Notifiable incidents are:

the death of a person

a ‘serious injury or illness’, or

a dangerous incident arising out of work carried out by a business, undertaking or a workplace.

Notifiable incidents relate to any person—whether an employee, contractor or member of the public.

If a notifiable incident occurs the model WHS Act sets out that:

immediate notification of a ‘notifiable incident’ to the regulator, after becoming aware of it

if the regulator asks—written notification with 48 hours of the request, and

preservation of the incident site until an inspector arrives or directs otherwise.

Q10. In NSW, how will you report the workplace accident? (2 marks)

Answer+Marking Guide

Call the following number

New South Wales	WorkCover NSW	13 10 50	Website not applicable for notifications

Location of Evidences (Table 1)

3.3 Justification for solutions used to solve apparatus/circuit problems is documented.

3.4 Work completion is documented and an appropriate person or persons notified in accordance with established procedures.

Assessment Test 2-

SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/G033 Assessment Mapping/G033+G063 Question + Marking Guide 2

The students’ performance is assessed by test.

EKAS	Assessment
KS01-EG033A Electrical apparatus and circuits Evidence shall show an understanding of electrical apparatus and circuits to an extent indicated by the following aspects: T1 Lighting circuits – looping at the light/switch encompassing: the “loop at the light” method of wiring lighting circuits. the “loop at the switch” method of wiring lighting circuits wiring diagrams for the lighting circuit of an installation that incorporates one-way, two-way and two-way and intermediate switching of light points using the loop at the light/switch methods of TPS wiring. TPS cabling requirement for the loop at the light/switch circuit. installation methods of accessories and wiring for a lighting circuit incorporating one-way, two-way and two-way and intermediate switching of lighting points using the loop at the light/switch method of TPS wiring. correct operation of the install circuits including testing for correct compliance with Australian Standards. T2 Circuits for socket outlets encompassing: the purpose of socket outlets. requirements concerning the polarity of switched socket outlets. correct cable size to supply 10 A, 15 A and 20 A socket outlets (single and three phase), for given installation conditions.	Test 1 & Test 2 Online Practical Support G033+G063+G107 (Week 1 to 6 Lessons)(G033) G063 Wk 7+8 G033 Hot Water System G106 Cable Termination (UG Cable) G106 Cable Termination G106+G033 Practical G033+G063+G107 Week 10 to 15 **Youtube Videos for Electrical Engineering Lessons** **Australian Electrician Training** **AS3000** **AS3000:2016**

number of socket outlets connected to a 16 A and 20 A circuit breaker. installation methods of a single phase socket outlet circuits. correct operation of the installed circuits including testing (dead testing only) for correct compliance with Australian Standards. T3 Final sub-circuits and segregation encompassing: purpose of mixed circuits. circuit loading for a mixed circuit. purpose of segregation of circuits and the AS/NZS3000 requirements. Installation methods a single phase mixed circuits. correct operation of the installed circuits including testing for correct compliance with Australian Standards. T4 Electrical heating control devices encompassing: methods of manual heat control. methods of automatic heat control. types and application for common thermostats. operation of common thermostats. sensitivity and differential of thermostats. testing of a thermostat (including differential and correct operation) applications of simmerstats (infinite controls). operation of a simmerstat. electronic heat control (phase control and zero voltage switching). T5 Fixed electrical heating appliances encompassing: Terms: heat energy, temperature, specific heat capacity, thermal conductivity and	**AS3008** **NSW Electrical Services Rule** Electrician Capstone unit **Electrician Capstone Test Old Questions** Electrician Capstone Unit Study Guide.zip Online practical Work performance practical PLUS Online reference resources are provided to the students to acquire the competencies needed in this unit

thermal stability. determining the heat energy in joules and kWh in a simple heating process. methods of heat transfer. Determining the heat energy input and output of a heating process. connections to a two phase stove. operation of reverse cycle air conditioning. T6 Electrical water heater operation encompassing: types of water heaters (instantaneous and storage) and their methods of control. intrinsic safety (pressure relief and thermal cut-out). testing of over temperature cut-out point of a thermostat. switchboard requirements to supply a controlled load water heater. internal circuit of a twin element water heater, and supply connections. tariffs employed by local supply authorities. solar heating system and its integration into an installation. T7 Alternative supplies encompassing: reasons for the installation of alternative supplies. types of alternative supply systems. characteristics and operation of UPSs. Australian Standards and local requirements for safety services supply systems. T8 Installation of batteries encompassing: common types of primary cells and secondary batteries and typical applications. terminal voltage of common primary cells and secondary cells. correct storage, handling and disposal techniques	

for cells and batteries. charge/discharge cycle for a secondary cell. effect of internal resistance on a secondary cell. state of charge of a secondary cell. installation of batteries as per AS/NZS3011 commissioning procedures for various secondary batteries. safe working procedures when working with secondary cells and batteries. T9 Fire protection – residential fire and smoke alarms encompassing: types of fire and smoke alarms. regulations and standards requirements regarding residential fire and smoke alarms. locations for residential fire and smoke alarms. wiring methods for residential fire and smoke alarms. operation of typical residential fire and smoke alarms T10 Emergency and evacuation lighting and lighting control encompassing: factors and requirements of emergency and evacuation lighting concerning illumination levels, luminaire positioning and operating period. characteristics of maintained, non maintained and sustained emergency lighting systems. arrangement of batteries in point and central bank emergency lighting supply systems. lighting control methods T11 Lighting concepts and incandescent lighting encompassing:	

basic concepts of lighting. terminology, principles and standards relevant to lighting (energy efficiency as per BCA new lamp types and permitted replacements and their efficacy).. basic types of luminaries. operation of an incandescent lamp. types of incandescent lamps. expected lamp life, colour rendering and efficacy for typical incandescent lamps. lighting layout in terms of visual comfort and relevant Australian standards T12 Fluorescent low intensity discharge lighting encompassing: types of low intensity discharge lamps. expected lamp life, colour rendering and efficacy for typical types of low intensity discharge lamps. operation of low intensity discharge luminaires including their control equipment. Australian Standard and local requirements for low intensity discharge lighting. methods for satisfying Australian Standards and local supply authority requirements regarding low intensity discharge lighting. T13 High intensity discharge lighting encompassing: types of high intensity discharge lamps. expected lamp life, colour rendering and efficacy for typical types of high intensity discharge lamps. operation of high intensity discharge luminaires including their control equipment. Australian Standard and local requirements for high intensity discharge lighting.	

methods for satisfying Australian Standards and local supply authority requirements regarding high intensity discharge lighting. LED lighting and its applications. Neon, Argon and Xenon lighting and their applications. comparison of incandescent, low intensity discharge, high intensity discharge, LED and other types of lighting	

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

G033+G063 are concurrently assessed.

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1	X		
1.2		X	X
1.3			X
2.1	X		
2.2	X		
2.3	X		
2.4	X		
2.5	X		
2.6	X		
2.7	X		
3.1	X		
3.2	X		
3.3			X
EKAS Assessment		X	X

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with UEENEEG107A- Assessment Mapping+Question+Marking Guide+Observation.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0018 Select wiring systems and select cables for low voltage electrical installations		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to select wiring systems and cables for general electrical installation	1.1	The extent and nature of the electrical installation is determined from job specifications.		Practical 1 to 5 of UEENEEG107A-Assessment Mapping+Question+ Marking Guide+ Observation.pdf Page 1 to 5	
	1.2	Safety and other regulatory requirements to which the electrical installation shall comply area are identified, obtained and understood	Q 1 to 7 of UEENEEG107A-Assessment Mapping+Question+ Marking Guide+ Observation.pdf Page 6 to 7		
	1.3	Cable routes, the route lengths of cables and the conditions in which the wiring system is to operate is determined from job specifications or from consultation with appropriate persons		Practical 1 to 5 of UEENEEG107A-Assessment Mapping+Question+ Marking Guide+ Observation.pdf Page 1 to 5	
2 Select wiring systems and cables for general electrical installation	2.1	Wiring systems are selected for suitability for the environments in which they are to operate		Practical 7 to 10 of UEENEEG107A-Assessment Mapping+Question+ Marking Guide+ Observation.pdf Page 9 to 13	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	2.2	Cable conductor sizes are selected to meet current-carrying capacity requirements and voltage-drop and earth fault-loop impedance limitations.		**As above**	
	2.3	Circuit protective devices are selected to meet requirement for co-ordination with conductor current-carrying capacity.		**As above**	
	2.4	Earthing system components are selected to meet requirements of an MEN system		**As above**	
	2.5	Evidence is obtained that electrical equipment selected complies with safety requirements.		**As above**	
3 Document electrical installation circuits, control and protection arrangements	3.1	Evidence is obtained from manufacturers/suppliers that electrical equipment selected complies with safety requirements.		Practical 16 of UEENEEG107A-Assessment Mapping+Question+ Marking Guide+ Observation.pdf Page 13	
	3.2	Reasons for selections made, including calculations, are documented in accordance with established procedures.	Test 1 Q1 to 5		
	3.3	Electrical installation arrangement and specifications for all selected items are documented in accordance with established procedures and forwarded to appropriateperson(s).	Test 2 Q1 to 15		

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Main, Sub-main & Distribution Board Wiring		Practical 1 to 5	
OHS Practice	Q 1 to 7 of UEENEEG107A-Assessment Mapping+Question + Marking Guide+ Observation.pdf Page 6 to 7		
Wiring system, Cable selection, Circuit protective devices, Earthing system	Test 1 Q1 to 5 Test 2 Q1 to 15	Practical 7 to 10 of UEENEEG107A-Assessment Mapping+Question + Marking Guide+ Observation.pdf Page 9 to 13	
Specifications related to usage of equipments		Practical 16 of UEENEEG107A-Assessment Mapping+Question + Marking Guide+ Observation.pdf Page 9 to 13	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Performance requirements - design and safety	Q 1 to 7 of UEENEEG107A-Assessment Mapping+Question + Marking Guide+ Observation.pdf Page 6 to 7		
T2 Final subcircuit arrangements		Practical 1 to 5 of UEENEEG107A-Assessment Mapping+Question + Marking Guide+ Observation.pdf Page 1 to 5	
T3 Factors affecting the suitability of wiring systems	Test 1 Q1 to 5 Test 2 Q1 to 15	Practical 7 to 10 of UEENEEG107A-Assessment Mapping+Question + Marking Guide+ Observation.pdf Page 9 to 13	
T4 Maximum demand on consumer's mains/submains	Test 1 Q1,2		
T5 Cable selection based on current carrying capacity T6 Cable selection based on voltage drop requirements T7 Cable selection based on fault loop impedance	Test 1 Q4 Test 2 Q2,3,10,15		
T8 Selecting protection devices	Test 2 Q6,14		
T9 Selecting devices for isolation and switching	Test 2 Q1,6,7,8,9		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T10 Switchboards	Test 2 Q6	Practical 7 to 10 of UEENEEG107A-Assessment Mapping+Question + Marking Guide+ Observation.pdf Page 9 to 13	

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	Test 1 + 2	Practical 1 to 16	

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEG107A Select wiring systems and cables for low voltage general electrical installations

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

The following assessments questions are arranged in Test 1 & 2

1 Prepare to select wiring systems and cables for general electrical installation

.

1.1 The extent and nature of the electrical installation is determined from job specifications.

1.3 Cable routes, the route lengths of cables and the conditions in which the wiring system is to operate is determined from job specifications or from consultation with appropriate persons.

For 1.3, cable route length in the following installations are to be determined & installation conditions such as installation in air-unenclosed/ enclosed, under ground unenclosed/ enclosed are determined and the appropriate size of electrical cables are selected by applying AS3008 Cable Selection Rule

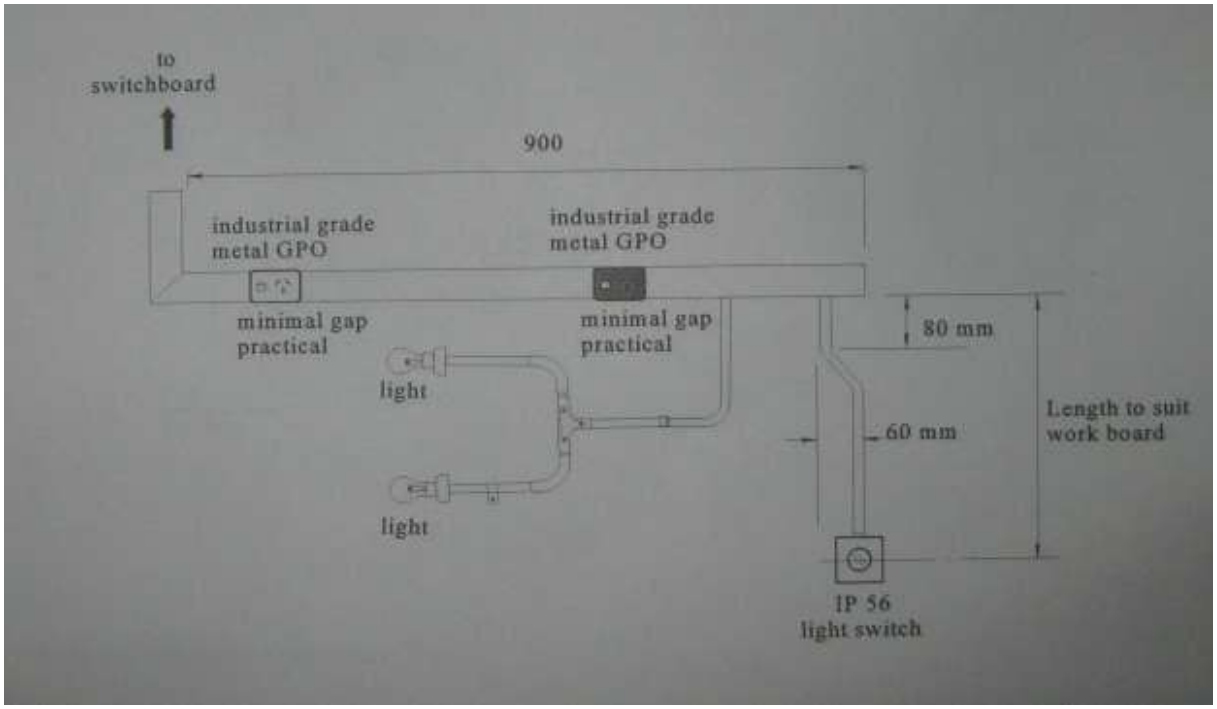
Determine the appropriate equipments to do the following tasks

Practical 1 to 5- Students' performances in the practicals are assessed.

Modification of design diagram to do the actual assembly

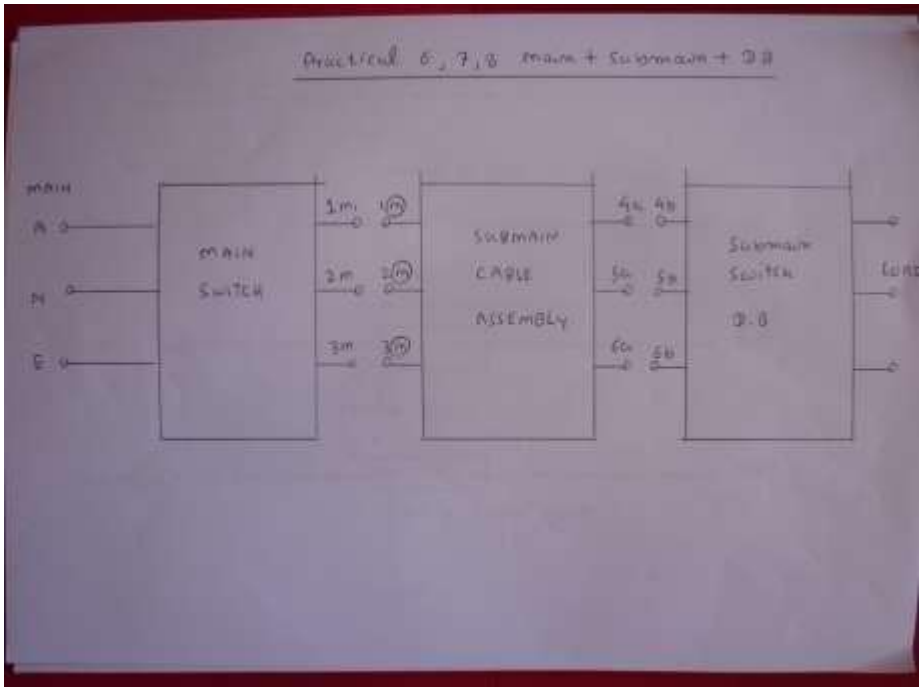
Trace the following wiring assembly on the given wiring board. The given drawing is just an outline.

The actual assembly is different from it. Sketch the actual assembly diagram & circuit diagram.



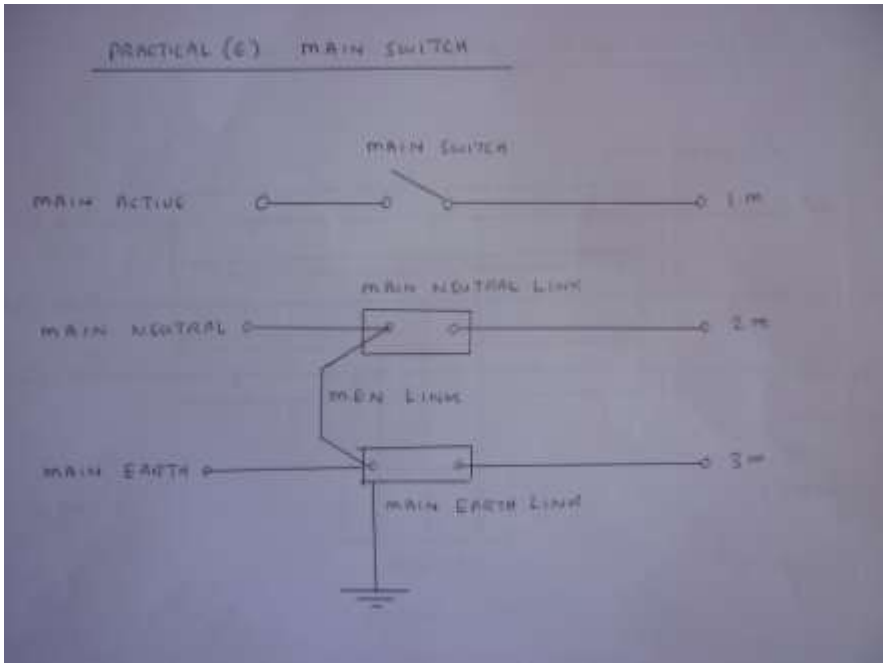
Main, Sub-main & Distribution Board Wiring

Wire the main, sub-main and distribution board wiring by using the following circuit diagrams (OR)
Trace the circuit & draw the circuit diagram.



Main

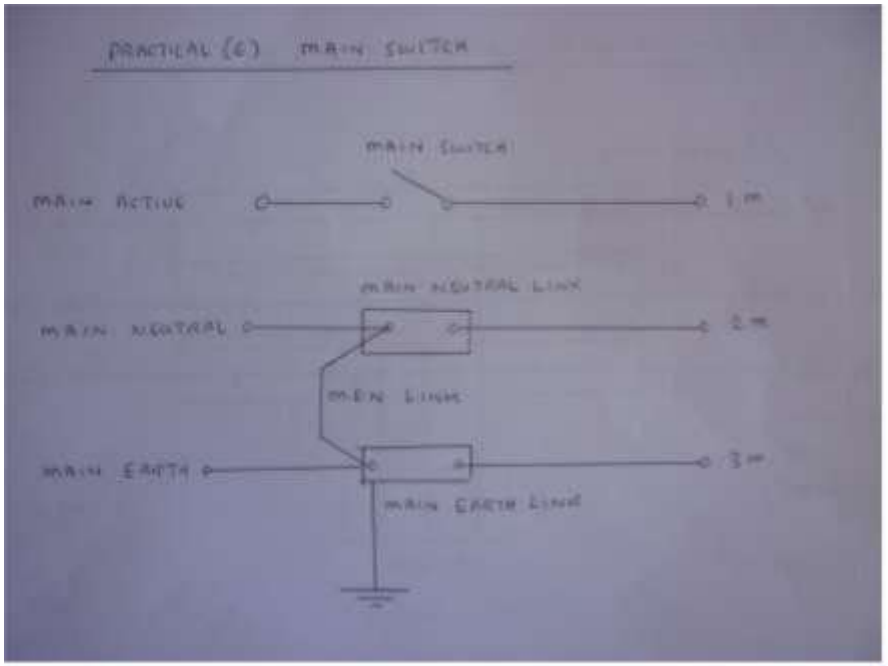
Wire the main board wiring by using the following circuit diagrams (OR) Trace the circuit & draw the circuit diagram.



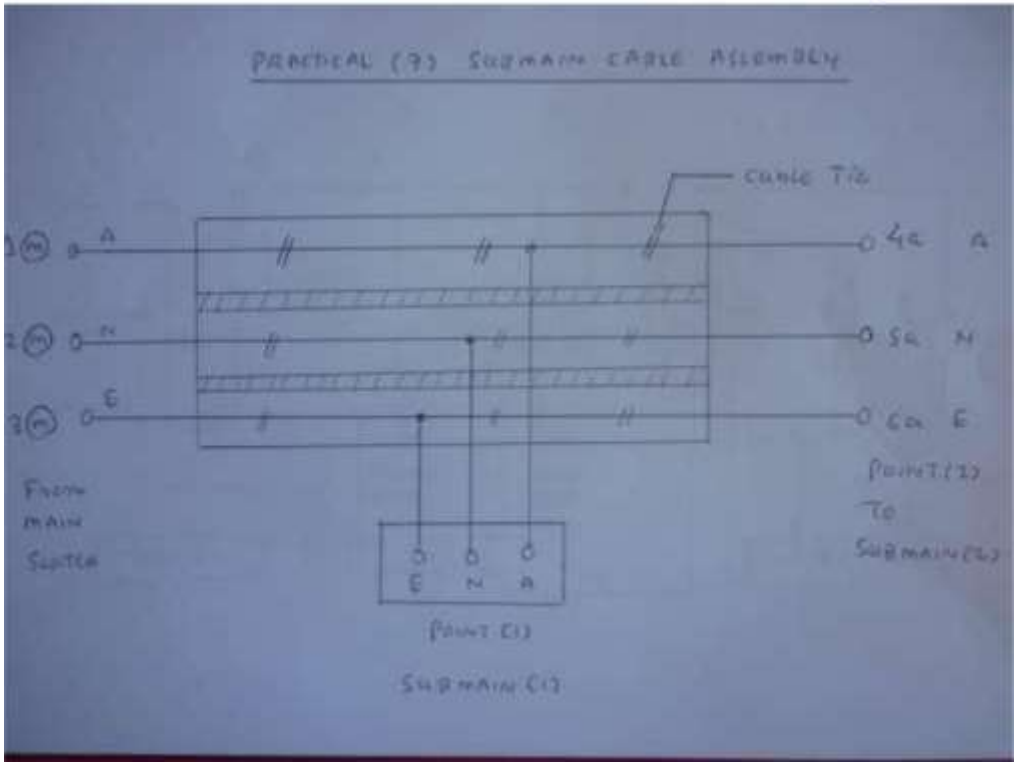
Sub-main Board Wiring

Wire the main, sub-main and distribution board wiring by using the following circuit diagrams (OR)
Trace the circuit & draw the circuit diagram.

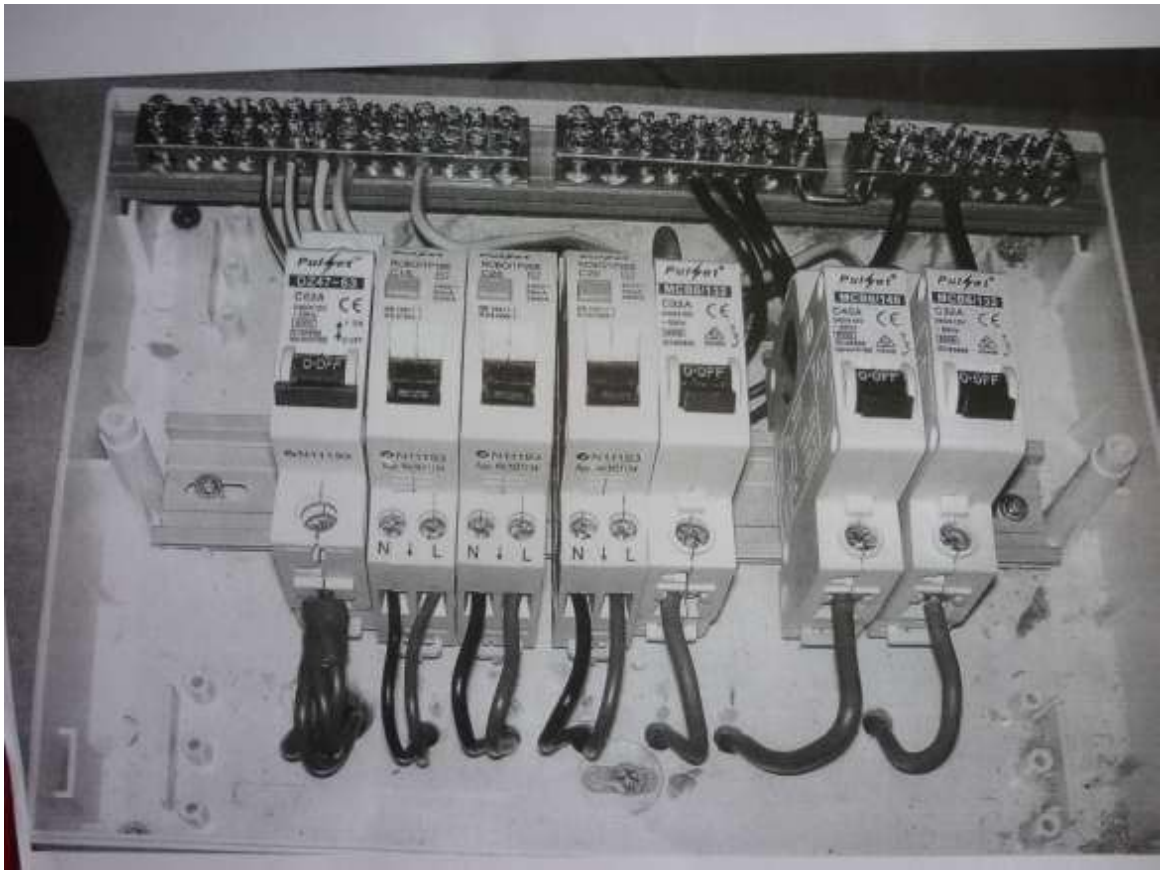
PRACTICAL (6) MAIN SWITCH

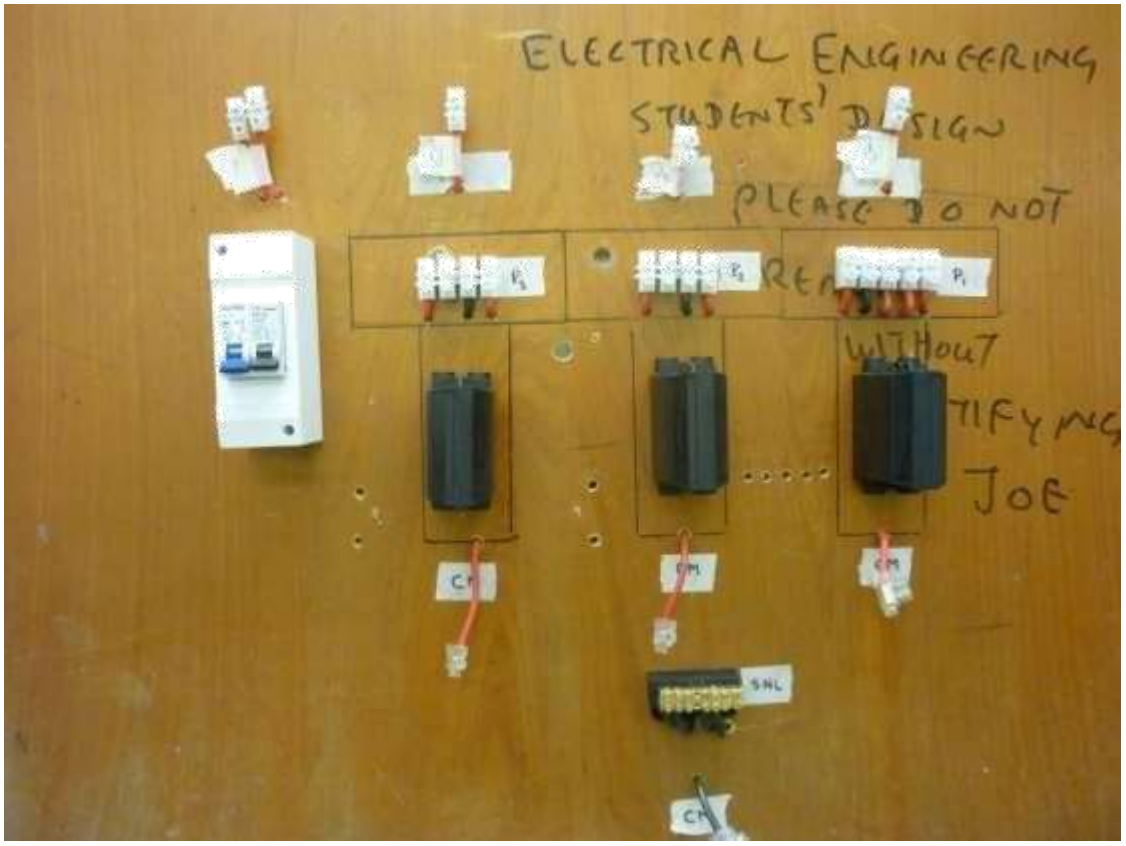


PRACTICAL (7) SUBMAIN CABLE ASSEMBLY




STUDENTS DESIGN
PROJECT
PROPERTY OF ULTIMO
ELECTRICAL ENGINEERING
(IN H2-11)
PLEASE DO NOT REMOVE
WITHOUT NOTIFYING
JOE


Pulsar
C63A
CE
O-OFF
N
L



Theory knowledge

1.2 Safety and other regulatory requirements to which the electrical installation shall comply are identified, obtained and understood.

Q1 Interpret the following symbols (4 marks)









Answer+Marking Guide—Each 1 mark

Eye Safety Glass must be worn

Biochemmical Hazard warning

Electrical Hazard

Head Protection must be worn

Practical Action

Questions

Q2 Who can hold a WHS entry permit?

Q3 Who can hold a Fair Work entry permit?

Q4 Who is Fit & proper person?

ANSWER & MARKING GUIDE Each 2 marks

Who can hold a WHS entry permit

Under the *Work Health and Safety Act 2011* (the WHS Act) a permit holder must be:

an elected officer of the union, or
an employee of the union,

And must:

have satisfactorily completed prescribed training, and
hold an entry permit under the *Fair Work Act 2009* (the Act).

Who can hold a Fair Work entry permit

Under the Act a permit holder must be:

an elected officer of the union, or
an employee of the union, and
a fit and proper person to hold a Fair Work entry permit, as determined by the Fair Work Commission.

Fit & proper person

The Delegate of the Commission must be satisfied that the proposed permit holder is a 'fit and proper person' before a Fair Work entry permit can be issued. Section 513 of the Act details criteria for assessing whether a proposed permit holder is a 'fit and proper person' to hold a permit.

Practical Action 2 marks

Questions

Q5. You are a project manager of the worksite, provide your instruction to your workers to fill the attached ESH Thresold Review form.

Questions

Q5. If you want to lift a heavy item, what steps will you follow? (2 marks)

Answer

Do not bend the back.

Bend the kneel.

Hold the item with two hands.

Place the body upright.

Lift them by using kneel force

Q6. What are the risk assessment process in disconnecting & re-connecting of electrical equipments? (2 marks)

Answer+Marking Guide

Risk assessments must be based on relevant factors including:
Operating and storage environment;
Usage (particularly the movement of the equipment and flexing of the supply cord);
Equipment / characteristics (function, make and model);
Experience with the equipment;
Age of the equipment;
Electrical safety knowledge of typical users; and
Previous inspection and testing results.

Q7. Write down the procedure to connect an electric motor to power supply.

Answer+Marking Guide

Check motor rating, voltage and current by looking at the nameplate
Check the type of motor whether AC or DC
Measure supply voltage by meter.
Test motor insulation resistance by megger
Check any damage on body.
Check the terminal / plug
Use insulation glove to handle the motor.
Join the supply.
Observe noise and vibration of the motor

Students' performance is assessed

Select wiring systems and cables for general electrical installation

2.1 Wiring systems are selected for suitability for the environments in which they are to operate.

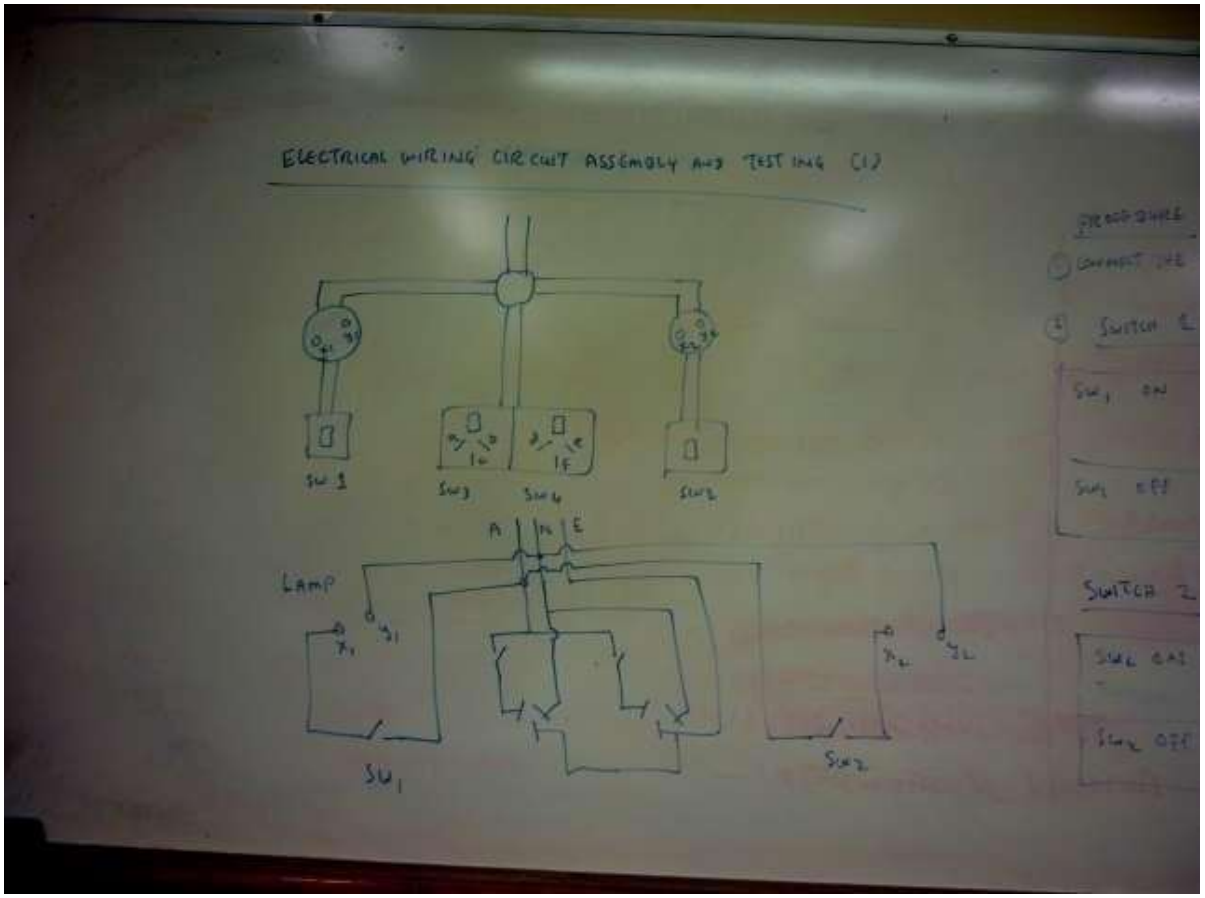
2.2 Cable conductor sizes are selected to meet current-carrying capacity requirements and voltage-drop and earth fault-loop impedance limitations.

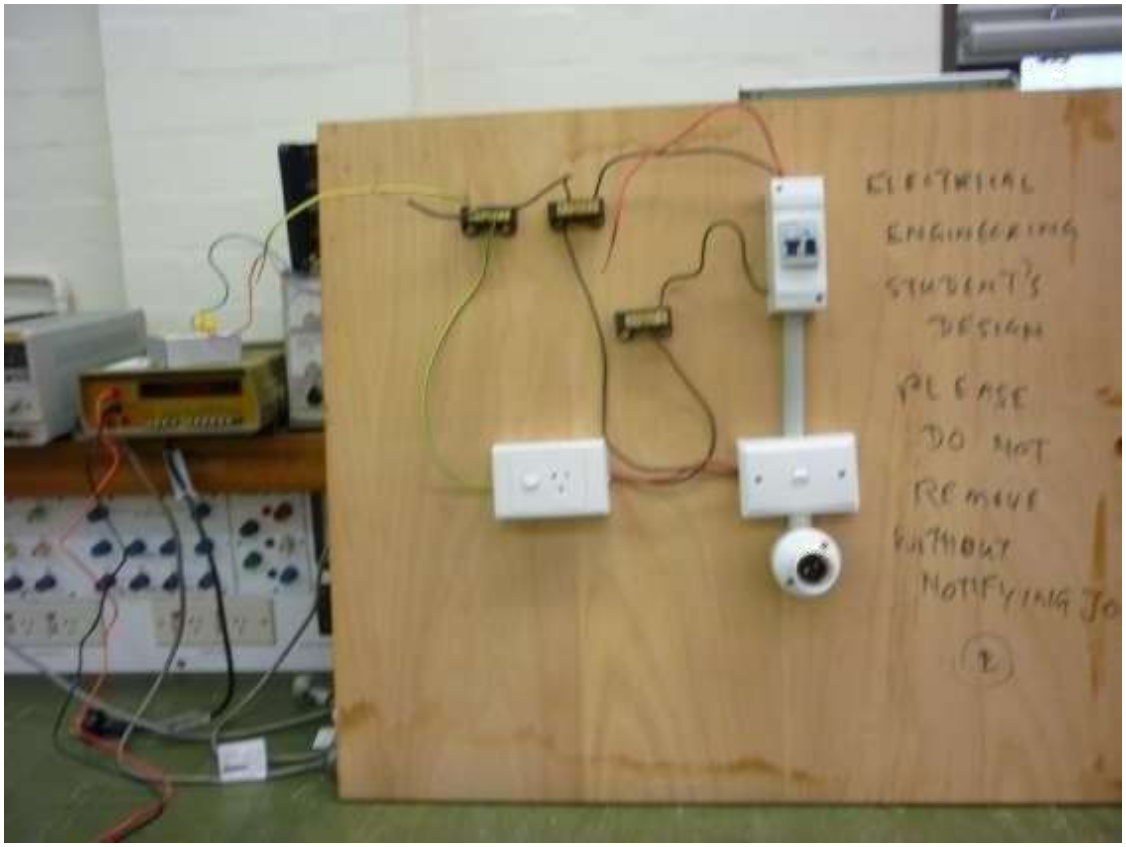
2.3 Circuit protective devices are selected to meet requirement for co-ordination with conductor current-carrying capacity.

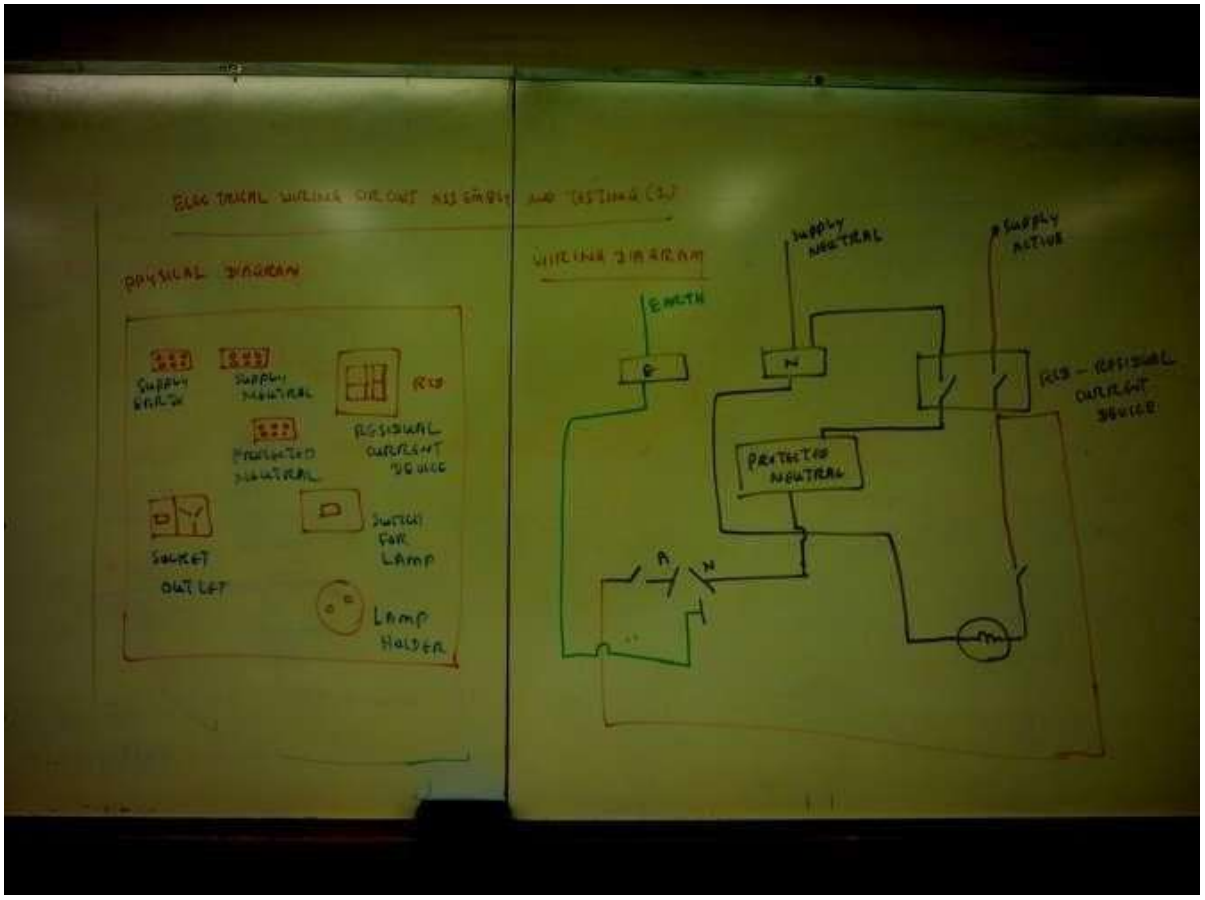
2.4 Earthing system components are selected to meet requirements of an MEN system.

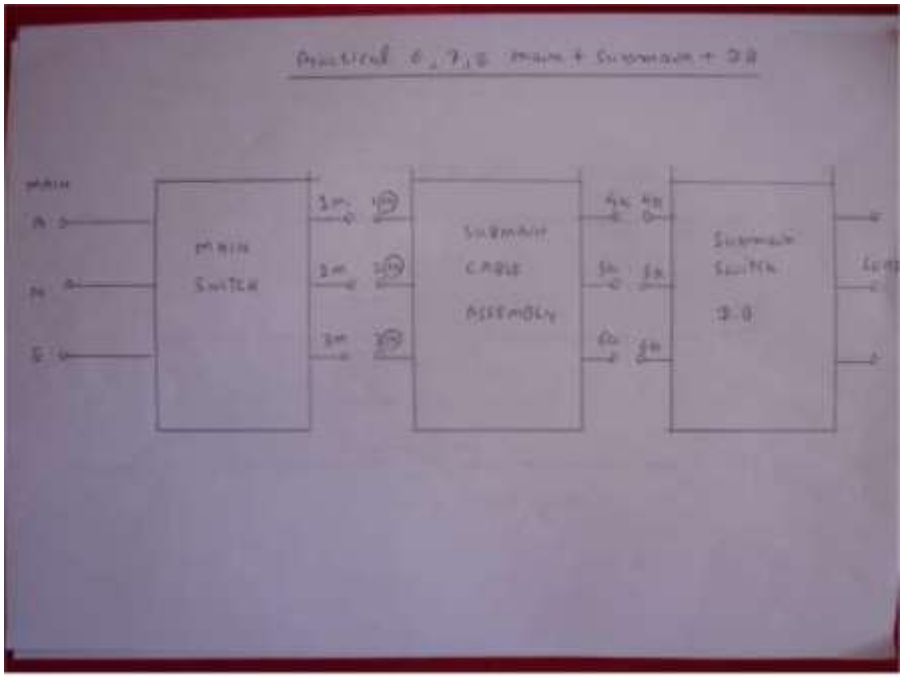
2.5 Evidence is obtained that electrical equipment selected complies with safety requirements.

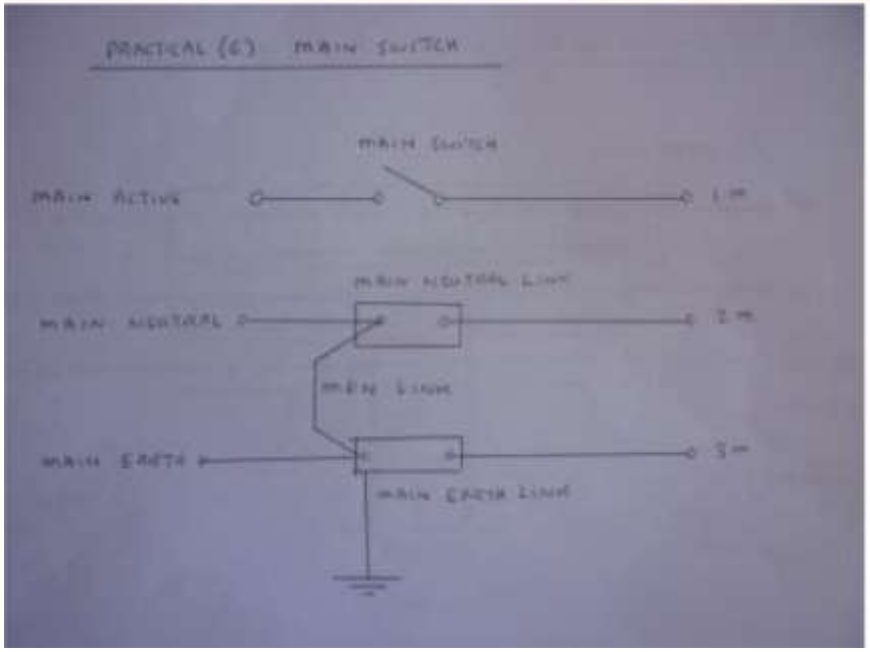
Installation of the following circuit control equipments are to be assembled by the students & their performances are assessed. Practical 7 to 10


ELECTRICAL WIRING CIRCUIT ASSEMBLY AND TESTING (1)
SW 1
SW3
SW4
SW2
A
B
E
LAMP
SW1
SW2

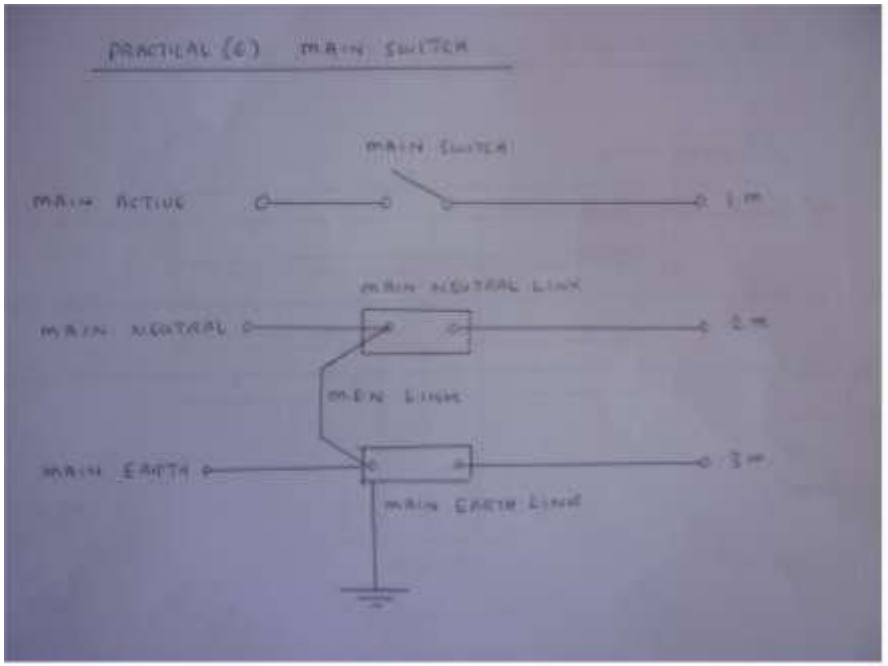

ELECTRICAL
ENGINEERING
STUDENT'S
DESIGN
PLEASE
DO NOT
REMOVE
WITHOUT
NOTIFYING


PHYSICAL DIAGRAM
SUPPLY ACTIVE
SUPPLY NEUTRAL
RCD
RESIDUAL CURRENT DEVICE
PROTECTED NEUTRAL
SOCKET OUT LET
SWITCH FOR LAMP
LAMP HOLDER
WIRING DIAGRAM
EARTH
SUPPLY NEUTRAL
SUPPLY ACTIVE
E
N
RCD - RESIDUAL CURRENT DEVICE
PROTECTED NEUTRAL
A
N

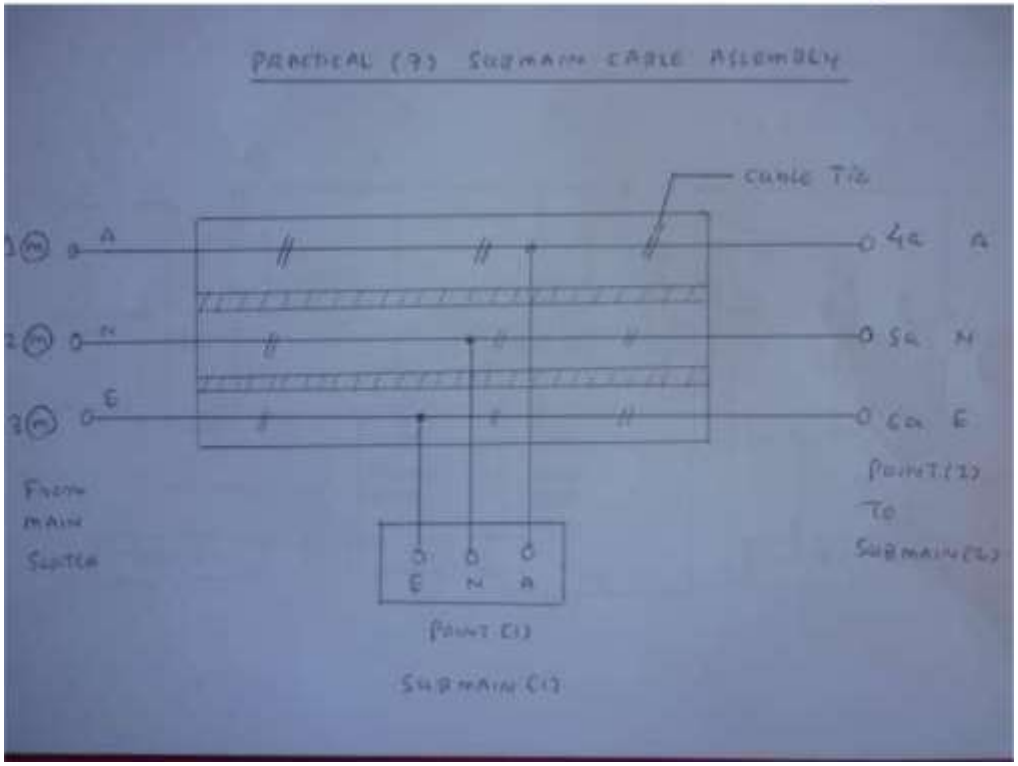

MAIN
MAIN SWITCH
SUBMAIN CABLE ASSEMBLY
SUBMAIN SWITCH
3.0

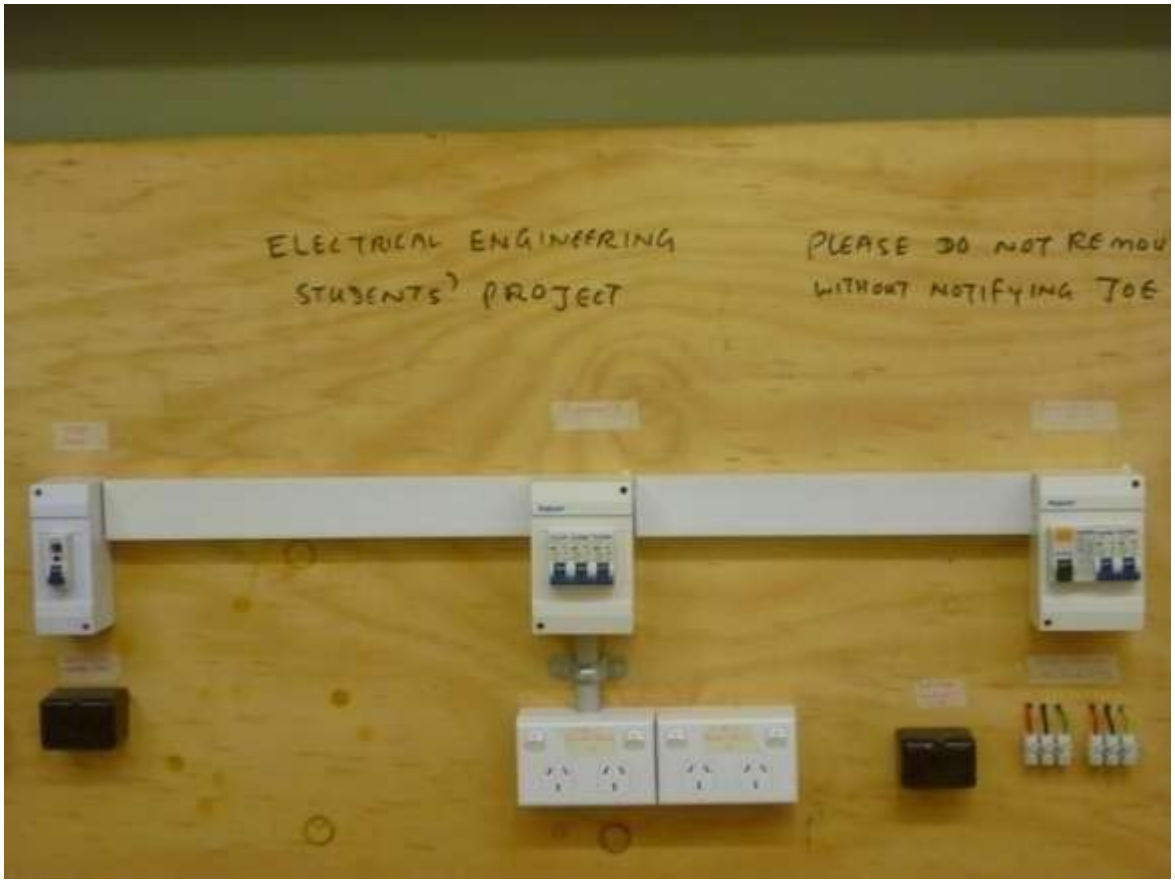

PRACTICAL (6) MAIN SWITCH
MAIN SWITCH
MAIN ACTIVE
MAIN NEUTRAL LINK
MAIN NEUTRAL
MAIN LINK
MAIN EARTH
MAIN EARTH LINK

PRACTICAL (6) MAIN SWITCH



PRACTICAL (7) SUBMAIN CABLE ASSEMBLY





3 Document electrical installation circuits, control and protection arrangements

3.1 Evidence is obtained from manufacturers/suppliers that electrical equipment selected complies with safety requirements.

Practical 16

The students are instructed to collect the specifications related to usage of equipments from manufacturers.

PRACTICALS

www.electricaldiploma2013.webs.com

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

Then the students are instructed to download the followings resources to get the specifications

Stage 1 Electrical Workshop Update

Stage 1 Electrical Workshop

Advanced Wiring Download Link

Stage 1 to 3 Practicals

Electrical Machine Practicals

Electrical Wiring Equipment

Estimating & specification preparation practice is assessed.

3.2 Reasons for selections made, including calculations, are documented in accordance with established procedures.

3.3 Electrical installation arrangement and specifications for all selected items are documented in accordance with established procedures and forwarded to appropriateperson(s).

Assessment Test 1 & 2-

SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/G107 Assessment Mapping/ G107 Test 1 Question.doc SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/ G107 Test 1 Marking.pdf SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/ G107 Test2 Question.pdf

SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/ G107 Test 2 Marking Question 5.doc SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/ G107 Class Assignment

The students' performance is assessed by test.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		**ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students'	Summative	

work in own record	Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

audit	
Students' work to be presented for audit	In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

EKAS	Assessment
KS01-EG107A Electrical installation — cable selection and co-ordination Evidence shall show an understanding of selecting cables and ensuring co-ordination between protection device and conductors in electrical installations that comply with the Wiring Rules, Selection of cables standards and Service Rules to an extent indicated by the following aspects: T1 Performance requirements - design and safety encompassing: ☐ harmful effects against which the design of an electrical installation must provide protection. ☐ performance standards of a correctly functioning electrical installation. ☐ supply characteristics that shall be considered when designing an electrical installation. ☐ acceptable methods for determining the maximum demand in consumer's mains and sub-mains. ☐ AS/NZS 3000 requirements limiting voltage drop in an installation. ☐ reason for dividing electrical installations into	Test 1 & Test 2 Online Practical Support G033+G063+G107 (Week 1 to 6 Lessons)(G033) G106 Cable Termination (UG Cable) G106 Cable Termination G106+G033 Practical (Concurrently with G107) G033+G063+G107 Week 10 to 15 **Youtube Videos for Electrical Engineering Lessons** **Australian Electrician Training**

circuits and the factors that shall determine their number and type. typical external factors that may damage an electrical installation and that shall be considered in the installation design. methods for protecting persons and livestock against direct and indirect contact with conductive parts and the typical application of each. acceptable methods of protection against the risks of ignition of flammable materials and injury by burns from the thermal effects of current, in normal service. likely sources of unwanted voltages and the methods for dealing with this potential hazard. acceptable methods for protecting persons and livestock against injury and property against damage from the effects of over current. requirement for protection against fault current. requirement for protection against the harmful effects of faults between live parts of circuits supplied at different voltages. need for protection against injury from mechanical movement and how this may be achieved. features of 'fire rated construction' and how the integrity of the fire rating can be maintained in relation to electrical installation. T2 Final subcircuit arrangements encompassing: factors that shall be considered in determining the number and type of circuits required for an installation. daily and seasonal demand for lighting, power, heating and other loads in a given installation.	**AS3000** **AS3000:2016** **AS3008** **NSW Electrical Services Rule** Electrician Capstone unit **Electrician Capstone Test Old Questions** Electrician Capstone Unit Study Guide.zip Online practical Work performance practical PLUS Online reference resources are provided to the students to acquire the competencies needed in this unit

number and types of circuits required or a particular installation. current requirements for given final subcircuits. layout/schedule of circuits for given installations. T3 Factors affecting the suitability of wiring systems encompassing: wiring systems typically used with various construction methods and particular environments. installation conditions that may affect the current-carrying capacity of cables. external influences that may affect the current-carrying capacity and/or may cause damage to the wiring system. AS/NZS 3000 requirements for selecting wiring systems for a range of circuits, installation conditions and construction methods into which the wiring system is to be installed. Note: Wiring systems include cable enclosures, underground wiring, aerial wiring, catenary support, emergency systems, busbar trunking and earth sheath return. T4 Maximum demand on consumer’s mains/submains encompassing: acceptable methods for determining the maximum demand on an installation’s consumer’s mains and submains. maximum demand for the consumer's mains for given installations up to 400 A per phase. maximum demand for given submains. T5 Cable selection based on current carrying capacity requirements encompassing: installation conditions for a range of wiring systems and applications.	

external influences that require the use of a derating factor. AS/NZS 3000 requirements for coordination of cables and protection devices. AS/NZS 3008 used to select conductor size based on the maximum current requirement for a given installation condition including any applicable derating factors. T6 Cable selection based on voltage drop requirements encompassing: AS/NZS 3000 requirements for maximum voltage drop in an installation. relevant tables in AS/NZS 3008 for unit values of voltage drop. calculation of the expected voltage drop in a given circuit. selecting cables to satisfy voltage drop requirements in addition to current carrying capacity requirements. T7 Cable selection based on fault loop impedance requirements encompassing: AS/NZS 3000 requirements for maximum fault loop impedance in an installation. relevant tables in AS/NZS 3008 to determine cable impedances. calculation of the expected fault loop impedance for a given circuit arrangement. selecting cables to satisfy fault loop impedance requirements in addition to current carrying capacity requirements and voltage drop requirements. T8 Selecting protection devices encompassing: acceptable methods of protection against indirect contact. AS/NZS 3000 requirements for selecting methods and devices to protect against	

indirect contact for a range of installation types and conditions. □ coordination between conductors and protection devices to ensures the protection of cables from over heating due to over current. □ possible injuries to persons and livestock from hazards due to a short circuit. □ AS/NZS 3000 requirements for selecting devices to protect against overload current for a range of circuits and loads. □ AS/NZS 3000 requirements for selecting devices to protect against short-circuit current for a range of installation conditions. T9 Selecting devices for isolation and switching encompassing: □ requirements for the provision of the isolation of every circuit in an electrical installation. □ need for protection against mechanical movement of electrically activated equipment. □ AS/NZS 3000 requirements for selecting devices for isolation and switching for a range of installations and conditions. T10 Switchboards encompassing: □ AS/NZS 3000 and local supply authority requirements for switchboards. □ tariff structures for the supply of electricity. □ equipment installed at the main switchboards with capacities up to 400 A per phase. □ layout of a main switchboard for an installation supplied with single phase single tariff whole current metering. □ layout of a main switchboard for an installation supplied with single phase multiple tariff whole current metering.	

layout of a main switchboard for an installation supplied with multiphase single tariff whole current metering. layout of a main switchboard for an installation supplied with multiphase multiple tariff whole current metering. layout of a main switchboard for a multiple tenancy installation with whole current metering. layout of a main switchboard, including metering, for an installation supplied with three phase CT metering. local supply authority requirements for connection of an electrical installation to the electrical supply system	

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	X
1.2		X	X
1.3	X		
1.4	X		
1.5	X		
1.6	X		
1.7	X		

2.1	X		
2.2	X		
2.3	X		
2.4	X		
2.5	X		
2.6	X		
2.7		X	X
3.1	X		
3.2	X		
3.3			X
3.4			X
EKAS Assessment		X	X

ELECTRICAL TRADE REFERENCE

http://electricaldiploma2013.zoomshare.com/files/electricaltradereference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with E108A+G106A Assessment Mapping+Performance+Marking Guide.pdf Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0023 Terminate cables, cords and accessories for low voltage circuits*		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
<Insert Elements>	<Insert PC number>	<Insert Performance Criteria>	**<Insert question number or task skill number** from assessment tool that address the specific Performance criteria	**<Insert question number or task skill number** from assessment tool that address the specific Performance criteria	**<Insert question number or task skill number** from assessment tool that address the specific Performance criteria
1 Prepare to terminate cables, cords and conductors	1.1	OHS procedures for a given work area are identified, obtained and understood.	Q1+2 of E108A+G106A Assessment Mapping+ Performance +Marking Guide.pdf (Page 1+2)		
	1.2	Health and safety risks are identified and established risk control measures and procedures in preparation for the work are followed.	Q3 of E108A+G106A Assessment Mapping+ Performance +Marking Guide.pdf (Page 3)		
	1.3	Safety hazards that have not previously been identified are noted and established risk control measures are implemented			Q4 of E108A+G106A Assessment Mapping+ Performance +Marking Guide.pdf (Page 3)
	1.4	The junction box/ terminal enclosures and terminal types are inspected to select the type and size of cable and conductor termination devices needed.		**Practical 1 Task 1**	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.5	Tools, materials and testing devices needed to for terminating cables and cords are obtained in accordance with established procedures and checked for correct operation and safety.		**Practical 1 Task 2**	
2 Terminate cables, cords and conductor	2.1	OHS risk control measures and procedures for carrying out the work are followed.	**As per 1.1+1.2+1.3**		
	2.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.	**As per 1.1+1.2+1.3**		
	2.3	Cable/cord ends are cut and sheath/insulation stripped with sufficient length to prevent stain on terminations and without undue waste.		**Practical 1 Task 3**	
	2.4	Cable glands/retaining devices are fitted and secured to ensure cable/cord cannot be pulled out of entry into junction box/ terminal enclosure		**Observation in practical task**	
	2.5	Conductors are prepared to suit the type of terminal at which there are to be connected.		**Observation in practical task**	
	2.6	Conductors are terminated to ensure continuity across the terminal.		**Observation in practical task**	
	2.7	Established methods for dealing with unexpected		**Activity 1- Reacting the**	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		situations are discussed with appropriate person or persons and documented.		**emergency**	
	2.8	Unexpected situations are dealt with safely and with the approval of an authorised person.		**Activity 1- Reacting the emergency**	
3. Test terminated cables and cords	3.1	OHS work completion risk control measures and procedures are followed.	**As per 1.1+1.2+1.3**		
	3.2	Terminated cables are tested to ensure continuity and insulation resistance comply with requirements.		**Activity 3- Testing**	

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Cable termination/ connection		**Practical 1 Task 1**	
Testing		**Activity 3- Testing**	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Tools & equipments for wiring G106-T1 Cable types and terminations G106-T3 Flat TPS wiring systems G106-T4 Circular TPS wiring systems G106-T5 Thermoplastic insulated cables in non-metallic enclosures G106-T6 Thermoplastic insulated cables G106-T7 Fire protection cabling and systems G106-T8 Steel wire armoured (SWA) cables	Q6 of E108+137+G106 Test Question		
Cable termination tools G106-T2 Cords, cables and plugs	Q7 of E108+137+G106 Test Question		
Wire crimping	Q8 of E108+137+G106 Test Question		
Cable lugging tools+ Crimping tools	Q9 +10 of E108+137+G106 Test Question		
Continuity testing	Q11 + 12 of E108+137+G106 Test Question		
Insulation Resistance Test	Q13 of E108+137+G106 Test Question		

Add rows to the following table as required

Assessment Conditions	Assessment	Assessment	Assessment

			event 1 Written Test	event 2 Practical & Observation	event 3 Assignment
. Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources			Q 7 to 13 of E108+E137+G106 Test	Practical 1 Task a to d Activities 1/2/3/4	

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEE108A Lay wiring/cabling and terminate accessories for extra-low voltage (ELV) circuits UEENEEG106A Terminate cables, cords and accessories for low voltage circuits

UNIT CAPSTONE ASSESSMENT

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1.Prepare to lay wiring/cabling and connect accessories for extra-low voltage circuits.

1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.

Q1. Identify safety equipments & signs to be used when you are using fitting & machining



process.

Answers +Marking Guide (2 marks)

Safety glass

Safety glove

Safety shoe

Ear protection

First aids sign

Q2 Write the safety procedure to operate the drilling machine

Answers +Marking Guide (5 marks)

PRE-OPERATIONAL SAFETY CHECKS

Check workspace and walkways to ensure no slip-hazards are present.
Check that the drill chuck guard is in position.
Ensure the chuck key (if used) has been removed from the drill chuck.
Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted).
Follow correct clamping procedures to ensure work is secure.
If the job obstructs the walkway erect a barricade.
Adjust spindle speed to suit drill or cutter diameter.
Faulty equipment must not be used. Immediately report suspect equipment.

OPERATIONAL SAFETY CHECKS

Never leave the Drill Press while it is running.
Before making adjustments or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
Feed downwards at a sufficient rate to keep the drill cutting.
Feed with care as the drill breaks through the underside of the work.
Use a safe working posture (beware of hair catching).

HOUSEKEEPING

Switch off the machine.
Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

Hair/clothing entanglement - rotating spindle/drill
Eye injuries
Flying swarf/chips
Sharp edges & burrs

1.2 Established OHS risk control measures and procedures

Q3 What are the main source of hazards to use the drilling machine?

Answers +Marking Guide (5 marks)

(1) Hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
drawing in or trapping hazards;
entanglement hazards;
shearing hazards;
cutting hazards;
impact hazards;

(2) hazards related to the location of the machine or plant, for example:
- its stability, for instance, whether it could roll or fall over;

(3) hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them.

To prevent the hazards, the above risks are to be identified & eliminated.

1.3	Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor

Q4.Write WHS Duty of Care Checklist for Managers/Supervisors

Answers +Marking Guide (8 marks)

WHS Duty of Care Checklist for Managers/Supervisors

Familiarise yourself with the organization Work Health & Safety Policy 2016 and Work Health and Safety Procedures to ensure you are aware of your personal responsibility for workplace health and safety (WHS) within your area of delegated authority.

Ensure that the work for which you are responsible is carried out in accordance with the University's WHS risk management steps to safeguard the health, safety and wellbeing of those involved and others who may be affected.

Demonstrate active and visible leadership in WHS risk management. Identify hazards or WHS risks associated with different jobs, tasks and projects and assess the risks to the health and safety of those involved. Conduct this risk identification and assessment in consultation with those involved or affected.

Implement suitable risk controls within agreed timeframes. These may include competency based training, adequate supervision and adoption of safe operating procedures. Choose these risk controls in consultation with those involved or affected.

Inform staff, students and contractors of WHS requirements and expectations, directing them to relevant information and risk control resources available. This may include local WHS induction (refer to the WHS induction checklist), on-the-job instruction and specific WHS training.

Promptly address WHS issues that are brought to your attention in consultation with those involved or affected.

Refer WHS issues that are beyond your control to the relevant manager(s) for their attention, but ensure that interim action is taken to reduce the risks in a practical way.

Investigate incidents, seeking to identify the causes and take steps to prevent recurrence.

1.4	The nature of the work is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

Organize the tools & equipments to do the following assembly task

Practical 1

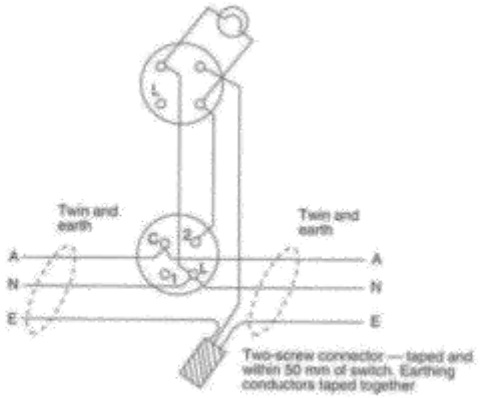
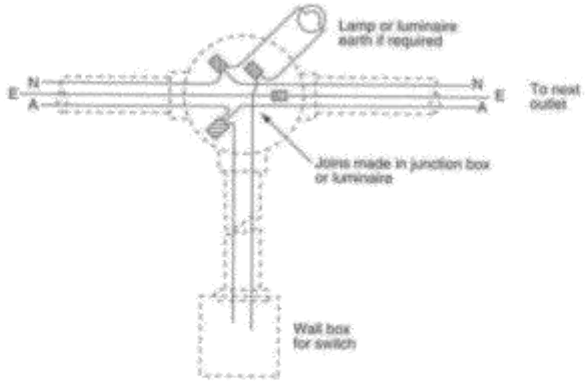


Fig. 6.8 *Looping at switch using twin and earth cable*



Equipments

In addition to above tools & equipments, you need to purchase & bring the following additional equipments & wiring accessories.

Students performance in the practical is assessed.

1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.

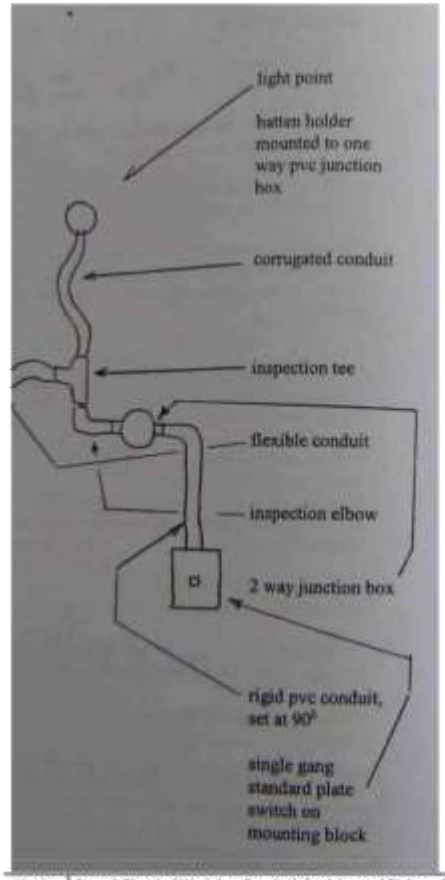
Students co-operation in the practical is evaluated.

1.6	Materials required for the work are obtained in accordance with established routines and procedures.

List the tools & materials to perform the following assembly task.

Practical (5) Conduit wiring circuit on timber board

You have to do the following wiring. Wiring to be done as enclosed wiring in conduit

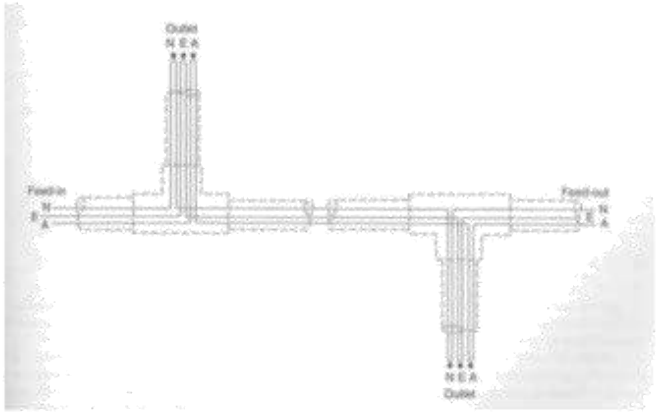


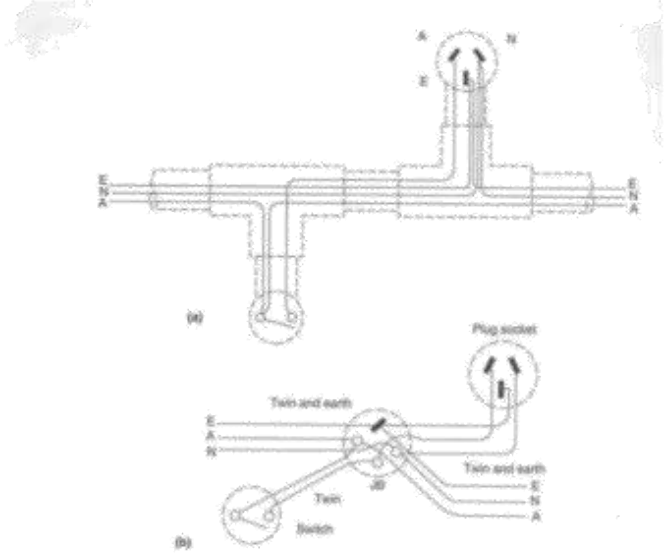
1.7 Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.

List the tools & materials to perform the following assembly task.

Practical (6) Wiring circuit for socket outlet on timber board

Do the following circuits on timber board





UEENEEG106A

1.4	The junction box/ terminal enclosures and terminal types are inspected to select the type and size of cable and conductor termination devices needed.

Activity

Select the appropriate junction to make the connection

UEENEEG106A

1.5	Tools, materials and testing devices needed to for terminating cables and cords are obtained in accordance with established procedures and checked for correct operation and safety.

As per 1.7

2.Lay wiring/cabling and connect accessories for extra-low voltage circuits.

2.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2 & 1.3

2.2	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.

Practical tasks 2

You are required to energize the wiring circuit that you have already done on the work board given in the picture. Demonstrate the followings

- Isolating the supply
- Checking the circuit
- Checking the machine
- Marking the original assembly.
- Use of hand tools
- Dismantle and keep the components systematically.
- Reassembly.
- Safety Checking

2.3	Wiring and accessories are installed to comply standards and job specifications with sufficient excess to affect terminations.
	.
2.3 G106	Cable/cord ends are cut and sheath/insulation stripped with sufficient length to prevent stain on terminations and without undue waste.

Observation

Observed students performance in

Cutting the wire
Cable termination
Installing the components
Wire up
Checking the polarity & continuity
Compliance with AS3000 standard

2.4 Accessories are installed straight and square in the required locations and within acceptable tolerances.

2.4 G106 Cable glands/retaining devices are fitted and secured to ensure cable/cord cannot be pulled out of entry into junction box/ terminal enclosure

Observation

Simplication of wire lines
Systematic arrangement of components
Neat & accurate worksmanship are to be evaluated.

2.5 Cables and conductors are terminated at accessories in accordance with manufacture's specifications and regulatory requirements.

2.5 G106 Conductors are prepared to suit the type of terminal at which there are to be connected

Observation

Cutting the wire
Cable termination
Installing the components
Wire up
Checking the polarity & continuity
Compliance with AS3000 standard

2.6 Cables installed for future service and marked in accordance with the cable identification scheme and terminated incompliance with regulatory requirements.

2.6 G106 Conductors are terminated to ensure continuity across the terminal.

Observation

How to allocate the cable for future expansion is observed.

2.7 Procedures for referring non-routine events to

immediate supervisor for directions are followed.

Observation

During the practical, emergency evacuation order or lock down order may be coming. In this case students will need to calmly step the works and follow the instruction . But they might put tools and components somewhere around and when they come back, they may not remember where they put them. In this case the students are to be instructed the step they reached before emergency situation and systematically place the tools and equipments before evacuation. Their interaction to such an simulated event is observed and evaluated.

2.8 Cable installation and termination is carried out efficiently without waste of materials or damage to apparatus, circuits or the surrounding environment and using sustainable energy practices.

Observation

Checking the fabricated assembly is to be done to ensure the followings

- Proper alignment
- Proper fit
- Meet the required dimension
- No damage
- No over use of materials

3.Complete and report work activities.

3.1 Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2, 1.3

3.2 Work site is cleaned and made safe in accordance with established procedures.

Observation

House keeping procedure in

Returning the tools and equipments
Cleaning the work place are to be assessed

3.3 Work supervisor is notified of the completion of the work in accordance with established procedures.

3.2 G106 Terminated cables are tested to ensure continuity

Observation

Students report to completion
Checking of their job
Signing off in supervisor record are to be done.

EKAS Assessment

Refer Question & Marking Scheme for Tests

ASSESSMENT SCHEDULE

E101+E102+E105+E108 +G106 are concurrently assessed.

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment

1.1		X	X
1.2		X	X
1.3		X	
1.4	X		
1.5	X		
1.6	X		
1.7	X		
2.1	X		
2.2	X		
2.3	X		
2.4	X		
2.5	X		
2.6	X		
2.7	X		
2.8	X		
2.9	X		
3.1			X
3.2	X		
3.3	X		
EKAS Assessment		X	X

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/		SAG Sem 2-2016-U Kyaw Naing (Joe)/ASSESSMENT MAPPING Sem 2-2016/ Test Questions/ E108+137+G106 Marking Guide.pdf

Feedback own record		**ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for audit		
Students' work to be		

presented for
audit

ELECTRICAL TRADES REFERENCES

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with G006A Assessment Mapping+Performance+Marking Guide.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0024 Test and connect alternating current (a.c.) rotating machine		

and connect alternating current

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve single and three phase low voltage machines problem.	1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.	Q1 +2 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 1,2)		
	1.2	Established OHS risk control measures and procedures	Q3 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 2)		
	1.3	Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor	Q4 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 2)		
	1.4	The nature of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.		Practical 1 to 5 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 4, 5)	
	1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.		Performance evaluation in Practical 1 to 5 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 4, 5)	
	1.6	Materials required for the work are obtained in accordance with established routines and procedures		Practical 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 7)	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.7	Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.		Practical 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 7)	
2 Solve single and three phase low voltage machine problems	2.1	Established OHS risk control measures and procedures for carrying out the work are followed	As per 1.1, 1.2 & 1.3		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.		Practical 1 to 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 7)	
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures		Practical 1 to 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 8)	
	2.4	Established methods are used to solve machine problems from measure and calculated values as they apply to single and three-phase low voltage machines.	Test 1 & 2 All Questions		
	2.5	Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.	Test 1 & 2		
	2.6	Unexpected situations are dealt with safely and with the approval of an authorised person.	All Questions		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	2.7	Problems are solved without damage to machines, circuits, the surrounding environment or services and using sustainable energy practices.	Test 1 & 2		
3.Complete and report work activities. .	3.1	Established OHS risk control measures and procedures for carrying out the work are followed.	As per 1.1, 1.2, 1.3		
	3.2	Work site is cleaned and made safe in accordance with established procedures		Observation (Housekeeping in Practical 1 to 6)	
	3.3	Justification for solutions used to solve machine problems is documented.	Test 1 & 2		
	3.4	Work completion is documented and an appropriate person or persons notified in accordance with established procedures.	Test 1 & 2		

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
OHS Activities	Q1 +2 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 1,2)		
Three phase motor No Load Test		Practical 1	
Three phase motor speed measurement		Practical 2	
Testing motor winding impedance		Practical 3	
Testing motor winding polarity		Practical 4	
Transformer Open Circuit & Short Circuit Test		Practical 5	
Direct Online Motor Starter		Practical 6	
Forward Reverse Starter		Practical 6	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Transformer construction	Test 2 Q 1		
T2 Transformer operation	Test 2 Q 2,3		
T3 Transformer losses, efficiency and cooling	Test 2 Q 4		
T4 Transformer voltage regulation and percent impedance	Test 2 Q 5		
T5 Parallel operation of transformers and transformer auxiliary equipment	Test 2 Q 6		
T6 Auto-transformers and instrument transformers	Test 2 Q 8,9		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
KS02-EG006A Alternating current rotating machines	Test 1 Q 1 to 10		
T2 Three phase induction motor construction		Practical 2	
T3 Three phase induction motor characteristics	Test 1 Q1,2		
T4 Single phase motors – split phase	Test 1 Q 3		
T5 Single phase motors – capacitor and shaded pole T6 Single phase motors – universal		Observation of practical 1, 2	
T7 Motor protection	Test 1 Q 1		
T8 Three phase synchronous machines			Assignment tasks on Synchronous machines
T9 Alternators and generators			Assignment tasks on Synchronous machines

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate		Practical 1 to 6	Assignment

the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to Relevant practical equipments Records relating to electrical engineering resources	Test 1, 2		

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEG006A Solve problems in single and three phase low voltage Machines

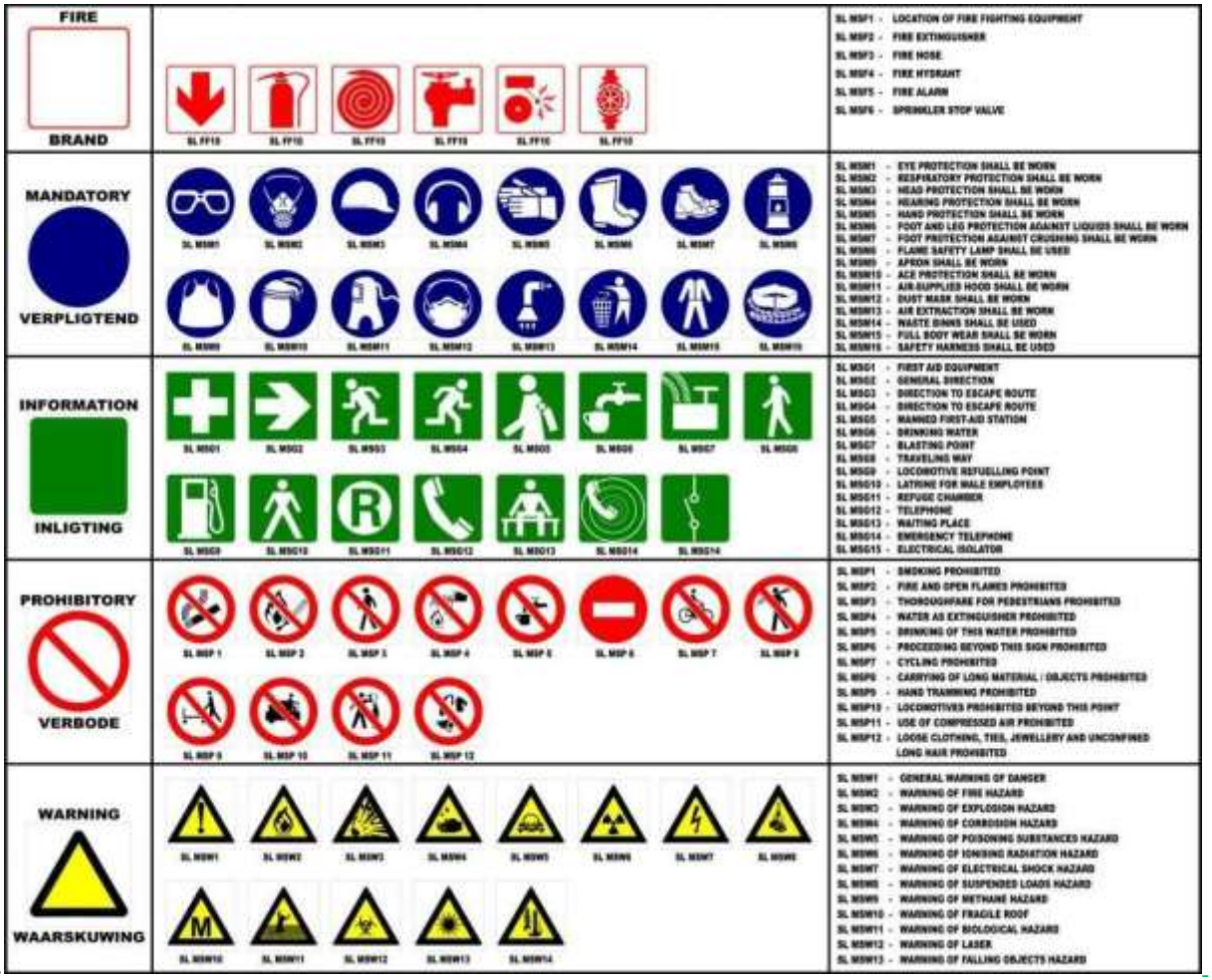
UNIT CAPSTONE ASSESSMENT

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve single and three phase low voltage machines problem.

1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.

Q1. Identify safety equipments & signs to be used when you are using fitting & machining



process.

Answers +Marking Guide (2 marks)

Safety glass

Safety glove

Safety shoe

Ear protection

First aids sign

Q2 Write the safety procedure to operate the drilling machine

Answers +Marking Guide (5 marks)

PRE-OPERATIONAL SAFETY CHECKS

Check workspace and walkways to ensure no slip-hazards are present.
Check that the drill chuck guard is in position.
Ensure the chuck key (if used) has been removed from the drill chuck.
Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted).
Follow correct clamping procedures to ensure work is secure.
If the job obstructs the walkway erect a barricade.
Adjust spindle speed to suit drill or cutter diameter.
Faulty equipment must not be used. Immediately report suspect equipment.

OPERATIONAL SAFETY CHECKS

Never leave the Drill Press while it is running.
Before making adjustments or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
Feed downwards at a sufficient rate to keep the drill cutting.
Feed with care as the drill breaks through the underside of the work.
Use a safe working posture (beware of hair catching).

HOUSEKEEPING

Switch off the machine.
Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

Hair/clothing entanglement - rotating spindle/drill
Eye injuries
Flying swarf/chips
Sharp edges & burrs

1.2 Established OHS risk control measures and procedures

Q3 What are the main source of hazards to use the drilling machine?

Answers +Marking Guide (5 marks)

(1) Hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
- drawing in or trapping hazards;

entanglement hazards;
shearing hazards;
cutting hazards;
impact hazards;

(2) hazards related to the location of the machine or plant, for example:
- its stability, for instance, whether it could roll or fall over;

(3) hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them.

To prevent the hazards, the above risks are to be identified & eliminated.

1.3	Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor

Q4.Write WHS Duty of Care Checklist for Managers/Supervisors

Answers +Marking Guide (8 marks)

WHS Duty of Care Checklist for Managers/Supervisors

Familiarise yourself with the organization Work Health & Safety Policy 2016 and Work Health and Safety Procedures to ensure you are aware of your personal responsibility for workplace health and safety (WHS) within your area of delegated authority.

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Demonstrate active and visible leadership in WHS risk management. Identify hazards or WHS risks associated with different jobs, tasks and projects and assess the risks to the health and safety of those involved. Conduct this risk identification and assessment in consultation with those involved or affected.

Implement suitable risk controls within agreed timeframes. These may include competency based training, adequate supervision and adoption of safe operating procedures. Choose these risk controls in consultation with those involved or affected.

Inform staff, students and contractors of WHS requirements and expectations, directing them to relevant information and risk control resources available. This may include local WHS induction (refer to the WHS induction checklist), on-the-job instruction and specific WHS training.

Promptly address WHS issues that are brought to your attention in consultation with those involved or affected.

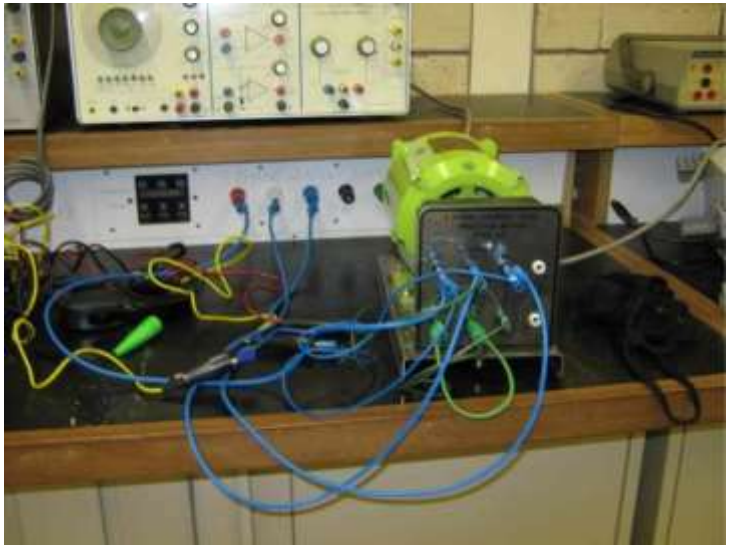
Refer WHS issues that are beyond your control to the relevant manager(s) for their attention, but ensure that interim action is taken to reduce the risks in a practical way.

Investigate incidents, seeking to identify the causes and take steps to prevent recurrence.

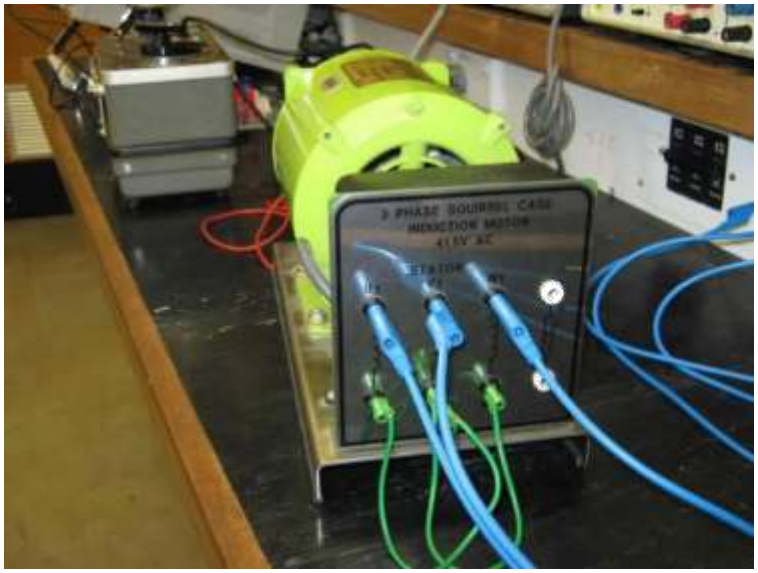
1.4	The nature of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

The performance characteristics of AC/DC Motors, Transformers are to be assessed by performing the following practical tasks.

Practical 1-Three phase motor No Load Test



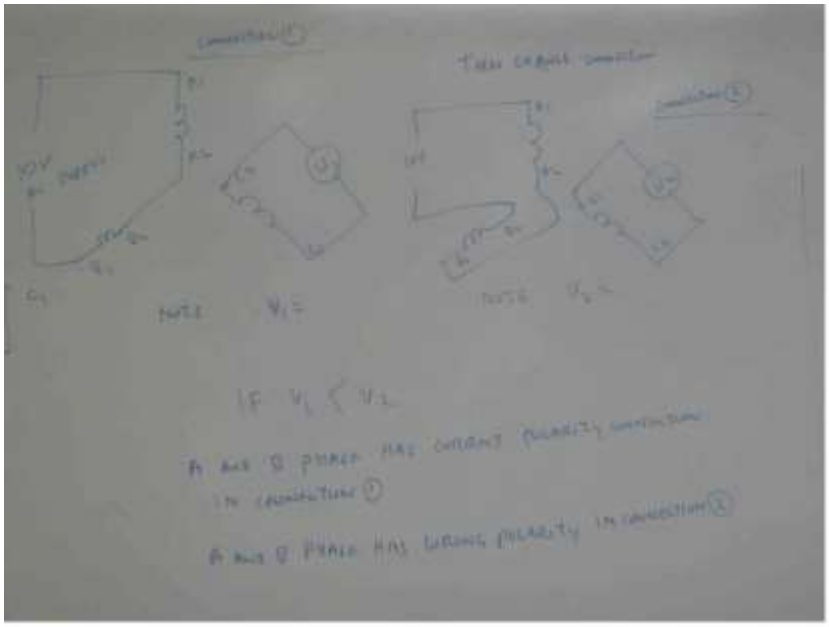
Practical 2 Three phase motor speed measurement



Practical 3 Testing motor winding impedance

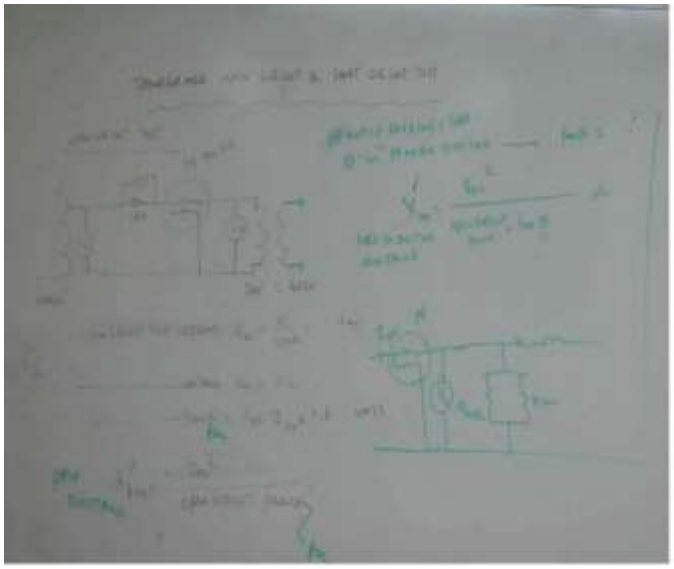


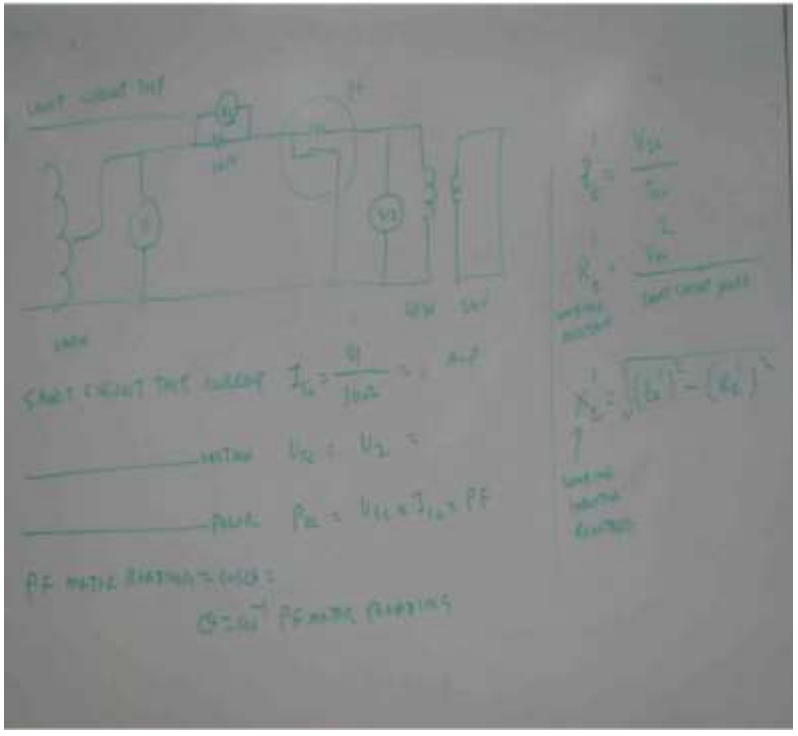
Practical 4 Testing motor winding polarity





Practical 5Power Transformer Open Circuit & Short Circuit Test







Students performance in the practical is assessed.

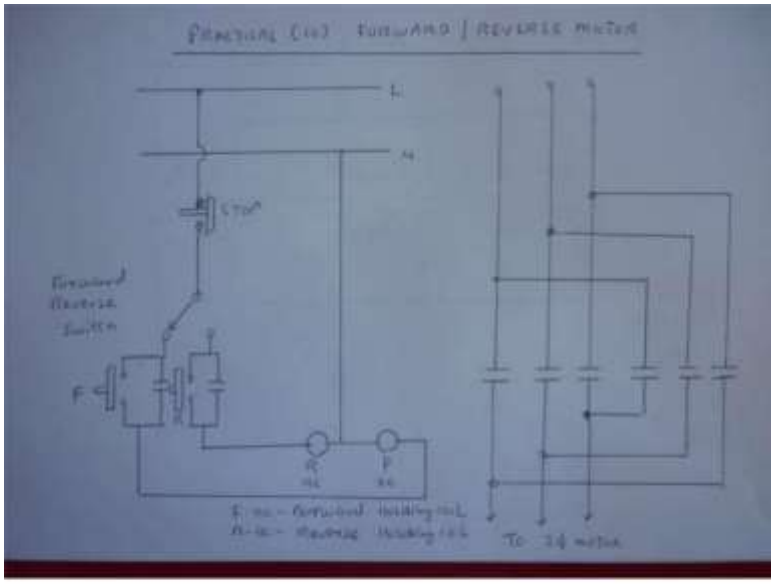
1.5 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.

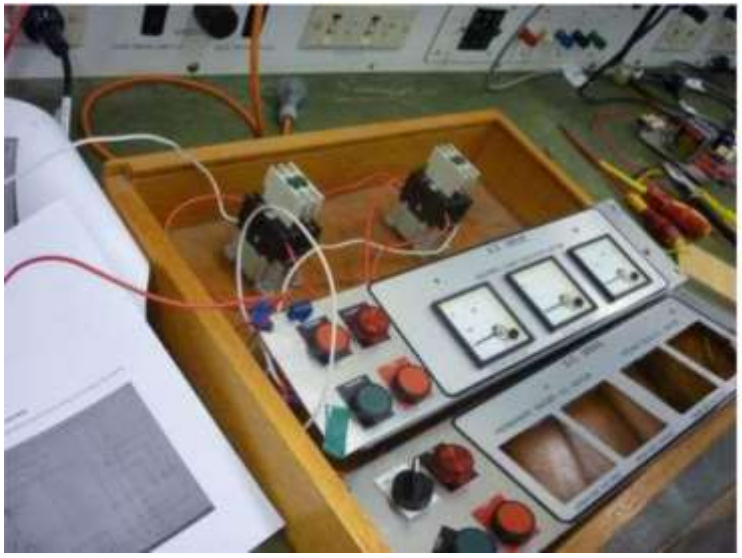
Students co-operation in the practical is evaluated.

1.6 Materials required for the work are obtained in accordance with established routines and procedures.

List the tools & materials to perform the following assembly task. For Direct Online Motor Starter

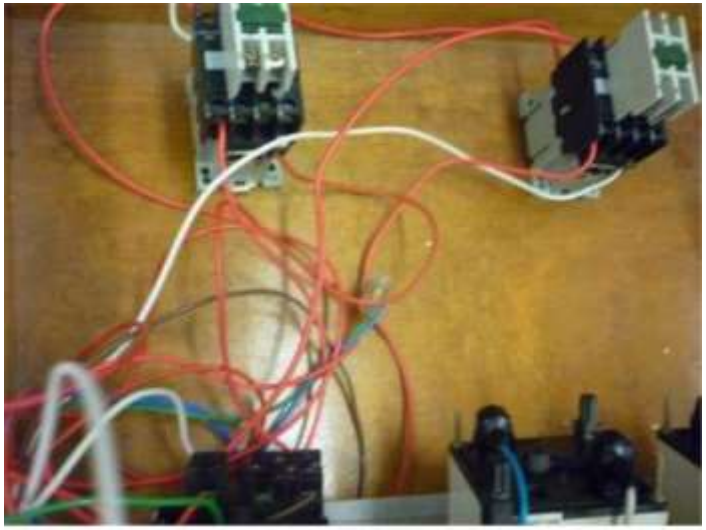
Practical 6





1.7	Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.

List the tools & materials to perform the following assembly task.





2 Solve single and three phase low voltage machine problems

2.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2 & 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Students performing in measuring motor voltage, current, frequency , power,. Using various meters such as multi meter, clamp meter, watt meter, Power factor meter are evaluated & assessed.

2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.

Practical tasks 7

You are required to energize the wiring circuit that you have already done on the work board given in the picture. Demonstrate the followings

Isolating the supply
Checking the circuit
Checking the machine
Marking the original assembly.
Use of hand tools
Dismantle and keep the components systematically.
Reassembly.
Safety Checking

2.4 Established methods are used to solve machine problems from measure and calculated values as they apply to single and three-phase low voltage machines.

2.5 Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.

2.6 Unexpected situations are dealt with safely and with the approval of an authorised person.

2.7 Problems are solved without damage to machines, circuits, the surrounding environment or services and using sustainable energy practices.

Theory Test Assessment

SAG Sem 2-2016-U Kyaw Naing(Joe)/ ASSESSMENT MAPPING-Sem 2-2016/ G006 Assessment Mapping/

G006.pdf Online Practical Activity Support

Electrical Machine Winding

Practical Demonstration Videos (Youtube)

Coil Winding
http://youtu.be/SQlyjA2w9Rs

Motor Manufacturing
http://youtu.be/uqXfEWscyWk

Motor Winding
http://youtu.be/bFluDsslt98

Removing Motor winding
http://youtu.be/Ps2HBeLvikA

Rewinding the motor
http://youtu.be/iwtYONTQFCk

Three phase Motor Operation
http://youtu.be/mw8i_MLecyY

Transformer Coil Winding
http://youtu.be/u182H2PZvo4

Fitting Motor Winding in motor production factory

http://youtu.be/EoGExBWRUBw

3. Complete and report work activities.

3.1 Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2, 1.3

3.2 Work site is cleaned and made safe in accordance with established procedures.

Observation

House keeping procedure in

Returning the tools and equipments
Cleaning the work place are to be assessed

3.3 Justification for solutions used to solve machine problems is documented.

3.4 Work completion is documented and an appropriate person or persons notified in accordance with established procedures.

EKAS ASsessment

Observation

Students report to completion
Checking of their job
Signing off in supervisor record are to be done.

EKAS Assessment

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons
http://www.mongroupsydney1.com/youtubevideos.htm

Refer Question & Marking Scheme for Tests

EKAS Components	Assessment Tasks
KS01-EG006A Single and three-phase transformers Evidence shall show an understanding of single and three phase transformers to an extent indicated by the following aspects: T1 Transformer construction encompassing: types of lamination style and core construction	Practical 1 to 6 Assignment Theory Test SAG Sem 2-2016-U Kyaw Naing(Joe)/ ASSESSMENT MAPPING-Sem 2-2016/ G006 Assessment Mapping/ G006.pdf

used in single-phase, three phase, double wound, auto transformers and instrument transformers. - identification of different winding styles/types used in transformers. - methods used to insulate low and high voltage transformers. - construction of transformer tanks for distribution transformers. - transformer auxiliary equipment. (Bushings, surge-diverters, tap-changers, hot oil & winding indicators, breather, Buchholz relay and conservator). - function of transformer auxiliary equipment. - types of information stated on transformer nameplates. - application of transformers. - performing basic insulation resistance, continuity and winding identification tests. T2 Transformer operation encompassing: - principles of mutual induction of a transformer. - factors that determine the induced voltage in a transformer winding. - determining the value of a transformers	Youtube practical demonstration videos **Work performance + Practical Instruction Back up** Click HERE to download practicals Refer Electrical Machine Drive Magnetics Practicals The following Youtube Lesson Videos are supplemented to cover all aspects of EKAS Requirements. E029 Lesson 1 Electric motor drive 1 http://youtu.be/IfJVYgfBWlw E029 Lesson 2 Electric motor drive 2 http://youtu.be/ZSmWel8QZlU E029 Lesson 3 Induction motor starting http://youtu.be/9f3RB0vctNk E029 Lesson 4 Density+Friction http://youtu.be/T0W1axM9BPw

secondary voltage and current given one winding's electrical details and turns ratio. - identification of voltage and current components of a phasor diagram for a transformer on no-load. - principles of power transferred from the primary to secondary when a load is connected using a phasor diagram neglecting impedance drops. - selecting transformers for specific application/s. - safety features specified in AS/NZS3000 with respect to transformers and isolating transformers. T3 Transformer losses, efficiency and cooling encompassing: - power losses which occur in a transformer. - tests which allow the power losses of a transformer to be determine. - determination of transformer losses and efficiency using test results. relationship between transformer cooling and rating. - methods used for natural and forced cooling of transformers.	E029 Lesson 5 Linear motion http://youtu.be/9g3FiTq782Q E029 Lesson 6 Force+mass+acceleration http://youtu.be/4YotFs_Ikqo E029 Lesson 7 Acceleration against resistance http://youtu.be/9kkEdKPlXcA E029 Lesson 8 Torque+work+energy http://youtu.be/UdZBeq2BKp0 E029 Lesson 9 Momentum+Impulse http://youtu.be/WdzlLCHjgMU http://youtu.be/yWyXUZ6LooQ E029 Lesson 10 The law of machine http://youtu.be/ntKMZ04wl3E E029 Lesson 11 Stress and strain http://youtu.be/u1LyoKSxOfQ G008+G009 Lesson 1 AC Machine+AC motor control.zip http://youtu.be/fwyx6xSOPIs http://youtu.be/DJ_huMMsVT4 http://youtu.be/pezBHVInm6M G008+G009 Lesson 2 Synchronous

properties of transformer oil. tests conducted on transformer oil. T4 Transformer voltage regulation and percent impedance encompassing: voltage regulation as applicable to a transformer. reasons for voltage variation in the output of a transformer. determine the voltage regulation of a transformer from voltage and percentage impedance values. percentage impedance as applied to transformers. determine the percent impedance by using test results. determine percent impedance of a transformer by calculation. T5 Parallel operation of transformers and transformer auxiliary equipment encompassing: determine polarity markings for an unidentified single phase double wound transformer. need for parallel operation of transformers. conditions/restrictions required before two	machine+DC machine+Transformer.zip http://youtu.be/bwxocSr9ptE http://youtu.be/ohyGNBontLg http://youtu.be/adm0lWJYlyE G012 Lesson 1 Electrical components energy and power.zip http://youtu.be/erWoPZWwqKk G012 Lesson 2 Industrial electrical applications.zip http://youtu.be/fl77efWcWOI G012 Lesson 3 Transformer voltage regulation inductance capacitance.zip http://youtu.be/Lkde-u1m-7k G012 Lesson 4 Multiphase system ac dc motor.zip http://youtu.be/evclHlQ9nlI G012 Lesson 5 Squirrel cage

transformers can be connected in parallel. - connecting transformers in parallel to supply a single load (loading on transformers operating in parallel). - the consequences/effect of an incorrect connection. T6 Auto-transformers and instrument transformers encompassing: - identification of auto-transformers, voltage transformers and current transformers from their winding diagrams. - determining voltage and current in the windings of an auto-transformer by calculation. - advantages and disadvantages of an auto-transformer. - AS/NZS3000 requirements with respect to transformers. - construction of voltage transformers. ratings of voltage transformers. construction of current transformers. ratings of current transformers.	induction motor starting.zip http://youtu.be/1AiP0qwSczo G012 Lesson 6 Wound rotor motor motor construction starter.zip http://youtu.be/6vTtNxToGbY G040 Lesson 1 Power transformer rating 1.zip http://youtu.be/qjWJVQAh_jA G040 Lesson 1 Power transformer rating 2.zip http://youtu.be/JonzO8JD-k4 G040 Lesson 2 Open circuit short circuit test.zip http://youtu.be/Ru-KlKv40OY G040 Lesson 3 Transformer regulation.zip http://youtu.be/t6IZMwMj-B4 **DC Machine and control** G044 Lesson 1 DC Machine

precautionary measures taken to connect and disconnect instrument transformers. connection diagrams for instrument transformers. applications for auto-transformers and instrument transformers. KS02-EG006A Alternating current rotating machines Evidence shall show an understanding of alternating current rotating machines to an extent indicated by the following aspects: T1 Operating Principles of three phase induction motors encompassing: determining circuit operating characteristics by using the right hand (grip) rule for conductors and solenoids and Fleming's left and right hand rules. characteristics of the magnetic field produced by single, two and three-phase windings. speed of rotation of a rotating magnetic field. relationship between the rotor speed, slip and rotor frequency. basic principle of operation of an induction motor. reversing the direction of rotation of a three	Principle.zip http://youtu.be/-jAtAH_Ny94 G044 Lesson 2 DC Winding +Armature reaction.zip http://youtu.be/SYx2SSmMKlE http://youtu.be/YtTPpipiUYI G044 Lesson 3 Factors affecting speed & direction of rotation.zip http://youtu.be/9-7wsKVrhls http://youtu.be/O_uo2H5Rflc http://youtu.be/QaabA5pmB9E

phase induction motor T2 Three phase induction motor construction encompassing: basic component parts of a three-phase induction motor. types of rotors used in three-phase induction motors. connecting three-phase induction motor in both star and delta. dismantling three-phase induction motors. testing insulation resistance of a three-phase induction motor prior to connection to the supply. testing winding resistance (ohmic value and continuity) of a three-phase induction motor prior to connection to the supply T3 Three phase induction motor characteristics encompassing: relationship between torque, speed, and power and interpretation of speed/torque curves of induction motors. squirrel cage motors operating characteristics conditions necessary for an induction motor to produce maximum torque.	

operating characteristics of an induction motor from name plate information and by measurement. induction motors efficiency and minimum energy performance standards (MEPS). full load efficiency and power factor of induction motors. T4 Single phase motors – split phase encompassing: common types of single phase motor. principles of operation of a split phase induction motor. construction and basic characteristics of a split phase induction motor. applications of split phase induction motors. connecting, running and reversing a split phase induction motor. T5 Single phase motors – capacitor and shaded pole types encompassing: identification of single phase induction motors including capacitor start, capacitor start/capacitor run, permanent split capacitor (PSC) and shaded pole principles of operation of each motor type listed above. operating characteristics and typical applications	

of each motor type listed above. connection and running each type of motor listed. reversing the direction of rotation of each of the capacitor type motors. T6 Single phase motors – universal encompassing: principles of operation of a series universal motor. identification and functions of each of the basic parts of a series universal motor. operating characteristics and typical uses for a series universal motor. connecting, running and reversing a series universal motor. T7 Motor protection encompassing: reasons why motor protection is required. requirements of the AS/NZS3000 Wiring rules with regards to motor protection. types of motor overload protection. operating principles of microtherm devices, thermal and magnetic motor protection devices. electrical features of motor protection HRC fuses. effects of under voltage and over voltage on	

motors and motor circuits. ? effects of repetitive starting and/or reversing on motors. ? special requirements for motor protection, in high humidity or moist environments, high temperature areas and corrosive atmospheres. ? operating principles of phase failure protection. ? selecting suitable protective devices for a given motor and starter combination. T8 Three phase synchronous machines- operation principles and construction encompassing: ? power transfer diagram of an a.c. synchronous machine. ? need for the generation of a sinusoidal waveform. ? principles of operation of a synchronous alternator. ? principles of operation of a synchronous motor. ? principles of operation of an asynchronous generator (induction generator). ? identification of main parts of a synchronous alternator/motor. ? methods used to provide the excitation of a synchronous alternator/motor.	

block diagram of an alternator voltage regulator. advantages gained by the parallel operation of alternators. starting methods of synchronous motors. T9 Alternators and generators encompassing: effects on the generated voltage of variations in excitation. effects on generated voltage of variations in load. identification of characteristic curves of an alternator. types of prime movers used with single and three phase portable/standby alternators. manual operation of single and three phase portable/standby alternators. ratings of single and three phase portable/standby alternators. applications of single and three phase portable/standby alternators. construction details of single and three phase portable/standby alternators. common faults found in portable/standby alternators.	

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1	X		
1.2	X		
1.3	X		
1.4		X	X
1.5		X	X
1.6	X		
1.7	X		
2.1	X		
2.2	X		
2.3	X		
2.4		X	X
2.5		X	X
2.6	X		
2.7		X	X
3.1	X		
3.2	X		
3.3		X	X
3.4		X	X
EKAS Assessment		X	X

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment		Theory Test Assessment SAG Sem 2-2016-U Kyaw Naing(Joe)/ ASSESSMENT MAPPING-Sem 2-2016/ G006 Assessment Mapping/

Cover/ Feedback own record		**ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5

to be presented for audit	Printed documents

ELECTRICAL MACHINES ONLINE REFERENCES

G003+G004+G009Practicals.pdf (12.48MB)
Generator Test.pdf (0.61MB)

MachineRepair3.zip (3.61MB)

G044+7762AC2.zip (5.45MB)

E029 Motor Control 1.zip (13.32MB)

MachineControlCkt2.zip (7.64MB)

8PowerElectronicsDevices.zip (5.6MB)

MachineRepair1.zip (6.25MB)

G044+7762AC1.zip (5.86MB)

UEEEL0024 Test and connect alternating current

Power Transformer+Line-G040.zip (158.78MB)

Elect Machine-G043+G044+G045.zip (118.53MB)

MachineControlCkt1.zip (9.7MB)

MachineControlCkt3.zip (16.13MB)

MachineRepair2.zip (4.64MB)

7MachineDriveSystems.zip (8.36MB)

G040_7762AD_Notes.doc (9.24MB)

E029 Motor Control 2.zip (14.8MB)

G044 Tutorial.doc (4.05MB)

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with G006A Assessment Mapping+Performance+Marking Guide.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0025 Test and connect transformers		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve single and three phase low voltage machines problem.	1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.	Q1 +2 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 1,2)		
	1.2	Established OHS risk control measures and procedures	Q3 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 2)		
	1.3	Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor	Q4 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 2)		
	1.4	The nature of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.		Practical 1 to 5 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 4, 5)	
	1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.		Performance evaluation in Practical 1 to 5 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 4, 5)	
	1.6	Materials required for the work are obtained in accordance with established routines and procedures		Practical 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 7)	

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.7	Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.		Practical 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 7)	
2 Solve single and three phase low voltage machine problems	2.1	Established OHS risk control measures and procedures for carrying out the work are followed	As per 1.1, 1.2 & 1.3		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.		Practical 1 to 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 7)	
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures		Practical 1 to 6 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 8)	
	2.4	Established methods are used to solve machine problems from measure and calculated values as they apply to single and three-phase low voltage machines.	Test 1 & 2 All Questions		
	2.5	Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.	Test 1 & 2		
	2.6	Unexpected situations are dealt with safely and with the approval of an authorised person.	All Questions		

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Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	2.7	Problems are solved without damage to machines, circuits, the surrounding environment or services and using sustainable energy practices.	Test 1 & 2		
3.Complete and report work activities. .	3.1	Established OHS risk control measures and procedures for carrying out the work are followed.	As per 1.1, 1.2, 1.3		
	3.2	Work site is cleaned and made safe in accordance with established procedures		Observation (Housekeeping in Practical 1 to 6)	
	3.3	Justification for solutions used to solve machine problems is documented.	Test 1 & 2		
	3.4	Work completion is documented and an appropriate person or persons notified in accordance with established procedures.	Test 1 & 2		

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
OHS Activities	Q1 +2 of G006A Assessment Mapping+Performance+ Marking Guide.pdf (Page 1,2)		
Three phase motor No Load Test		Practical 1	
Three phase motor speed measurement		Practical 2	
Testing motor winding impedance		Practical 3	
Testing motor winding polarity		Practical 4	
Transformer Open Circuit & Short Circuit Test		Practical 5	
Direct Online Motor Starter		Practical 6	
Forward Reverse Starter		Practical 6	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Transformer construction	Test 2 Q 1		
T2 Transformer operation	Test 2 Q 2,3		
T3 Transformer losses, efficiency and cooling	Test 2 Q 4		
T4 Transformer voltage regulation and percent impedance	Test 2 Q 5		
T5 Parallel operation of transformers and transformer auxiliary equipment	Test 2 Q 6		
T6 Auto-transformers and instrument transformers	Test 2 Q 8,9		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
KS02-EG006A Alternating current rotating machines	Test 1 Q 1 to 10		
T2 Three phase induction motor construction		Practical 2	
T3 Three phase induction motor characteristics	Test 1 Q1,2		
T4 Single phase motors – split phase	Test 1 Q 3		
T5 Single phase motors – capacitor and shaded pole T6 Single phase motors – universal		Observation of practical 1, 2	
T7 Motor protection	Test 1 Q 1		
T8 Three phase synchronous machines			Assignment tasks on Synchronous machines
T9 Alternators and generators			Assignment tasks on Synchronous machines

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate		Practical 1 to 6	Assignment

the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to Relevant practical equipments Records relating to electrical engineering resources	Test 1, 2		

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEG006A Solve problems in single and three phase low voltage Machines

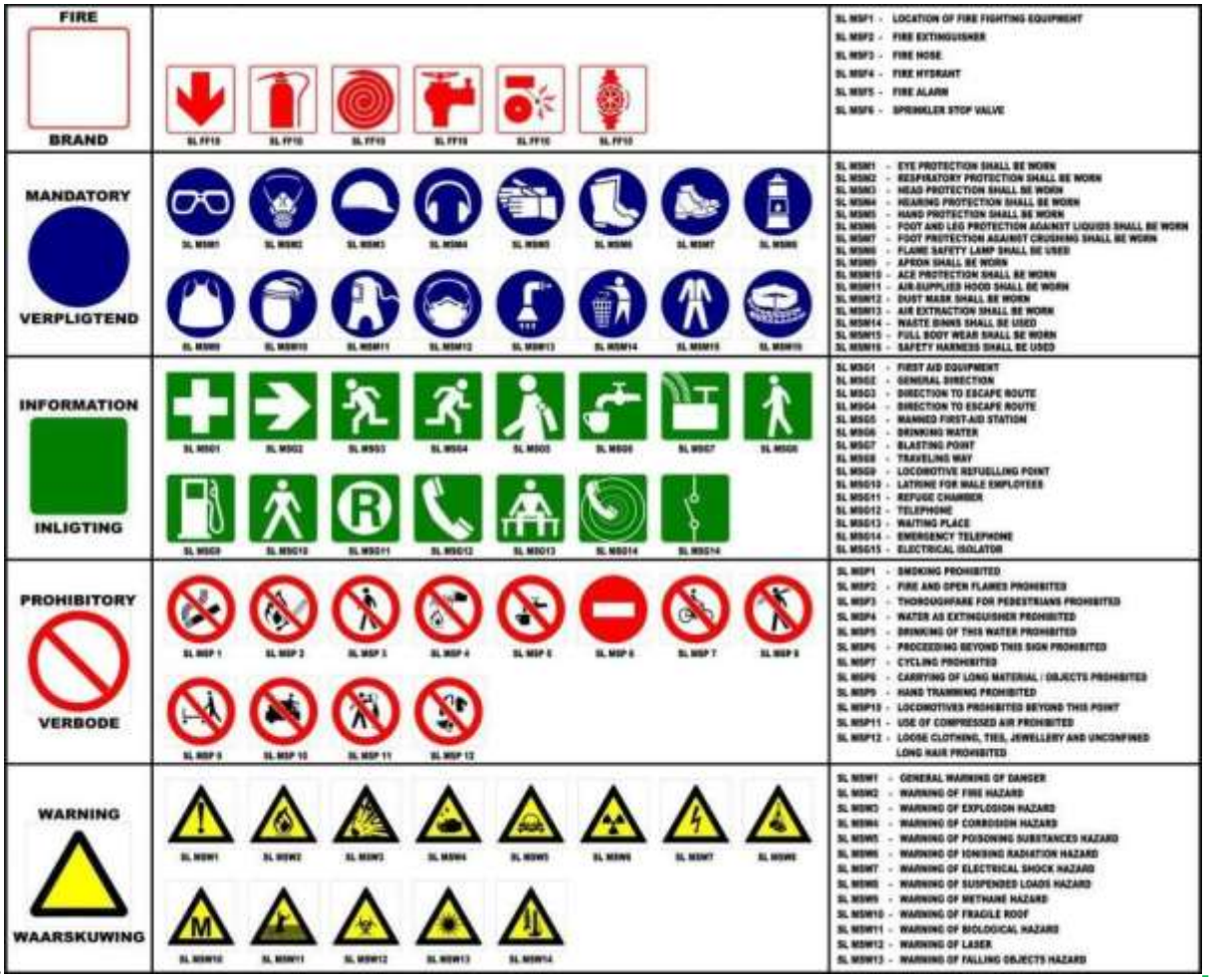
UNIT CAPSTONE ASSESSMENT

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve single and three phase low voltage machines problem.

1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.

Q1. Identify safety equipments & signs to be used when you are using fitting & machining process.



Answers +Marking Guide (2 marks)

Safety glass

Safety glove

Safety shoe

Ear protection

First aids sign

Q2 Write the safety procedure to operate the drilling machine

Answers +Marking Guide (5 marks)

PRE-OPERATIONAL SAFETY CHECKS

Check workspace and walkways to ensure no slip-hazards are present.
Check that the drill chuck guard is in position.
Ensure the chuck key (if used) has been removed from the drill chuck.
Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted).
Follow correct clamping procedures to ensure work is secure.
If the job obstructs the walkway erect a barricade.
Adjust spindle speed to suit drill or cutter diameter.
Faulty equipment must not be used. Immediately report suspect equipment.

OPERATIONAL SAFETY CHECKS

Never leave the Drill Press while it is running.
Before making adjustments or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
Feed downwards at a sufficient rate to keep the drill cutting.
Feed with care as the drill breaks through the underside of the work.
Use a safe working posture (beware of hair catching).

HOUSEKEEPING

Switch off the machine.
Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

Hair/clothing entanglement - rotating spindle/drill
Eye injuries
Flying swarf/chips
Sharp edges & burrs

1.2 Established OHS risk control measures and procedures

Q3 What are the main source of hazards to use the drilling machine?

Answers +Marking Guide (5 marks)

(1) Hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
- drawing in or trapping hazards;

entanglement hazards;
shearing hazards;
cutting hazards;
impact hazards;

(2) hazards related to the location of the machine or plant, for example:
- its stability, for instance, whether it could roll or fall over;

(3) hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them.

To prevent the hazards, the above risks are to be identified & eliminated.

1.3	Safety hazard not previously identified are reported and advice on risk control measures is sought from the work supervisor

Q4.Write WHS Duty of Care Checklist for Managers/Supervisors

Answers +Marking Guide (8 marks)

WHS Duty of Care Checklist for Managers/Supervisors

Familiarise yourself with the organization Work Health & Safety Policy 2016 and Work Health and Safety Procedures to ensure you are aware of your personal responsibility for workplace health and safety (WHS) within your area of delegated authority.

Ensure that the work for which you are responsible is carried out in accordance with the University's WHS risk management steps to safeguard the health, safety and wellbeing of those involved and others who may be affected.

Demonstrate active and visible leadership in WHS risk management. Identify hazards or WHS risks associated with different jobs, tasks and projects and assess the risks to the health and safety of those involved. Conduct this risk identification and assessment in consultation with those involved or affected.

Implement suitable risk controls within agreed timeframes. These may include competency based training, adequate supervision and adoption of safe operating procedures. Choose these risk controls in consultation with those involved or affected.

Inform staff, students and contractors of WHS requirements and expectations, directing them to relevant information and risk control resources available. This may include local WHS induction (refer to the WHS induction checklist), on-the-job instruction and specific WHS training.

Promptly address WHS issues that are brought to your attention in consultation with those involved or affected.

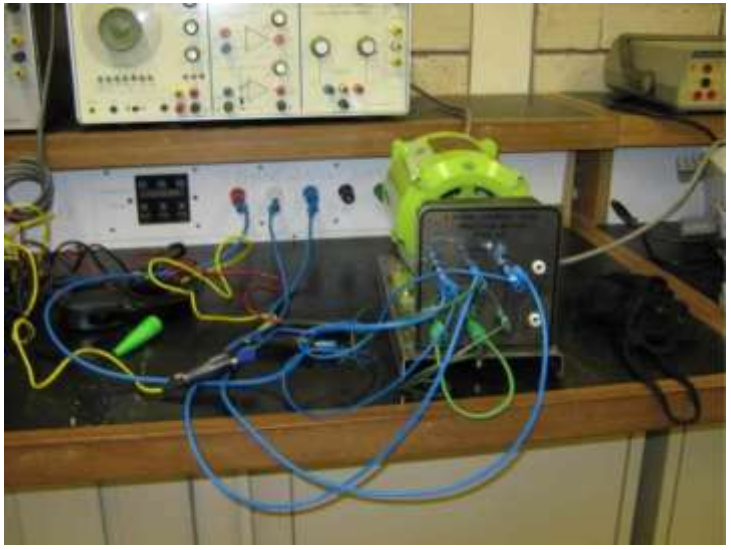
Refer WHS issues that are beyond your control to the relevant manager(s) for their attention, but ensure that interim action is taken to reduce the risks in a practical way.

Investigate incidents, seeking to identify the causes and take steps to prevent recurrence.

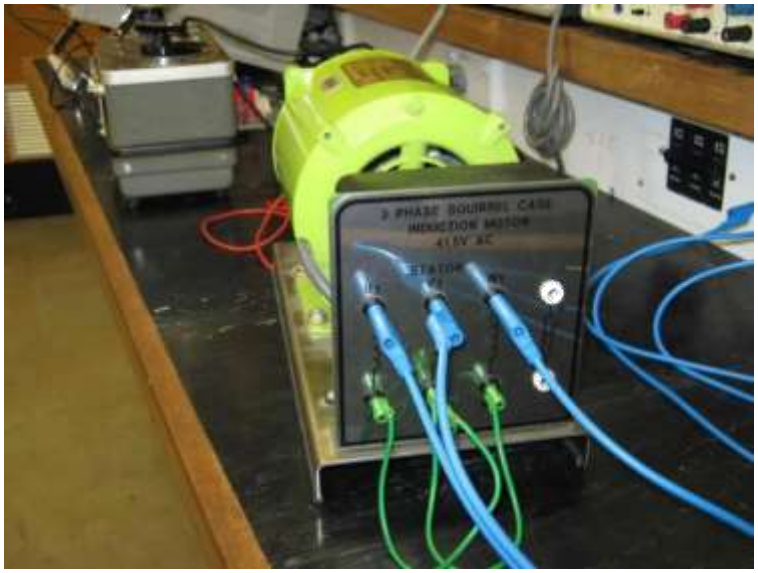
1.4	The nature of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

The performance characteristics of AC/DC Motors, Transformers are to be assessed by performing the following practical tasks.

Practical 1-Three phase motor No Load Test



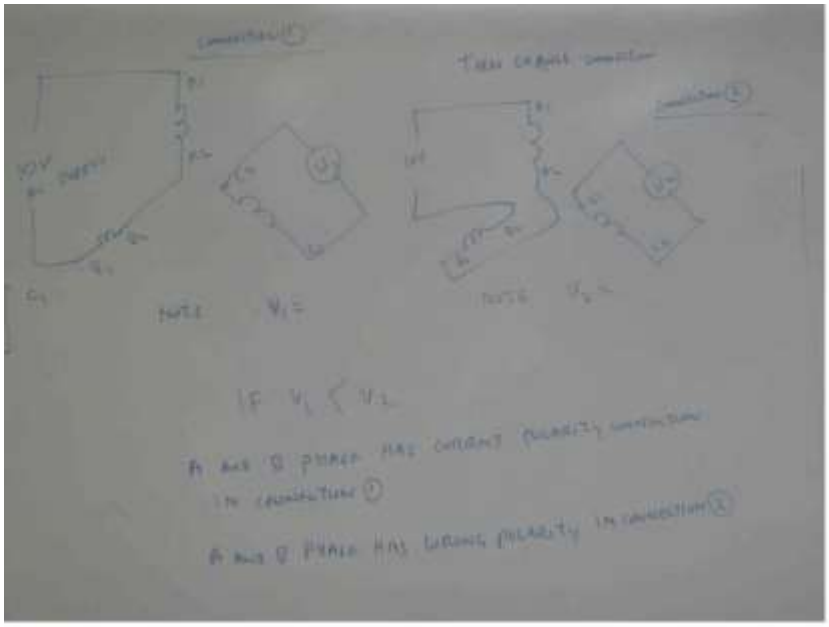
Practical 2 Three phase motor speed measurement



Practical 3 Testing motor winding impedance

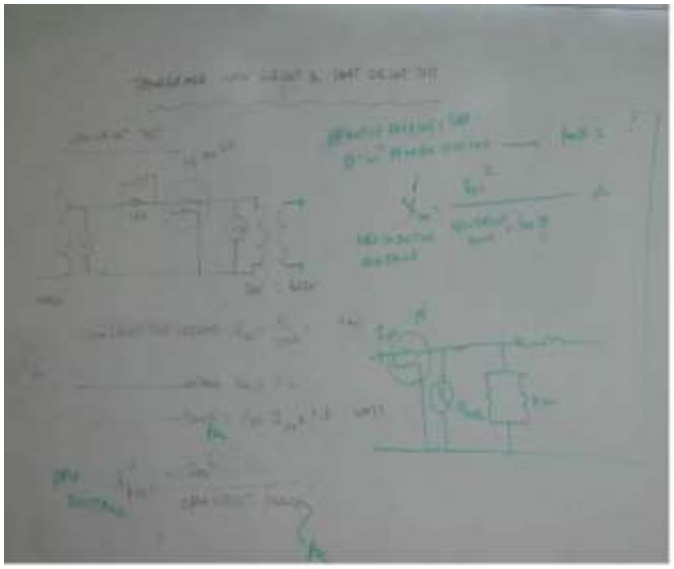


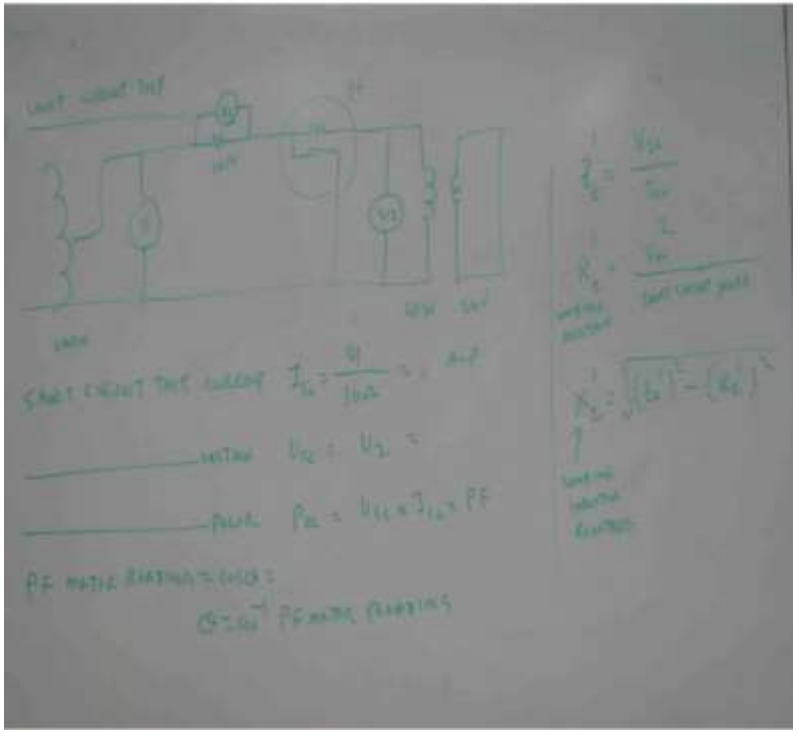
Practical 4 Testing motor winding polarity





Practical 5Power Transformer Open Circuit & Short Circuit Test







Students performance in the practical is assessed.

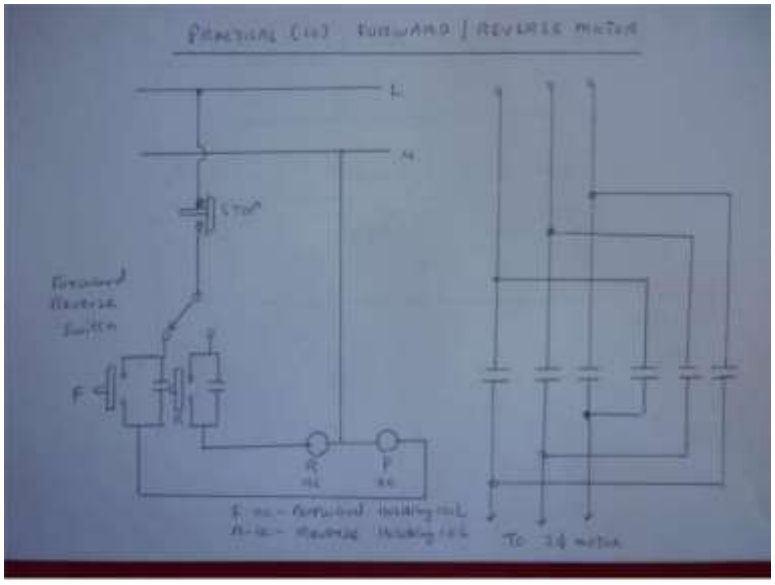
1.5	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.

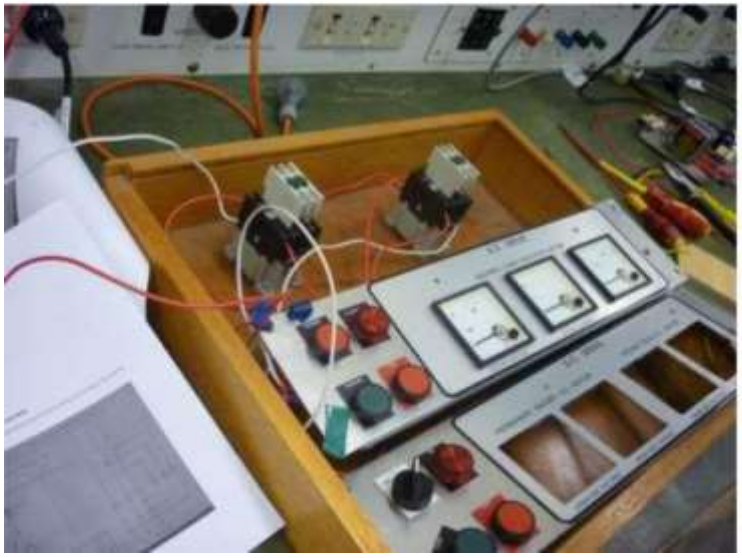
Students co-operation in the practical is evaluated.

1.6	Materials required for the work are obtained in accordance with established routines and procedures.

List the tools & materials to perform the following assembly task. For Direct Online Motor Starter

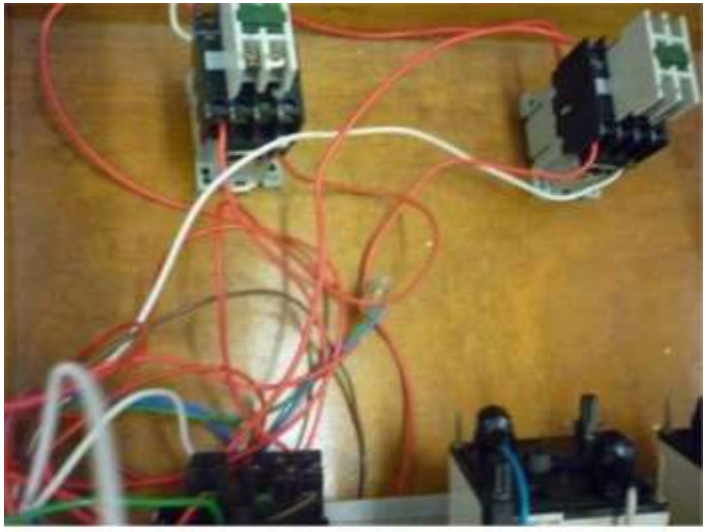
Practical 6





1.7	Tools, equipment and measuring devices needed to carry out the work are obtained and checked for correct operation and safety.

List the tools & materials to perform the following assembly task.





2 Solve single and three phase low voltage machine problems	
2.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2 & 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Students performing in measuring motor voltage, current, frequency , power,. Using various meters such as multi meter, clamp meter, watt meter, Power factor meter are evaluated & assessed.

2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.

Practical tasks 7

You are required to energize the wiring circuit that you have already done on the work board given in the picture. Demonstrate the followings

Isolating the supply
Checking the circuit
Checking the machine
Marking the original assembly.
Use of hand tools
Dismantle and keep the components systematically.
Reassembly.
Safety Checking

2.4 Established methods are used to solve machine problems from measure and calculated values as they apply to single and three-phase low voltage machines.

2.5 Established methods for dealing with unexpected situations are discussed with appropriate person or persons and documented.

2.6 Unexpected situations are dealt with safely and with the approval of an authorised person.

2.7 Problems are solved without damage to machines, circuits, the surrounding environment or services and using sustainable energy practices.

Theory Test Assessment

SAG Sem 2-2016-U Kyaw Naing(Joe)/ ASSESSMENT MAPPING-Sem 2-2016/ G006 Assessment Mapping/

G006.pdf Online Practical Activity Support

Electrical Machine Winding

Practical Demonstration Videos (Youtube)

Coil Winding
http://youtu.be/SQlyjA2w9Rs

Motor Manufacturing
http://youtu.be/uqXfEWscyWk

Motor Winding
http://youtu.be/bFluDsslt98

Removing Motor winding
http://youtu.be/Ps2HBeLvikA

Rewinding the motor
http://youtu.be/iwtYONTQFCk

Three phase Motor Operation
http://youtu.be/mw8i_MLecyY

Transformer Coil Winding
http://youtu.be/u182H2PZvo4

Fitting Motor Winding in motor production factory

http://youtu.be/EoGExBWRUBw

3. Complete and report work activities.

3.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2, 1.3

3.2	Work site is cleaned and made safe in accordance with established procedures.

Observation

House keeping procedure in

Returning the tools and equipments
Cleaning the work place are to be assessed

3.3	Justification for solutions used to solve machine problems is documented.
3.4	Work completion is documented and an appropriate person or persons notified in accordance with established procedures.

EKAS ASsessment

Observation

Students report to completion
Checking of their job
Signing off in supervisor record are to be done.

EKAS Assessment

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons
http://www.mongroupsydney1.com/youtubevideos.htm

Refer Question & Marking Scheme for Tests

EKAS Components	Assessment Tasks
KS01-EG006A Single and three-phase transformers Evidence shall show an understanding of single and three phase transformers to an extent indicated by the following aspects: T1 Transformer construction encompassing: types of lamination style and core construction	Practical 1 to 6 Assignment Theory Test SAG Sem 2-2016-U Kyaw Naing(Joe)/ ASSESSMENT MAPPING-Sem 2-2016/ G006 Assessment Mapping/ G006.pdf

used in single-phase, three phase, double wound, auto transformers and instrument transformers. - identification of different winding styles/types used in transformers. - methods used to insulate low and high voltage transformers. - construction of transformer tanks for distribution transformers. - transformer auxiliary equipment. (Bushings, surge-diverters, tap-changers, hot oil & winding indicators, breather, Buchholz relay and conservator). - function of transformer auxiliary equipment. - types of information stated on transformer nameplates. - application of transformers. - performing basic insulation resistance, continuity and winding identification tests. T2 Transformer operation encompassing: - principles of mutual induction of a transformer. - factors that determine the induced voltage in a transformer winding. - determining the value of a transformers	Youtube practical demonstration videos www.electricaldiploma2013.webs.com **Work performance + Practical Instruction Back up** Click HERE to download practicals http://www.filefactory.com/file/cf88135/n/Practical.zip Refer Electrical Machine Drive Magnetics Practicals The following Youtube Lesson Videos are supplemented to cover all aspects of EKAS Requirements. E029 Lesson 1 Electric motor drive 1 http://youtu.be/IfJVYgfBWlw E029 Lesson 2 Electric motor drive 2 http://youtu.be/ZSmWel8QZlU E029 Lesson 3 Induction motor starting http://youtu.be/9f3RB0vctNk E029 Lesson 4 Density+Friction http://youtu.be/T0W1axM9BPw

secondary voltage and current given one winding's electrical details and turns ratio. - identification of voltage and current components of a phasor diagram for a transformer on no-load. - principles of power transferred from the primary to secondary when a load is connected using a phasor diagram neglecting impedance drops. - selecting transformers for specific application/s. - safety features specified in AS/NZS3000 with respect to transformers and isolating transformers. T3 Transformer losses, efficiency and cooling encompassing: - power losses which occur in a transformer. - tests which allow the power losses of a transformer to be determine. - determination of transformer losses and efficiency using test results. relationship between transformer cooling and rating. - methods used for natural and forced cooling of transformers.	E029 Lesson 5 Linear motion http://youtu.be/9g3FiTq782Q E029 Lesson 6 Force+mass+acceleration http://youtu.be/4YotFs_Ikqo E029 Lesson 7 Acceleration against resistance http://youtu.be/9kkEdKPlXcA E029 Lesson 8 Torque+work+energy http://youtu.be/UdZBeq2BKp0 E029 Lesson 9 Momentum+Impulse http://youtu.be/WdzlLCHjgMU http://youtu.be/yWyXUZ6LooQ E029 Lesson 10 The law of machine http://youtu.be/ntKMZ04wl3E E029 Lesson 11 Stress and strain http://youtu.be/u1LyoKSxOfQ G008+G009 Lesson 1 AC Machine+AC motor control.zip http://youtu.be/fwyx6xSOPIs http://youtu.be/DJ_huMMsVT4 http://youtu.be/pezBHVInm6M G008+G009 Lesson 2 Synchronous

properties of transformer oil. tests conducted on transformer oil. T4 Transformer voltage regulation and percent impedance encompassing: voltage regulation as applicable to a transformer. reasons for voltage variation in the output of a transformer. determine the voltage regulation of a transformer from voltage and percentage impedance values. percentage impedance as applied to transformers. determine the percent impedance by using test results. determine percent impedance of a transformer by calculation. T5 Parallel operation of transformers and transformer auxiliary equipment encompassing: determine polarity markings for an unidentified single phase double wound transformer. need for parallel operation of transformers. conditions/restrictions required before two	machine+DC machine+Transformer.zip http://youtu.be/bwxocSr9ptE http://youtu.be/ohyGNBontLg http://youtu.be/adm0lWJYlyE G012 Lesson 1 Electrical components energy and power.zip http://youtu.be/erWoPZWwqKk G012 Lesson 2 Industrial electrical applications.zip http://youtu.be/fl77efWcWOI G012 Lesson 3 Transformer voltage regulation inductance capacitance.zip http://youtu.be/Lkde-u1m-7k G012 Lesson 4 Multiphase system ac dc motor.zip http://youtu.be/evclHlQ9nlI G012 Lesson 5 Squirrel cage

transformers can be connected in parallel. - connecting transformers in parallel to supply a single load (loading on transformers operating in parallel). - the consequences/effect of an incorrect connection. T6 Auto-transformers and instrument transformers encompassing: - identification of auto-transformers, voltage transformers and current transformers from their winding diagrams. - determining voltage and current in the windings of an auto-transformer by calculation. - advantages and disadvantages of an auto-transformer. - AS/NZS3000 requirements with respect to transformers. - construction of voltage transformers. ratings of voltage transformers. construction of current transformers. ratings of current transformers.	induction motor starting.zip http://youtu.be/1AiP0qwSczo G012 Lesson 6 Wound rotor motor motor construction starter.zip http://youtu.be/6vTtNxToGbY G040 Lesson 1 Power transformer rating 1.zip http://youtu.be/qjWJVQAh_jA G040 Lesson 1 Power transformer rating 2.zip http://youtu.be/JonzO8JD-k4 G040 Lesson 2 Open circuit short circuit test.zip http://youtu.be/Ru-KlKv40OY G040 Lesson 3 Transformer regulation.zip http://youtu.be/t6IZMwMj-B4 **DC Machine and control** G044 Lesson 1 DC Machine

precautionary measures taken to connect and disconnect instrument transformers. connection diagrams for instrument transformers. applications for auto-transformers and instrument transformers. KS02-EG006A Alternating current rotating machines Evidence shall show an understanding of alternating current rotating machines to an extent indicated by the following aspects: T1 Operating Principles of three phase induction motors encompassing: determining circuit operating characteristics by using the right hand (grip) rule for conductors and solenoids and Fleming's left and right hand rules. characteristics of the magnetic field produced by single, two and three-phase windings. speed of rotation of a rotating magnetic field. relationship between the rotor speed, slip and rotor frequency. basic principle of operation of an induction motor. reversing the direction of rotation of a three	Principle.zip http://youtu.be/-jAtAH_Ny94 G044 Lesson 2 DC Winding +Armature reaction.zip http://youtu.be/SYx2SSmMKlE http://youtu.be/YtTPpipiUYI G044 Lesson 3 Factors affecting speed & direction of rotation.zip http://youtu.be/9-7wsKVrhls http://youtu.be/O_uo2H5Rflc http://youtu.be/QaabA5pmB9E

phase induction motor T2 Three phase induction motor construction encompassing: ? basic component parts of a three-phase induction motor. ? types of rotors used in three-phase induction motors. ? connecting three-phase induction motor in both star and delta. ? dismantling three-phase induction motors. ? testing insulation resistance of a three-phase induction motor prior to connection to the supply. ? testing winding resistance (ohmic value and continuity) of a three-phase induction motor prior to connection to the supply T3 Three phase induction motor characteristics encompassing: ? relationship between torque, speed, and power and interpretation of speed/torque curves of induction motors. ? squirrel cage motors operating characteristics conditions necessary for an induction motor to produce maximum torque.	

operating characteristics of an induction motor from name plate information and by measurement. induction motors efficiency and minimum energy performance standards (MEPS). full load efficiency and power factor of induction motors. T4 Single phase motors – split phase encompassing: common types of single phase motor. principles of operation of a split phase induction motor. construction and basic characteristics of a split phase induction motor. applications of split phase induction motors. connecting, running and reversing a split phase induction motor. T5 Single phase motors – capacitor and shaded pole types encompassing: identification of single phase induction motors including capacitor start, capacitor start/capacitor run, permanent split capacitor (PSC) and shaded pole principles of operation of each motor type listed above. operating characteristics and typical applications	

of each motor type listed above. connection and running each type of motor listed. reversing the direction of rotation of each of the capacitor type motors. T6 Single phase motors – universal encompassing: principles of operation of a series universal motor. identification and functions of each of the basic parts of a series universal motor. operating characteristics and typical uses for a series universal motor. connecting, running and reversing a series universal motor. T7 Motor protection encompassing: reasons why motor protection is required. requirements of the AS/NZS3000 Wiring rules with regards to motor protection. types of motor overload protection. operating principles of microtherm devices, thermal and magnetic motor protection devices. electrical features of motor protection HRC fuses. effects of under voltage and over voltage on	

motors and motor circuits. • effects of repetitive starting and/or reversing on motors. • special requirements for motor protection, in high humidity or moist environments, high temperature areas and corrosive atmospheres. • operating principles of phase failure protection. • selecting suitable protective devices for a given motor and starter combination. T8 Three phase synchronous machines- operation principles and construction encompassing: • power transfer diagram of an a.c. synchronous machine. • need for the generation of a sinusoidal waveform. • principles of operation of a synchronous alternator. • principles of operation of a synchronous motor. • principles of operation of an asynchronous generator (induction generator). • identification of main parts of a synchronous alternator/motor. • methods used to provide the excitation of a synchronous alternator/motor.	

block diagram of an alternator voltage regulator. advantages gained by the parallel operation of alternators. starting methods of synchronous motors. T9 Alternators and generators encompassing: effects on the generated voltage of variations in excitation. effects on generated voltage of variations in load. identification of characteristic curves of an alternator. types of prime movers used with single and three phase portable/standby alternators. manual operation of single and three phase portable/standby alternators. ratings of single and three phase portable/standby alternators. applications of single and three phase portable/standby alternators. construction details of single and three phase portable/standby alternators. common faults found in portable/standby alternators.	

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1	X		
1.2	X		
1.3	X		
1.4		X	X
1.5		X	X
1.6	X		
1.7	X		
2.1	X		
2.2	X		
2.3	X		
2.4		X	X
2.5		X	X
2.6	X		
2.7		X	X
3.1	X		
3.2	X		
3.3		X	X
3.4		X	X
EKAS Assessment		X	X

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment		Theory Test Assessment

Cover/ Feedback own record		**ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5

to be presented for audit	Printed documents

ELECTRICAL MACHINES ONLINE REFERENCES

G003+G004+G009Practicals.pdf (12.48MB)

Generator Test.pdf (0.61MB)

MachineRepair3.zip (3.61MB)

G044+7762AC2.zip (5.45MB)

E029 Motor Control 1.zip (13.32MB)

MachineControlCkt2.zip (7.64MB)

8PowerElectronicsDevices.zip (5.6MB)

MachineRepair1.zip (6.25MB)

G044+7762AC1.zip (5.86MB)

Power Transformer+Line-G040.zip (158.78MB)

Elect Machine-G043+G044+G045.zip (118.53MB)

MachineControlCkt1.zip (9.7MB)

MachineControlCkt3.zip (16.13MB)

MachineRepair2.zip (4.64MB)

7MachineDriveSystems.zip (8.36MB)

G040_7762AD_Notes.doc (9.24MB)

E029 Motor Control 2.zip (14.8MB)

G044 Tutorial.doc (4.05MB)

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with G143A Assessment Mapping+Performance+Marking Guide.pdf Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0041 - Develop engineering solution for synchronous machine and control problems		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1.Prepare to developengineering solution for synchronous machine problems	1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures	Q1+2 of G143A Assessment Mapping+Performance+ Marking Guide.pdf Page 1		
	1.2	Established OHS risk control measures and procedures	Q3+4of G143A Assessment Mapping+Performance+ Marking Guide..pdf Page 2		
	1.3	The extent of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.		Practical- Generator Test	
	1.4	Activities are planned to meet scheduled timelines in consultation with others involved in the work. Effective strategies are formed to ensure solution development and implementation is carried out efficiently.		Observation in Practical	
	1.5				Advanced Diploma in Electrical Engineering Exercises Page 208) Q 11, 12
2. Develop engineering solution for synchronous machine problems.	2.1	Established OHS risk control measures and procedures for carrying out the work are followed.	As per 1.1,1.2,1.3		
	2.2	Knowledge of synchronous machine construction, operation, characteristics and applications are applied to developing	Q1 to 6 of G143A Assessment Mapping+Performance+		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		solutions to synchronous machine problems.	Marking Guide.pdf Page 5,6		
	2.3	Parameters, specifications and performance requirements in relation to each machine problem are obtained in accordance with established procedures	As above		
	2.4	Approaches to resolving synchronous machine problems are analysed to provide most effective solutions.	As above		
	2.5	Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.	As above		
3 Test, document and implement engineering solution for synchronous machine problem.	3.1	Solutions to machine problems are tested to determine their effectiveness and modified where necessary.	Q 1 to 6 of Test 3		
	3.2	Adopted solutions are documented including instruction for their implementation that incorporates risk control measure to be followed	Q 1 to 6 of Test 3		
	3.3	Appropriately competent and qualified person(s) required to implement solutions to synchronous machine problems are coordinated in accordance with regulatory requirements and enterprise policy	Q 1 to 6 of Test 3		
	3.4	Justification for solutions used to solve synchronous machine problems is documented for inclusion in work/project development records in accordance with professional	Q 1 to 6 of Test 3		

Add rows to the following table as required

		Performance Evidence	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
Testing generator				Practical	
Measuring Synchronous impedance				Practical	

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Investigating the relation between frequency and voltage generated.		Practical	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 a.c. generators – construction, types and cooling	Advanced Diploma in Electrical Engineering Exercises Page 131) Q 64 to 67		
T2 a.c. generators – operating principles and characteristics	Advanced Diploma in Electrical Engineering Exercises Page 131) Q 68 to 70		
T3 Synchronising a.c. generators			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 79 to 87

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T4 a.c. generators power, torque and efficiency	Advanced Diploma in Electrical Engineering Exercises Page 131) Q 70		
T5 Voltage regulation (AVR)			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 77 to 84
T6 a.c. generator operational stability			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 82 to 85
T7 a.c. generator protection			Advanced Diploma in Electrical Engineering Exercises Page 128) Q57,58
T8 Induction generator			Advanced Diploma in Electrical Engineering Exercises Page 166) Q 64

	Knowledge Evidence		Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T9 Three phase synchronous motors					Advanced Diploma in Electrical Engineering Exercises Page 167) Q 72 to 76

Add rows to the following table as required

	Assessment Conditions		Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources			Test 1, 2, 3	Practical	All assignments

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEG143A Develop engineering solution for synchronous machine

UNIT CAPSTONE ASSESSMENT

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 1 Prepare to developengineering solution for synchronous machine problems

1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.

Q1. Identify safety equipments & signs to be used when you are using fitting & machining



process.

Answers +Marking Guide (2 marks)

Safety glass

Safety glove

Safety shoe

Ear protection

First aids sign

Q2 Write the safety procedure to operate the drilling machine

Answers +Marking Guide (5 marks)

PRE-OPERATIONAL SAFETY CHECKS

Check workspace and walkways to ensure no slip-hazards are present.
Check that the drill chuck guard is in position.
Ensure the chuck key (if used) has been removed from the drill chuck.
Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted).
Follow correct clamping procedures to ensure work is secure.
If the job obstructs the walkway erect a barricade.
Adjust spindle speed to suit drill or cutter diameter.
Faulty equipment must not be used. Immediately report suspect equipment.

OPERATIONAL SAFETY CHECKS

Never leave the Drill Press while it is running.
Before making adjustments or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
Feed downwards at a sufficient rate to keep the drill cutting.
Feed with care as the drill breaks through the underside of the work.
Use a safe working posture (beware of hair catching).

HOUSEKEEPING

Switch off the machine.
Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

Hair/clothing entanglement - rotating spindle/drill
Eye injuries
Flying swarf/chips
Sharp edges & burrs

1.2 Established OHS risk control measures and procedures

Q3 What are the main source of hazards to use the drilling machine?

Answers +Marking Guide (5 marks)

(1) Hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
drawing in or trapping hazards;
entanglement hazards;

shearing hazards;
cutting hazards;
impact hazards;
(2) hazards related to the location of the machine or plant, for example:
- its stability, for instance, whether it could roll or fall over;
(3) hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them.
To prevent the hazards, the above risks are to be identified & eliminated.

Q4.Write WHS Duty of Care Checklist for Managers/Supervisors

Answers +Marking Guide (8 marks)

WHS Duty of Care Checklist for Managers/Supervisors

Familiarise yourself with the organization Work Health & Safety Policy 2016 and Work Health and Safety Procedures to ensure you are aware of your personal responsibility for workplace health and safety (WHS) within your area of delegated authority.

Ensure that the work for which you are responsible is carried out in accordance with the University's WHS risk management steps to safeguard the health, safety and wellbeing of those involved and others who may be affected.

Demonstrate active and visible leadership in WHS risk management. Identify hazards or WHS risks associated with different jobs, tasks and projects and assess the risks to the health and safety of those involved. Conduct this risk identification and assessment in consultation with those involved or affected.

Implement suitable risk controls within agreed timeframes. These may include competency based training, adequate supervision and adoption of safe operating procedures. Choose these risk controls in consultation with those involved or affected.

Inform staff, students and contractors of WHS requirements and expectations, directing them to relevant information and risk control resources available. This may include local WHS induction (refer to the WHS induction checklist), on-the-job instruction and specific WHS training.

Promptly address WHS issues that are brought to your attention in consultation with those involved or affected.

Refer WHS issues that are beyond your control to the relevant manager(s) for their attention, but ensure that interim action is taken to reduce the risks in a practical way.

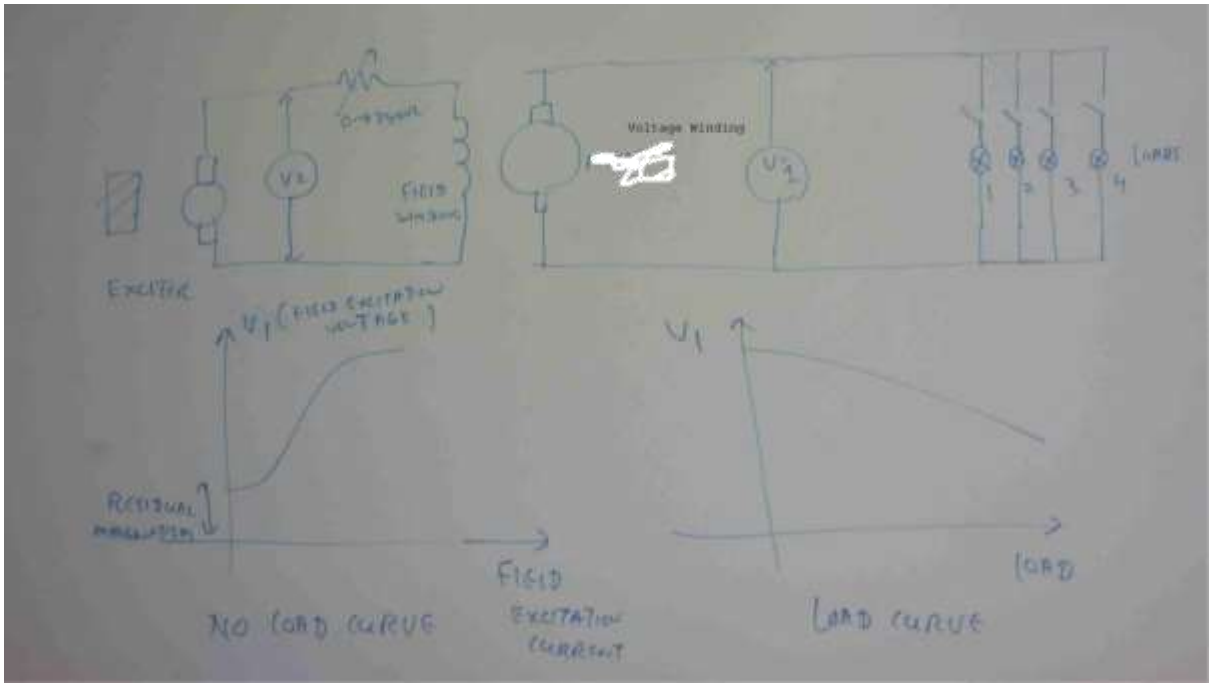
Investigate incidents, seeking to identify the causes and take steps to prevent recurrence.

1.3 The extent of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

The performance characteristics of AC Generator is to be assessed by performing the following practical tasks.

Practical 1-Generator Load Test





In the above circuit, AC Generator is also coupled to motor drive system & its Synchronous characteristics is to be determined.

Students performance in the practical is assessed.

1.4 Activities are planned to meet scheduled timelines in consultation with others involved in

the work.

Students cooperation & performance in the practical is assessed.

1.5 Effective strategies are formed to ensure solution development and implementation is carried out

1.5Effective strategies are formed to ensure solution development and implementation is carried out efficiently.
Ref-Advanced Diploma in Electrical Engineering Exercises Page 208)

(3) Strategy objective

Slide 1+2
Q11.What are the developing of strategies in project?
Q12.How will you examine the effectiveness of activities in project management?

Students co-operation in the practical is evaluated.

2 Develop engineering solution for synchronous machine problems.	
2.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2 & 1.3

2.2 Knowledge of synchronous machine construction, operation, characteristics and applications are applied to developing solutions to synchronous machine problems.

2.3 Parameters, specifications and performance requirements in relation to each machine problem are obtained in accordance with established procedures.

2.4 Approaches to resolving synchronous machine problems are analysed to provide most effective solutions.

2.5 Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.

2.6 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards.

ASSESSMENT

The students' performance in the following questions are to be assessed.

A 400 hp (300KW) , 6600V 60HZ 200 rpm synchronous motor operates at full load at a leading power factor of 0.8. If the synchronous reactance is 11 ohm Calculate the followings

The apparent power of the motor per phase
The ac line current
The value and phase of Ef
(d)Determine the torque angle δ (4 marks)

2. The factory has the following loads.

(i) Two 50 HP 3 phase induction motors PF 0.707 lagging efficiency 90%
(ii) Three 40 KW 3 phase induction motor power factor 0.8 lagging efficiency 95%
(iii) If 1 60 KW 3 phase synchronous motor with efficiency 98% 0.6 pf leading is connected in parallel Calculate total active and reactive power absorbed from the supply and total power factor.

(4 marks)

3. Sketch the connection diagram of synchronous induction motor.

(2 marks)

Describe (i) Auxiliary motor starting (ii) Induction motor starting of a synchronous motor.

(2 marks)

5 .What is significant difference between synchronous motor and induction motor?

(2 marks)

A synchronous capacitor is rated at 160 MVAR 16 KV 1200 rpm 60 HZ. It has a synchronous reactance of 0.8 pu and is connected to a 16 KV line.

Calculate the value of Ef so that the machine

absorb 160 MVAR (b) deliver 120 MVAR

Test, document and implement engineering solution for synchronous machine problem. 3.1

Solutions to machine problems are tested to determine their effectiveness and modified

where necessary.

3.2 Adopted solutions are documented including instruction for their implementation that

incorporates risk control measure to be followed.

3.3 Appropriately competent and qualified person(s) required to implement solutions to synchronous machine problems are coordinated in accordance with regulatory requirements and enterprise policy. (Note)

3.4 Justification for solutions used to solve synchronous machine problems is documented for inclusion in work/project development records in accordance with professional

EKAS Assessment

SAG Sem 2-2016 –U Kyaw Naing (Joe)/ASSESSMENT Mapping –Sem 2-2016/G143+145 Assessment Mapping/G143+145 Tests—Test 3 Q1,Q2,Q3,Q4,Q5,Q6

DELIVERY TO ACHIEVE THE COMPETENCY

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

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&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

Elect Machine-G043+G044+G045.zip

Electrical Machines

AC Machines 1

AC Machines 2

The students will have to answers the following questions

Slide 1+2+3

Q64.Explain the major difference between induction machine and synchronous machine.

Slide 3+4+5+6

Q65.Explain the construction of synchronous machine

Synchronous generator

Slide 1

Q66.Sketch the equivalent circuit , vector diagram and write the voltage equation for synchronous generator.

Slide 2

Q67.Sketch the circuit, vector diagram and write the voltage equation for synchronous motor.

Effect of field excitation

Slide 1+2

Q68.Explain the effect of field excitation on power factor of synchronous motor.

Slide 3+4+5

Q69.A three phase star connected alternator has a resistance of 0.3Ω and a synchronous reactance of 7 Ω per phase. It is excited to give 6.6KV line voltage on open circuit. Determine the internal voltage and per unit voltage regulation on full load current of 150 amp when the load power factor is (a) 0.707 lagging (b) 0.8 leading.

Q70.A 4000 Kw 6.6 KV 50 HZ 250 rpm synchronous motor operates at full load 0.7 leading power factor if the synchronous reactance is 15Ω. Calculate the followings

The apparent power of the motor per phase

The AC line current

The value and phase of Ef

(d) Determine the torque angle δ

Slide 8+9+10

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Q71.A synchronous condenser is rated at 260MVAR 26 KV 1500 rpm, 60HZ. It has a synchronous reactance of 0.8 pu and is connected to 26KV line. Calculate the value of Ef so that the machine (a) absorb 200MVAR (b) deliver 150 MVAR

Oscillation of synchronous machines

Slide 1+2

Q72.A 3000KV three phase 4 poles star connected synchronous machine has resistance and synchronous reactance per phase of 0.3Ω and 2Ω respectively. Calculate the emf and rotor displacement when the machine acts as a motor with input of 700MW and pf 0.9 lagging.

If the field current is required to produce emf / ph equal to rated voltage. Determine also field current for field excitation.

Q73.The factory has the following loads.

3 x 50HP three phase induction motor PF 0.6 lagging , efficiency 85%

4 x 45 Kw three phase induction motor 0.85 pf lagging, efficiency 90%

Calculate total active and reactive power. If one 100KW three phase synchronous motor with 97% efficiency, 0.65 leading pf is connected in parallel, calculate total active and reactive power and power factor.

Slide 6+7+8

Q74.Explain starting methods for synchronous motor.

Slide 9+10

Q75.Compare synchronous motor & induction motor

Slide 11+12 (Single phase motor)

Q76.Explain (a) cross field theory (b) rotating field theory of single phase motor.

Generator control

Slide 1+2

Q77.Explain the control of electric generating system.

Slide 3+4

Q78.Explain voltage regulator.

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Slide 5+6+7

Q79.Explain prime mover & governor

Slide 8+9

Q80.Explain the types of excitations

Slide 10+11

Q81.How will you select the regulator to control generator voltage?

Slide 12+13

Q82.What are the factors affecting voltage stability of generator system?

Slide 14+15

Q83. Sketch remote voltage sensing

system Slide 16

Q84.Explain typical generator instability problem.

Slide 17+18+22+23

Q85.Explain digital excitation system.

Slide 19+20+21

Q86.Sketch generator parallel control system.

Slide 24

Q87.Explain digital voltage regulation system.

Refer Question & Marking Scheme for Tests

EKAS Components	Assessment Tasks
KS01-EG143A Synchronous machine diagnostics Evidence shall show an understanding of developing engineering solutions for synchronous machine problems to an extent indicated by the following aspects: T1 a.c. generators – construction, types and cooling encompassing: construction of stator and rotor windings rotor construction (cylindrical and salient pole) advantages of rotating field construction excitation methods cooling methods	**Youtube Videos for Electrical Engineering Lessons** G043+G045+ G143+145+I145 Page 308 to 329 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf **Induction and synchronous machines & control** G043+G045 Lesson 1 AC Machine Introduction.zip http://youtu.be/-WlfOPhNDn8 G043+G045 Lesson 2 Slip+Equivalent Ckt.zip

prime movers T2 a.c. generators – operating principles and characteristics encompassing: a.c. generator equivalent circuits (synchronous reactance and resistance components) tests – open circuit, short circuit, stator impedance voltage regulation, island generator's terminal voltage load power factor determination of excitation voltage and load angle T3 Synchronising a.c. generators encompassing: conditions for synchronising (infinite bus) methods for synchronising (lamp methods, synchroscope) alternator load sharing, parallel operation T4 a.c. generators power, torque and efficiency encompassing: power input, input torque, speed power losses output power, load power factor, rotor angle, pu power	http://youtu.be/De79cbk2EOQ http://youtu.be/gprZTitiOao G043+G045 Lesson 3 Power Transfer.zip http://youtu.be/pCMcMPBrUEE http://youtu.be/7tJjDuG5SQc http://youtu.be/dV9VFsXeFnY G043+G045 Lesson 4 Test for equivalent ckt.zip http://youtu.be/HF4bJ6vWX2c G043+G045 Lesson 5 Equivalent Ckt Problems.zip http://youtu.be/PyPQsw0L_o0 http://youtu.be/f8VbD_APNfk http://youtu.be/SROLC5hkoc0 G043+G045 Lesson 6 Motor starting and control.zip http://youtu.be/Utfbzs7Ti6M http://youtu.be/VnNlesPgeZk http://youtu.be/AMO70oGS2Fs http://youtu.be/FQVMCMDSTwo G043+G045 Lesson 7 Synchronous machine introduction.zip

efficiency performance chart interpretation T5 Voltage regulation (AVR) encompassing: need for AVR's features of AVR's effects of rotor inductance connections of AVRs operation of AVRs T6 a.c. generator operational stability encompassing: power output, VAR effects, rotor angle, excitation control of VAR (OLTC transformers) voltage dependant nature of stability critical clearance angle of a.c. generator stability limits T7 a.c. generator protection encompassing: restricted, unrestricted primary, back up and duplicated protection overcurrent, short circuit, differential, reverse power, load unbalance, rotor overload, loss-of-field, rotor earth fault, station	http://youtu.be/KM9TJcr2MBk G043+G045 Lesson 8 Synchronous machine ckt problems.zip http://youtu.be/ZGsmZfLiPoc http://youtu.be/bnpYxKtSz1c G043+G045 Lesson 9 Synchronous machine starting.zip http://youtu.be/p4x03LkgBc8 http://youtu.be/yKmNWaxT2Hk G043+G045 Lesson 10 Single phase motor.zip http://youtu.be/9OgmEb0tFpE G043+G045 Lesson 11 Factors affecting motor operation.zip http://youtu.be/sAqyhDlpwwY

earth fault, under frequency protection - external fault protection T8 Induction generator encompassing: - types operating principles, characteristics - excitation methods - losses and efficiency - synchronising and paralleling T9 Three phase synchronous motors encompassing: - construction – rotor, stator, windings - excitation methods - operating principles (equivalent circuits, synchronous impedance) - hunting and stability limits - power factor correction - paralleling and synchronisation techniques - starting methods - braking methods	

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1	X		
1.2	X		
1.3	X	X	
1.4		X	X
1.5		X	X
2.1	X		
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
3.1		X	X
3.2		X	X
3.3		X	X
3.4		X	X
EKAS Assessment		X	X

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		Theory Test Assessment

		ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

ELECTRICAL MACHINES ONLINE REFERENCES

G003+G004+G009Practicals.pdf (12.48MB)

Generator Test.pdf (0.61MB)

MachineRepair3.zip (3.61MB)

G044+7762AC2.zip (5.45MB)

E029 Motor Control 1.zip (13.32MB)

MachineControlCkt2.zip (7.64MB)

8PowerElectronicsDevices.zip (5.6MB)

MachineRepair1.zip (6.25MB)

G044+7762AC1.zip (5.86MB)

Power Transformer+Line-G040.zip (158.78MB)

Elect Machine-G043+G044+G045.zip (118.53MB)

MachineControlCkt1.zip (9.7MB)

MachineControlCkt3.zip (16.13MB)

MachineRepair2.zip (4.64MB)

7MachineDriveSystems.zip (8.36MB)

G040_7762AD_Notes.doc (9.24MB)

E029 Motor Control 2.zip (14.8MB)

G044 Tutorial.doc (4.05MB)

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with G145A Assessment Mapping+Performance+Marking Guide.pdf Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEEEL0043 - Develop engineering solutions for induction machine and control problems		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1.Prepare to developengineering solution for synchronous machine problems	1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures	Test 1 Q1+2 of G145A Assessment Mapping+Performance+ Marking Guide.pdf Page 1		
	1.2	Established OHS risk control measures and procedures	Test 1 Q3+4of G145A Assessment Mapping+Performance+ Marking Guide..pdf Page 2		
	1.3	The extent of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.		Practical 1, 2,3,4 of G145A Assessment Mapping+Performance +Marking Guide.pdf Page 4+5	
	1.4	Activities are planned to meet scheduled timelines in consultation with others involved in the work.		Observation in Practical 1, 2,3,4 of G145A Assessment Mapping+Performance +Marking Guide.pdf Page 4+5	
	1.5	Effective strategies are formed to ensure solution development and implementation is carried out efficiently.			Advanced Diploma in Electrical Engineering Exercises Page 208) Q 11, 12
2. Develop engineering solution for induction	2.1	Established OHS risk control measures and procedures for carrying out the work are followed.	As per 1.1,1.2,1.3		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
machine problems.					
	2.2	Knowledge of induction machine construction, operation, characteristics and applications are applied to developing solutions to synchronous machine problems.	Test 1 Q1 to 12 of G145 A Assessment Mapping+Performance+ Marking Guide.pdf Page 6 to 8		
	2.3	Parameters, specifications and performance requirements in relation to each machine problem are obtained in accordance with established procedures	As above		
	2.4	Approaches to resolving synchronous machine problems are analysed to provide most effective solutions.	As above		
	2.5	Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.	As above		
3 Test, document and implement engineering solution for induction machine problem.	3.1	Solutions to machine problems are tested to determine their effectiveness and modified where necessary.	Q 7 of Test 3 Q 1 to 12 of Test 4		
	3.2	Adopted solutions are documented including instruction for their implementation that incorporates risk control measure to be followed	Q 7 of Test 3 Q 1 to 12 of Test 4		
	3.3	Appropriately competent and qualified person(s) required to implement solutions to synchronous machine problems are coordinated in accordance with regulatory requirements and enterprise policy	Q 7 of Test 3 Q 1 to 12 of Test 4		
	3.4	Justification for solutions used to solve synchronous machine problems is documented for inclusion in work/project development records in accordance with professional	Q 7 of Test 3 Q 1 to 12 of Test 4		

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Three phase motor No Load Test		Practical 1	
Three phase motor speed measurement		Practical 2	
Testing motor winding impedance		Practical 3	
Testing motor winding polarity		Practical 4	
Three phase induction motor winding design diagram			Project 1

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Operating principles of polyphase induction motors	Test 2 Q1 +2 of G145 A Assessment Mapping+ Performance+ Marking Guide.pdf Page 9		
T2 Construction of polyphase induction motors	Test 2 Q 4+5 of G145 A Assessment Mapping+ Performance+ Marking Guide.pdf Page 9		
T3 Speed-torque relationships in induction motors	Test 2 Q 9, 10, 25 of G145 A Assessment Mapping+ Performance+ Marking Guide.pdf Page 10+11		
T4 Induction motor performance testing	Test 2 Q 26+27 of G145 A Assessment Mapping+ Performance+ Marking Guide.pdf Page 12		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T5 Induction motor starters		Refer Practical 6 of UEENEEG006A Direct Online Motor Starter Forward/ Reverse Motor Starter Investigation	Test 2 Q 31+32 of G145 A Assessment Mapping+ Performance+ Marking Guide.pdf Page 13
T6 Reduced voltage starting			Advanced Diploma in Electrical Engineering Exercises Page 164) Q 46 to 51
T7 Speed control of induction motors			Advanced Diploma in Electrical Engineering Exercises Page 165) Q 54, 55, 60
T8 Braking of induction motors			Advanced Diploma in Electrical Engineering Exercises Page 165) Q 54, 55, 60
T9 Motor protection			Advanced Diploma in Electrical Engineering Exercises Page 165) Q 62,63

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T10 Motor selection criteria and RMS rating			Advanced Diploma in Electrical Engineering Exercises Page 171) Q 110 to 123
T12 Single phase induction motors			Advanced Diploma in Electrical Engineering Exercises Page 171) Q 105, 106

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test 1, 2, 3,4	Practical	All assignments+ Project

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEG145A Develop engineering solutions for induction machine

UNIT CAPSTONE ASSESSMENT

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 1 Prepare to developengineering solution for synchronous machine problems

1.1	OHS procedures for a given work area are obtained and understood through established routines and procedures.

Q1. Identify safety equipments & signs to be used when you are using fitting & machining



process.

Answers +Marking Guide (2 marks)

Safety glass

Safety glove

Safety shoe

Ear protection

First aids sign

Q2 Write the safety procedure to operate the drilling machine

Answers +Marking Guide (5 marks)

PRE-OPERATIONAL SAFETY CHECKS

Check workspace and walkways to ensure no slip-hazards are present.
Check that the drill chuck guard is in position.
Ensure the chuck key (if used) has been removed from the drill chuck.
Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop (if fitted).
Follow correct clamping procedures to ensure work is secure.
If the job obstructs the walkway erect a barricade.
Adjust spindle speed to suit drill or cutter diameter.
Faulty equipment must not be used. Immediately report suspect equipment.

OPERATIONAL SAFETY CHECKS

Never leave the Drill Press while it is running.
Before making adjustments or before cleaning swarf accumulations switch off and bring the machine to a complete standstill.
Feed downwards at a sufficient rate to keep the drill cutting.
Feed with care as the drill breaks through the underside of the work.
Use a safe working posture (beware of hair catching).

HOUSEKEEPING

Switch off the machine.
Leave the machine in a safe, clean and tidy state.

POTENTIAL HAZARDS

Hair/clothing entanglement - rotating spindle/drill
Eye injuries
Flying swarf/chips
Sharp edges & burrs

1.2 Established OHS risk control measures and procedures

Q3 What are the main source of hazards to use the drilling machine?

Answers +Marking Guide (5 marks)

(1) Hazards related to the machinery or plant, materials or items being processed or internal sources of energy, for example:
drawing in or trapping hazards;
entanglement hazards;

shearing hazards;
cutting hazards;
impact hazards;
(2) hazards related to the location of the machine or plant, for example:
- its stability, for instance, whether it could roll or fall over;
(3) hazards related to systems of work associated with the machine or plant, for example manual handling injuries caused when putting materials into them.
To prevent the hazards, the above risks are to be identified & eliminated.

Q4.Write WHS Duty of Care Checklist for Managers/Supervisors

Answers +Marking Guide (8 marks)

WHS Duty of Care Checklist for Managers/Supervisors

Familiarise yourself with the organization Work Health & Safety Policy 2016 and Work Health and Safety Procedures to ensure you are aware of your personal responsibility for workplace health and safety (WHS) within your area of delegated authority.

Ensure that the work for which you are responsible is carried out in accordance with the University's WHS risk management steps to safeguard the health, safety and wellbeing of those involved and others who may be affected.

Demonstrate active and visible leadership in WHS risk management. Identify hazards or WHS risks associated with different jobs, tasks and projects and assess the risks to the health and safety of those involved. Conduct this risk identification and assessment in consultation with those involved or affected.

Implement suitable risk controls within agreed timeframes. These may include competency based training, adequate supervision and adoption of safe operating procedures. Choose these risk controls in consultation with those involved or affected.

Inform staff, students and contractors of WHS requirements and expectations, directing them to relevant information and risk control resources available. This may include local WHS induction (refer to the WHS induction checklist), on-the-job instruction and specific WHS training.

Promptly address WHS issues that are brought to your attention in consultation with those involved or affected.

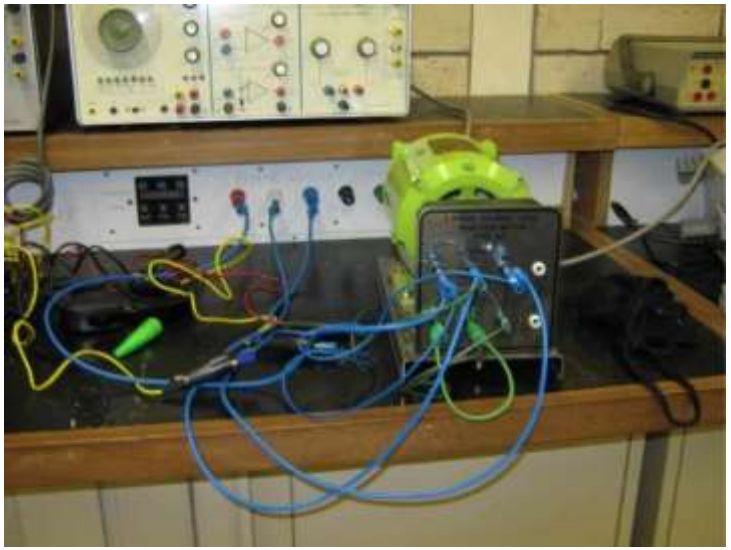
Refer WHS issues that are beyond your control to the relevant manager(s) for their attention, but ensure that interim action is taken to reduce the risks in a practical way.

Investigate incidents, seeking to identify the causes and take steps to prevent recurrence.

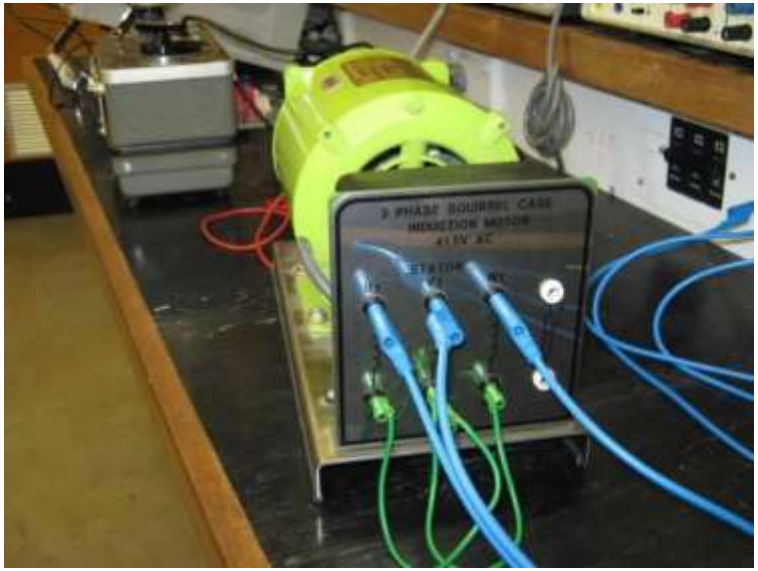
1.3 The extent of the machine problem is obtained from documentation and from work supervisor to establish the scope of work to be undertaken.

The performance characteristics of AC Induction Motors are to be assessed by performing the following practical tasks.

Practical 1-Three phase motor No Load Test



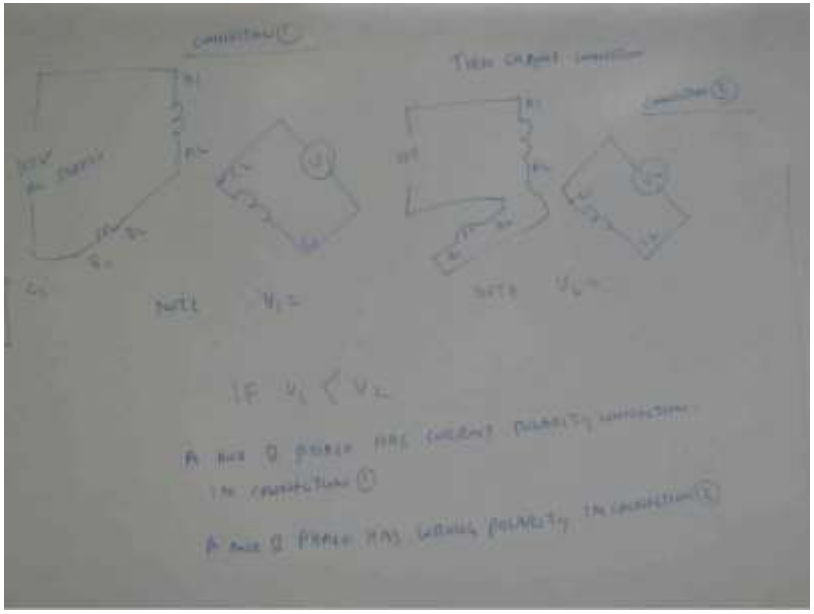
Practical 2 Three phase motor speed measurement



Practical 3 Testing motor winding impedance



Practical 4 Testing motor winding polarity





Students performance in the practical is assessed.

1.4 Activities are planned to meet scheduled timelines in consultation with others involved in

the work.

Students cooperation & performance in the practical is assessed.

1.5 Effective strategies are formed to ensure solution development and implementation is carried out

1.5Effective strategies are formed to ensure solution development and implementation is carried out efficiently.
Ref-Advanced Diploma in Electrical Engineering Exercises Page 208)

(3) Strategy objective

Slide 1+2
Q11.What are the developing of strategies in project?
Q12.How will you examine the effectiveness of activities in project management?

Students co-operation in the practical is evaluated.

2 Develop engineering solution for induction machine problems.	
2.1	Established OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1, 1.2 & 1.3

2.2 Knowledge of induction machine construction, operation, characteristics and applications are applied to developing solutions to synchronous machine problems.

2.3 Parameters, specifications and performance requirements in relation to each machine problem are obtained in accordance with established procedures.

2.4 Approaches to resolving induction machine problems are analysed to provide most effective solutions.

2.5 Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.

2.6 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards.

ASSESSMENT

The students' performance in the following questions are to be assessed.

1. Explain the operation principle of capacitor start motor.

(3 marks)

2. Sketch the vector diagram of capacitor run motor.

(3 marks)

3. Sketch the circuit diagram of capacitor run motor.

(3 marks)

4. How will you reverse the direction of the rotation of single phase motor.

(1 marks)

5. Explain the operation of shaded pole motor.

(3 marks)

A small 60Hz hysteresis clock motor possesses 32 poles. In making one complete turn with respect to the revolving field, the hysteresis loss in the rotor amounts to 0.8J

Calculate (a) The pull in and pull out torques (b) The maximum power out put before the motor stalls (c) The rotor losses when the motor is stalled (d) The rotor losses when the motor runs at synchronous speed.

(4 marks)

State (i) Locked rotor torque (ii) Breakdown torque

Sketch the shaded pole and indicate the direction of rotation.

(3 marks)

8. Sketch the connection of universal motor.

(2 marks)

9. Compare advantages and disadvantages of 1 phase and 3 phase motors.

(2 marks)

10. What are the abnormal operating conditions for AC induction motors.

(2 marks)

A large reel of paper installed at the end of paper machine has a diameter of 1.8 m a length of 5 .6 m and a moment of inertia of 4500 kg-m^2 . It is driven by a directly coupled variable speed dc motor turning at 120rpm. The paper is kept under a constant tension of 6000N.

Calculate the power of the motor when the reel turns at a constant speed of 120 rpm

If the speed has to be raised from 120 rpm to 160 rpm in 5 s , calculate the torque that the motor must develop during this interval.
Calculate the power of the motor after it has reached the desired speed of 160 rpm.
Calculate the power of the motor after it has reached the desired speed of 160 rpm.

(8 marks)

A motor has been idle for several days in an ambient temperature of 19 deg C is found to have a field resistance of 22 ohm. The motor then operates at full load and when temperatures have stabilized, the field resistance is found to be 30 ohm. The corresponding ambient temperature is 24 deg C. If the motor is built with class B insulation.

Calculate the followings

The average temperature of the winding at full load
The full load temperature rise by the resistance method.
Whether the motor meets the temperature standards.

(6 marks)

3 Test, document and implement engineering solution for induction machine problem.

3.1 Solutions to machine problems are tested to determine their effectiveness and modified

where necessary.

3.2 Adopted solutions are documented including instruction for their implementation that

incorporates risk control measure to be followed.

3.3 Appropriately competent and qualified person(s) required to implement solutions to synchronous machine problems are coordinated in accordance with regulatory requirements and enterprise policy. (Note)

3.4 Justification for solutions used to solve synchronous machine problems is documented for inclusion in work/project development records in accordance with professional

EKAS Assessment

DELIVERY TO ACHIEVE THE COMPETENCY

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

Elect Machine-G043+G044+G045.zip

Electrical Machines

AC Machines 1

AC Machines 2

The students will have to answers the following questions

-AC Machine introduction

Slide 1+2+3

Q1.Derive the formula to calculate rotating magnetic field.

Slide 4+5

Q2.Calculate the synchronous speed of a three phase induction motor having 12 poles , 60HZ.

Slide 6

Q3.Explain the starting characteristics of squirrel cage motor.

Slide 7.

Q4.Sketch the construction of squirrel cage induction motor and wound rotor motor.

Slide 8+9+10+11+12

Q5.Design three phase 48 slots 4 poles winding.

Induction motor

Slide 1

Q6.What is distribution

factor? Slide 2

Q7.What is coil span

factor? Slide 3

Q8.How do distribution factor & coil span factor affect the induced emf ?

Slide 4+5

Q9.A 0.7 HP 4 poles induction motor is excited by a single phase 540HZ source is full load speed is

1160 rpm. Calculate the slip.

Slide6+7

Q10.The 4 pole wound rotor induction motor is excited by a three phase 50HZ . Calculate the frequency of the rotor currentunder the following conditions.

At stand still

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Motor turning at 600 rpm in the same direction as the revolving field.

Motor turning at 600 rpm in the opposite direction to the revolving field.

Motor turning at 1800 rpm in the same direction to the revolving field.

Slide 8+9+10

Q11.(a) Calculate the approximate full load current . locked rotor current and no load current of a three phase induction motor having a rating of 600HP, 2400V.

(b)Estimate the apparent power drawn under locked rotor conduction.

State the normal rating of this motor expressed in kilowatt.

---

(3) Motor equivalent circuit.

Slide 1+2

Q12.Sketch the equivalent circuit & equation of induction motor.

---

(4) Wound rotor motor

Slide 1

Q13.Sketch DOL starter

Q14.Write equations for locked rotor current & locked rotor torque.

Slide 2+3+4

Q20.Write the equation for motor current at stand still condition & any slip.

Q21.A 440V 6 poles three phase 50 HZ induction motor has its winding delta connected & its rotor winding star connected. The standstill voltage measured between slip ring with the rotor open circuit 220V. The stator resistance / phase is 0.7 ohm and the stator reactance / phase is 5 ohm. The rotor resistance per phase is 0.07 ohm and rotor reactance per phase is 0.3 ohm. Calculate the rotor current and stator current when slip rings are short circuited to start the motor. Calculate rotor power factor & stator power factor.

Slide 5

Q22.In above problem , calculate rotor current and stator current when slip rings are connected to 5 ohm external resistance and motor is running at 0.04 slip. Slide 6

Q23.Sketch power transfer in induction machine for (a) motor mode (b) generator mode.

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Slide 7+8

Q24.Write the following equations.

Power absorbed by ideal stator winding

Power dissipated in rotor circuit.

Mechanical power

Power dissipated in rotor resistance

Rotor circuit power loss

Power absorbed by ideal stator winding.

Slide 9

Q25.A 400 V 4 poles three phase 60HZ slip ring induction motor has its stator winding delta connected and rotor winding star connected. The standstill voltage measured between slip rings with the rotor open circuited is 220V. The stator resistance per phase is 4 ohm. The rotor resistance per phase is 0.08 ohm and the rotor reactance per phase is 0.35 ohm. Calculate the maximum torque & slip.

---

(5) Torque +Motor test

Slide 1

Q26.Sketch the power flow diagram in motor.

Q27.Write the equation for

Mechanical power developed by rotor

Mechanical power delivered to load.

Mechanical torque.

---

(6) Synchronous speed + Slip + Power of motor

Slide 1

Q28.A three phase induction motor having synchronous speed of 1200 rpm draws 90kw from three phase feeder. Copper loss & iron loss in stator amount to 7kw. If the motor runs at 1140 rpm, calculate the followings.

Active power transmitted to the rotor

Rotor I 2 R loss.

160

Mechanical power developed.

The mechanical power delivered to the load knowing that the windage & friction losses are equal to 1.5 kw.

The efficiency of motor.

Slide 2+3

Q29.A three phase 8 poles squirrel cage induction motor connected to 50Hz line possesses a rotor speed 1000 rpm. The motor absorbs 45kw and the copper & iron losses in the stator to 6 kw & 2 kw respectively. Calculate the torque developed by motor. Slide 3+4

Q30.A three phase induction motor having a nominal rating of 80 kw and synchronous speed of 1800 rpm is connected to 660V source. Two meters method show a total power consumption 80kw and an ammeter indicates a line current 77 amp. Rotor speed is 1750 rpm. The following ratings are obtained. Stator iron loss = 2.5 kw, windage and friction loss = 1.5 kw. Resistance between two

stators = 0.3 ohm.

Calculate (a) Power supplied to the rotor.

(b) Rotor I 2 R loss

(c)Mechanical power supplied to the load

(d)Efficiency

(e)Torque developed at 1750 rpm.

Motor starters

Slide 1+2

Q31.Describe the motor reduced voltage starting

methods. Slide 3+4+5+6

Q32.Sketch DOL starter.

Three phase motor equivalent circuit

Slide 1+2+3

Q33.Explain the tests to determine the equivalent circuit of three phase motor.

Slide 4+5

161

Q34.A no load test conducted on a 50HP 900 rpm 415 V three phase 50HZ squirrel cage induction

motor yield the following results

No load test

No load voltage (L- L) = 415V

No load current = 15 A

No load power = 1450 watt

Resistance measured between two terminals

Locked rotor test

The locked rotor test conducted at reduced voltage gave the following results

Locked voltage (L to L) = 170V

Locked rotor power = 7500w

Locked rotor current = 70A

Determine the equivalent circuit of motor.

Refer Question & Marking Scheme for Tests

EKAS Components	Assessment Tasks
KS01-EG145A Induction machines diagnostics Evidence shall show an understanding of developing engineering solutions for induction motor problems to an extent indicated by the following aspects: T1 Operating principles of polyphase induction motors encompassing:	**Youtube Videos for Electrical Engineering Lessons** G043+G045+ G143+145+I145 Page 308 to 329 of

rotating magnetic field torque slip MMF relationships Leakage fluxes T2 Construction of polyphase induction motors encompassing: squirrel cage motors slip-ring motors construction considerations in minimisation of tooth locking T3 Speed-torque relationships in induction motors encompassing: maximum torque torque – slip relationships squirrel cage rotor types power flow in the motors power distribution torque units slip ring rotors T4 Induction motor performance testing encompassing: no-load test	http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf **Induction and synchronous machines & control** G043+G045 Lesson 1 AC Machine Introduction.zip http://youtu.be/-WlfOPhNDn8 G043+G045 Lesson 2 Slip+Equivalent Ckt.zip http://youtu.be/De79cbk2EOQ http://youtu.be/gprZTitiOao G043+G045 Lesson 3 Power Transfer.zip http://youtu.be/pCMcMPBrUEE http://youtu.be/7tJjDuG5SQc http://youtu.be/dV9VFsXeFnY G043+G045 Lesson 4 Test for equivalent ckt.zip http://youtu.be/HF4bJ6vWX2c G043+G045 Lesson 5 Equivalent Ckt Problems.zip http://youtu.be/PyPQsw0L_o0 http://youtu.be/f8VbD_APNfk http://youtu.be/SROLC5hkoc0 G043+G045 Lesson 6 Motor starting and control.zip

locked rotor tests - development of motor equivalent circuit from test results - analysis of motor performance using circle diagrams T5 Induction motor starters encompassing: - starting requirements - type of starters - starting torque - starting dynamics - static friction - mechanical loads - starting duration T6 Reduced voltage starting encompassing: - starting dynamics - change over conditions - starting duration - acceleration curves T7 Speed control of induction motors encompassing: - constant torque, constant power concepts	http://youtu.be/Utfbzs7Ti6M http://youtu.be/VnNlesPgeZk http://youtu.be/AMO70oGS2Fs http://youtu.be/FQVMCMDSTwo G043+G045 Lesson 7 Synchronous machine introduction.zip http://youtu.be/KM9TJcr2MBk G043+G045 Lesson 8 Synchronous machine ckt problems.zip http://youtu.be/ZGsmZfLiPoc http://youtu.be/bnpYxKtSz1c G043+G045 Lesson 9 Synchronous machine starting.zip http://youtu.be/p4x03LkgBc8 http://youtu.be/yKmNWaxT2Hk G043+G045 Lesson 10 Single phase motor.zip http://youtu.be/9OgmEb0tFpE G043+G045 Lesson 11 Factors affecting motor operation.zip http://youtu.be/sAqyhDlpwwY

torque-flux-voltage relationships rotor resistance control stator impedance control variable frequency control (e.g. PAM, PWM, Flux vector control) T8 Braking of induction motors encompassing: electrical braking systems (plugging, d.c. dynamic, regenerative, capacitor-magnetic) mechanical braking systems (mechanical drum, demag, eddy current) T9 Motor protection encompassing: overload earth fault phase failure T10 Motor selection criteria and RMS rating T11 Induction motor maintenance/repair encompassing: routine maintenance schedules type of repairs (mechanical, electrical) T12 Single phase induction motors encompassing:	

operating principles (especially RMF) construction types speed-torque relationships testing	

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1	X		
1.2	X		
1.3	X	X	
1.4		X	X
1.5		X	X
2.1	X		
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
3.1		X	X
3.2		X	X
3.3		X	X
3.4		X	X
EKAS Assessment		X	X

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		Theory Test Assessment G143 & G145 are assessed concurrently. **ASSESSMENT QUESTIONS IN THE TESTS ARE BASED ON THE QUESTIONS ATTACHED WITH THIS ASSESSMENT MAPPING, BUT IN ACTUAL ASSESSMENT,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME**
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

ELECTRICAL MACHINES ONLINE REFERENCES

G003+G004+G009Practicals.pdf (12.48MB)

Generator Test.pdf (0.61MB)

MachineRepair3.zip (3.61MB)

G044+7762AC2.zip (5.45MB)

E029 Motor Control 1.zip (13.32MB)

MachineControlCkt2.zip (7.64MB)

8PowerElectronicsDevices.zip (5.6MB)

MachineRepair1.zip (6.25MB)

G044+7762AC1.zip (5.86MB)

Power Transformer+Line-G040.zip (158.78MB)

Elect Machine-G043+G044+G045.zip (118.53MB)

MachineControlCkt1.zip (9.7MB)

MachineControlCkt3.zip (16.13MB)

MachineRepair2.zip (4.64MB)

7MachineDriveSystems.zip (8.36MB)

G040_7762AD_Notes.doc (9.24MB)

E029 Motor Control 2.zip (14.8MB)

G044 Tutorial.doc (4.05MB)

Advanced Diploma in Electrical Engineering Exercises

Click HERE

Assessment Mapping - UEENEEI151A Develop, enter and verify word and analogue control programs for programmable logic controllers.

Faculty:		**College:**	
Teaching Section:			
Qualification Number and Name:	Engineering Technology – Electrical		
Unit of Competency Number and Name:	UEEIC0015 - Develop, enter and verify word and analogue control programs for programmable logic controllers		

Elements & Performance Criteria			**Assessment event(s)**		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Workplace Simulations**	**Machine Safety Standards Assignment**	**Theory Test**
1Prepare to develop industrial control systems programs	1.1	OHS procedures for a given work area are identified, obtained and understood through established routines and procedures.	Workplace Sim 1 , repeated in 2 and 3		Section 1 question 9
	1.2	Established OHS risk control measures and procedures are followed in preparation for the work.	Workplace Sim 1 , repeated in 2 and 3		Section 1 question 9
	1.3	Mode of operation of the control system is determined from job specifications of the process/plant/machine to be controlled, and through consultation with appropriate person(s).	Workplace Sim 1 , repeated in 2 and 3		Section 1 question 9
	1.4	Equipment, software and testing devices needed to carry out the work are obtained and checked for correct operation and safety.	Workplace Sim 1 , repeated in 2 and 3		Section 1 question 9
	1.5	Installation of programmable controller is checked for compliance with regulations and job specification.	Workplace Sim 1 , repeated in 2 and 3		Section 1 question 9

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Workplace Simulations**	**Machine Safety Standards Assignment**	**Theory Test**
	1.6	OHS procedures for a given work area are identified, obtained and understood through established routines and procedures.	Workplace Sim 1 , repeated in 2 and 3		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Workplace Simulations**		**Theory Test**
2.Develop and enter and programs for industrial control systems.	2.1	Established OHS risk control measures and procedures for carrying out the work are followed.	Workplace Sim 1 , repeated in 2 and 3		Section 1 question 10 , 12
	2.2	Control solutions are developed and documented based on the operational mode and using acceptable methods for designing control system that contain numeric variables and values.	Workplace Sim 2 and 3		Section 1 question 10 , 12
	2.3	Developed control solution is entered using a personal computer and software applicable to the programmable controller.	Workplace Sim 1 , 2 and 3		Section 2
	2.4	Programming elements are written and used to manipulate word data. (See Note 1)	Workplace Sim 2 and 3		Section1 Q1-6 and 14

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Workplace Simulations**		**Theory Test**
	2.5	Program control values are assigned using applicable numbering systems and codes. (See Note 2)	Workplace Sim 2 and 3	Question1	Section1 Q1-6 and 14
	2.6	Programs are written to read and write analogue signals, both with and without.	Workplace Sim 2 and 3	Question1	
	2.7	Arithmetic functions are used to scale analogue inputs to a specified engineering span.	Workplace Sim 2 and 3	Question1	Section1 Q1-6 and 14
	2.8	Arithmetic functions are used to un-scale an engineering value to drive an analogue output.	Workplace Sim, 2 and 3	Question1	Section1 Q1-6 and 14
	2.9	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.	Workplace Sim 1 , repeated in 2 and 3		

Elements & Performance Criteria				Assessment event(s)	
Element(s)	**PC No**	**Performance Criteria (PC)**	**Workplace Simulations**	**Machine Safety Standards Assignment**	**Theory Test**
3. Monitor, verify and document programming activities.	3.1	Device operation is tested in strict accordance OHS requirements and procedures.	Workplace Sim 1 , 2 and 3		Section 2
	3.2	Entered instructions and settings are tested as meeting those specified for the control mode requirements.	Workplace Sim 1 , 2 and 3		
	3.3	Appropriate methods and tools are used to test and monitor control programs and operating faults, anomalies are identified and rectified. (See Note 3)	Workplace Sim 1 , 2 and 3		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Workplace Simulations**	**Machine Safety Standards Assignment**	**Theory Test**
	3.4	OHS work completion risk control measures and procedures are followed.	Workplace Sim 1 , 2 and 3		
	3.5	Control system specification and program are documented in accordance with established procedures.	Workplace Sim 1 , 2 and 3		

Performance Evidence	Workplace Simulations	Machine Safety Standards Assignment	Theory Test
Developing a control system solution to the required operating functions and parameters.	Workplace Sim 1 , 2 and 3		
Identifying non-compliance conditions of device installation.	Workplace Sim 1 , 2 and 3		
Converting control system to a PLC program.	Workplace Sim 1 , 2 and 3		
Entering programming functions and parameters correctly.	Workplace Sim 1 , 2 and 3		
Transferring programs to a PLC.	Workplace Sim 1 , 2 and 3		
Correcting programming anomalies.	Workplace Sim 1 , 2 and 3		
Testing and verify control system operation.	Workplace Sim 1 , 2 and 3		
Transferring program to external storage.	Workplace Sim 1 , 2 and 3		
Documenting control system and programming clearly.	Workplace Sim 1 , 2 and 3		
Dealing with unplanned events by drawing on required skills and knowledge to provide appropriate solutions incorporated in a holistic assessment with the above listed items.	Workplace Sim 1 , 2 and 3		

Knowledge Evidence	Workplace Simulations		Theory Test
• Software – enter/test /transfer/simulate	Workplace Sim 1 , 2 and 3		Section2

Knowledge Evidence	Workplace Simulations		Theory Test
• Use Jumps / Blocks / Structured Programming	Workplace Sim 1 , 2 and 3		Section1 and 2
• Statement List programming	Workplace Sim 1 , 2 and 3		
• Data manipulation and storage /Data Blocks	Workplace Sim 1 , 2 and 3		Section 2
• Word manipulation – Masking /shifting	Workplace Sim 1 , 2 and 3		Section 2
• Using Functions and re-usable code	Workplace Sim 1 , 2 and 3		Section 2
• Math functions and data manipulation	Workplace Sim 1 , 2 and 3		Section 2
• Indirect Addressing	Workplace Sim 1 , 2 and 3		Section 2
• Analog Value Processing – Scaling , addressing	Workplace Sim 1 , 2 and 3		Section 2
OH&S – Safety / PLC Safety	Workplace Sim 1 , 2 and 3		Section 1 question 10 , 12

Assessment Conditions	Workplace Simulations	Machine Safety Standards Assignment	Theory Test
Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – Evidence shall also comprise: • A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: • Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement • Apply sustainable energy principles and practices as specified in the performance criteria and range statement • Demonstrate an understanding of the required skills and knowledge as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. • Demonstrate an appropriate level of skills enabling employment • Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures	Cover all Practical Applications		Final Assessment of knowledge.

2. Assessors must satisfy NVR/AQTF assessor requirements. (*Insert Hyperlink to evidence*)	

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with K151A Assessment Mapping+Performance .pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	UEERE0012 - Develop effective engineering strategies for energy reduction in buildings		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1.Prepare to develop strategies for effective energy reduction in buildings	1.1	OHS procedures for a given work area are identified, obtained and understood	Q1 of K151A Assessment Mapping+ Performance .pdf (Page 1)		
	1.2	Established OHS risk control measures and procedures are followed in preparation for the work	Q2 of K151A Assessment Mapping+ Performance .pdf (Page 1)		
	1.3	The extent of evaluation is determined from specifications of building(s) and services, plant and machinery and discussed with appropriate personnel	Q1 ,2, 5 of Test 1		
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively with others		Observation Assessment Mapping+ Performance .pdf (Page 2)	
	1.5	Tools, testing devices, and materials needed to carryout the work are obtained and checked for correct operation and safety	Q3, 4 of Test 1		
2 Develop strategies for effective energy reduction in buildings.	2.1	OHS risk control measures and procedures for carrying out the work are followed	Q2 of K151A Assessment Mapping+ Performance .pdf (Page 3)		
	2.2	Tests and measurements are carried out in strict accordance with OHS requirements safety procedures	Q6, 8 of Test 2		
	2.3	In-depth knowledge of the energy use of building services, plant and machinery is applied to the	Q1a of Test 2	**Practical (1)** Measure energy	Advanced Diploma in Electrical

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		evaluation process		usage in the building .	Engineering Exercises (Page 271/272) Q1 to 27
	2.4	Energy evaluation tests are set up in accordance with established test methods and procedures for each particular parameter under scrutiny	Q3,4 of Test 2		Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q62 to 72
	2.5	Strategies to reduce energy use with compromising occupancy standards are developed from knowledge of energy management and evaluation			Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q84 to 102
	2.6	Unexpected situations are dealt with safely and with the approval of an authorised person		Q4 of K151A Assessment Mapping+ Performance .pdf (Page 10)	
	2.7	Evaluation is carried out without damage to systems, circuits, the surrounding environment or services and using sustainable energy practice		Observation – Practical 2 Solar panel installation practical	
3 Document and report strategies for effective energy reduction in buildings	3.1	OHS work completion risk control measures and procedures are followed	As per 1.1 & 1.2		
	3.2	Work site is cleaned and made safe in accordance with established procedures		Observation – Housekeeping Activity	
	3.3	Results of energy use evaluation and recommended strategies			Advanced Diploma

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		and their criterion for energy reduction are documented in accordance with established procedures			in Electrical Engineering Exercises (Page 271/272) Q103 to 115
	3.4	Energy reduction report is forwarded to appropriate persons		Practical 3-Preparing energy reduction plan report	

Add rows to the following table as required

		Performance Evidence	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
Risk assessment in installing solar panel on rooftop			Q1,2 of K151A Assessment Mapping+ Performance .pdf (Page 1)		
Passive solar design, Assessing comfort conditions					Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q1 to 27
Ventilation system design & application of psychrometric chart, Determination of energy usage					Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q62 to 72
Measure energy usage in the building				Practical 1	
Solar panel installation				Practical 2	

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Design for climate, Determining Solar effect & wind condition.			Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q84 to 102
Matching solar panel to load		Q4 of K151A Assessment Mapping+ Performance .pdf (Page 10)	
Energy use evaluation and recommended strategies			Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q103 to 115
Energy reduction report preparation		Practical 3	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Climate and thermal comfort	Test 2 Q6		
T2 Solar geometry and radiation	Test 1 Q2		
T3 Heat transfer	Test 1 Q1 & Q6		
T4 Glazing Systems	Test 1 Q2		
T5 Insulation	Test 1 Q1 & Q5		
T6 Thermal mass	Test 1 Q1 & Q7		
T7 Comfort control strategies	Test 2 Q1a, Q6,Q7		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T8 Energy efficiency in buildings + T11 Energy rating schemes			Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q103 to 115
T10 Integration of active solar system			Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q84 to 102
T12 Sustainable and safe building materials			Advanced Diploma in Electrical Engineering Exercises (Page 271/272) Q56 to 67

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments • Records relating to electrical engineering resources	Test 1+2	Practical 1,2,3	All assignments

Created by (Name)		Date created	

Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UEENEEK151A

Develop effective engineering strategies for energy reduction in buildings

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to develop strategies for effective energy reduction in buildings

1.1 OHS procedures for a given work area are identified, obtained and understood

Q1. To install the solar panel on the roof top, outline the OHS aspects to be concerned.

Marking Guide+Question (4 marks)

Precaution regarding working at height

Precaution against electrocution due to panel terminal

Precaution on insulation & heat resistance to protect heating

Ensure the strength of roof trusses to withstand the weight of equipments and workmen.

1.2 Established OHS risk control measures and procedures are followed in preparation for the work

Q2. List the risk level associated with the tasks in the following table from 1 to 6. 1=The most serious, 6=least serious

Injury caused by falling down from the height	
Electrical fire caused by overheating of solar panels	
No matching of solar panel and inverter	
Electrical interruption when sun set due to lack of battery.	
Equipments damage due to electrical surge	
Appearance of solar panel	

Marking Guide+Question (6 marks)

Injury caused by falling down from the height	1
Electrical fire caused by overheating of solar panels	2
No matching of solar panel and inverter	4
Electrical interruption when sun set due to lack of battery.	6
Equipments damage due to electrical surge	3
Appearance of solar panel	5

1.3 The extent of evaluation is determined from specifications of building(s) and services, plant and machinery and discussed with appropriate personnel
Test 1 Question

Q1+Q2+Q5

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others Observation (10 marks)

The practical tasks will be performed by 2 teams

Duties of team 1

Determine total electrical usage by all electrical equipments in a home

Duties of team 2

Estimate the appropriate size of solar panel to meet the electrical usage

The co-ordination between two teams will be assessed.

1.5 Tools, testing devices, and materials needed to carryout the work are obtained and checked for correct operation and safety

Test 1 Q3+4

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		

Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

2 Develop strategies for effective energy reduction in buildings.

2.1 OHS risk control measures and procedures for carrying out the work are followed

Q3. Match the OHS risk & control activities

Injury caused by falling down from the height	Matching solar panel rating & inverter rating
Electrical fire caused by overheating of solar panels	Fall prevention system is utilized
No matching of solar panel and inverter	Design & arrangement according to plan
Electrical interruption when sun set due to lack of battery.	Installation of back up battery
Equipments damage due to electrical surge	Use of insulators under solar panel & proper air ventilation
Appearance of solar panel	Surge protector is applied

Marking Guide+Question (6 marks)

Injury caused by falling down from the height	Fall prevention system is utilized
Electrical fire caused by overheating of solar panels	Use of insulators under solar panel & proper air ventilation
No matching of solar panel and inverter	Matching solar panel rating & inverter rating
Electrical interruption when sun set due to lack of battery.	Installation of back up battery
Equipments damage due to electrical surge	Surge protector is applied
Appearance of solar panel	Design & arrangement according to plan

2.2 Tests and measurements are carried out in strict accordance with OHS requirements safety procedures

Test 2 Question 6+8

Advanced Diploma in Electrical Engineering Exercises (Page 273)

Solar calculation , thermodynamic principle

Slide 1

Q35.Sketch solar irradiation diagram

Slide 2

Q36.Write the equation to calculate solar irradiation.

2.3 In-depth knowledge of the energy use of building services, plant and machinery is applied to the evaluation process

Test 2 Question 1a

Advanced Diploma in Electrical Engineering Exercises (Page 271/272)

(1)Passive solar design

Q1.What is a active solar system?

Q2.What are micro-climates in Australia?

Slide 2+8

Q3.What is passive solar system design?

Slide 3

Q4.What is thermal mass?

Q5.What are the features of hot humid climate?

Slide 4

Q6.Sketch the building glassing system & how it effects the heating in building?

Slide 5

Q7.Sketch the overview & layout of a building for wind and direct entry

Q8.Sketch direct and indirect sun gain system

Slide 6

Q9.Sketch solar collector.

Slide 7

Q10.Sketch (a0 Air based solar system (b) Water based solar system.

Slide 9+10+11

Q11.What are the factors affecting comfort?

Slide 12+13+14

Q12.Explain psychometric chart.

Slide 15

Q13.Explain (a0 Humidity (b) Relative humidity (c) web bulb temperature (d) Dew point temperature
Slide 16+17

Q14.Sketch the construction of air conditioning system for commercial building
Slide 18+20

272

Q15.Explain the methods for measuring air movement and balancing

Slide 19

Q16.Describe basic building construction with sketches.

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climate and human comfort
Slide 1

Q17.What is comfort?
Slide 2

Q18.Write the equation to calculate heating degree day.

Q19.Sketch wind and flow diagram of world
Slide 3+4

Q20.Describe the feature of (a0 Hot arid zone (b) Temperate
zone Slide 5+6

Q21.How does heat produced in human's body?

Slide 7+8

Q22.What change is required to make the comfort when reactive humidity is too high?

Slide 9

Q23.What is shading coefficient?

Slide 10+11

Q24.Sketch incidence & reflected ray diagram.

Slide 11

Q25.Write the equation for environmental temperature & dry resultant temperature.

Slide 12+13

Q26.Write the equation for thermal neutrality.

Slide 14.

Q27.Write the heat gain values for various types of activities.

2.4 Energy evaluation tests are set up in accordance with established test methods and procedures for each particular parameter under scrutiny
Advanced Diploma in Electrical Engineering Exercises (Page 277/278)

Test 2 Question ¾

Ventilation, application of psychrometric chart
Slide 1

Q62.Explain ventilation
Slide 2+3+4+5+6

Q63.Describe air velocity and air volume

Q64.What are the systems of ventilation ? sketch the
diagrams. Slide 7+8

Q65.Sketch air ventilation system for multi storey building.
Slide 9

Q66.Describe the application of psychrometric
chart. Slide 10+11+13+14

Q67.In winter, air at dry bulb temperature of 66°C & 70% RH enters the building through a heating battery. It is heated to dry bulb temperature of 25°C without adding moisture from psychrometric chart. Find

(a) Wet bulb temperature of incoming air

(b) Relative humidity of heated air.

Q68.In Summer, air at dry bulb temperature of 27°C and wet bulb temperature 20°C enters the building through a cooling coil. It is cooled to dry bulb temperature of 19°C

Find

(a) Relative humidity of incoming air

(b) Relative humidity of supply air after cooling.

Q69.The air in a room has a dry bulb temperature of 23°C. Find (a) The relative humidity of air (b) The temperature of walls when condensation occurs.

Q70.Air enters the plant at a dry bulb temperature of 24°C and 80% RH & is required to be cooled to dry bulb temperature of 19°C & 60% RH. Find (a) the temperature of air in washer (b) the reduction in moisture content of supply air.

Slide 16+17+18+19+20

Q71.(a) Calculate heat gain per day from the customers in a 200 m 2 gym, If the gym capacity is 60 customers and the gym is full between 6 am to 8 am and 5 pm to 8:30 pm. At all other times, it is 30% full on average.

Calculate heating contributions from all the appliances in a communal house containing 8 people. The house has one electric hot water system for two bath rooms, 6 bed rooms and one all electric kitchen. One TV, seven music systems, two computers and twenty lights. Assume that the house uses 32 kwh per day and the hot water is 45% of the load. The cooker consumes 20% of the load and 20% of heat generated by cooker is vented outside by the range hood.

In above (b) would it make any difference if the water heater was located outside the building?

What would be the heat gain per month if the cooker in (b) uses bottle gas (Gas is 45MJ/Kg and the house uses 0.5 kg/ day?

The table below lists the power consumption of the appliances used in the house and the hours per day for which they are used. Calculate heat gain from appliances per month.

Appliance Power (watt) Daily usage per appliance (hr)
TV 50 15

Music system 45 3

Computer 100 13

Printer 20 1 Lights

80 2

(7)Thermal mass, centralised air conditioner, cooling load
Slide 1

278

Q72.What are the materials that can be used as thermal mass . Explain the installation method of them.

2.5 Strategies to reduce energy use with compromising occupancy standards are developed from knowledge of energy management and evaluation

Advanced Diploma in Electrical Engineering Exercises (Page 279/280)

Activity

Measure energy usage in the building .

After having applied the energy saving process, compare the energy usage and submit the report.

Test 2 Q 1b

Building service energy management
Slide 1

Q84.Explain building service energy management
system. Slide 2

Q85.Write electricity & oil gas energy unit calculation formula
Slide 3+4

Q86.Compare building load sources

Q87.Express factors influencing room load.

Q88.What are fresh air requirements for various types working
spaces. Slide 5

Q89.Sketch fresh air supply system.
Slide 6

Q90.What are the factors affecting building energy
Slide 7 to 15

Q91.Sketch building water supply system and pipe fitting
Slide 10+11

Q92.Sketch hot water system.

Design for climate

Slide 1 to 4

Q93.What are the principles of design for climate?

Slide 5+6

Q94.Explain how to achieve thermal comfort inside building.

280

(12)Air movement

Slide 1

Q95.Explain air movement to get comfort.

Slide 2

Q96.What is evaporative cooling?

Slide 3

Q97.What are the ways of designing the building for Australian climate?

Solar effect & wind condition.
Slide 1

Q98.Explain the features of temperate climate & typical home construction method.
Slide 2

Q99.Explain hot arid climate & home construction method.
Slide 3

Q100.Explain hot humid climate & home construction method.
Slide 4

Q101.Sketch diagram for home to access the
wind. Slide 5

Q102.Write the equation to calculate ventilation.

2.6 Unexpected situations are dealt with safely and with the approval of an authorised person

Q4. If the voltage rating of available solar panel can not exactly match the required voltage level, what will you do?

Marking Guide+Question (2 marks)

Connect series/ parallel to get the most appropriate voltage.

Determine appropriate inverter & step up step down transformer.

2.7 Evaluation is carried out without damage to systems, circuits, the surrounding environment or services and using sustainable energy practice

Observation

Observe students fabrication of solar panel design & connection

Work performance + Practical Instruction Back up

Click HERE to download practicals

- Refer Solar & Renewable Energy Practicals

Location of Evidences (Table 1)

3 Document and report strategies for effective energy reduction in buildings

3.1 OHS work completion risk control measures and procedures are followed

As per 1.1 & 1.2

3.2 Work site is cleaned and made safe in accordance with established procedures

Observation

Students activity in house keeping after the practical task is observed & evaluated.

3.3 Results of energy use evaluation and recommended strategies and their criterion for energy reduction are documented in accordance with established procedures

Advanced Diploma in Electrical Engineering Exercises (Page 280)

After having applied the energy saving process, compare the energy usage and prepare the comparison chart

HVAC

Slide 1

Q103.What are the housekeeping check lists for HVAC system?
Slide 2+3

Q104.Explain the energy efficient operation of air-conditioning system.
Slide 4 to 8

Q105.Execute the building survey activities as described in slide 4+5
281

Q106.What are the building survey procedures for domestic and commercial buildings?

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(15) Solar hot water
system Slide 1+2

Q107.Sketch solar hot water system.
Slide 3

Q108.Sketch the construction and connection of solar absorber
plates Slide 4

Q109.Describe (a) Collector surface coating (b) Heat transfer medium (c) Insulation (d) Capacity of storage tank (e) Hot water temperature of solar hot water system.

Slide 5

Q110.Sketch connection of collector and storage
tank. Slide 6

Q111.Sketch the hydraulic circuit of solar water.

Slide 7

Q112.Sketch the electrical circuit for solar water heating system.

Slide 8+9

Q113.Describe installation , orientation & sizing of solar collector system.

Slide 10

Q114.Sketch solar assisted heat pump.

Slide 11

Q115.Explain lighting management for commercial building

3.4 Energy reduction report is forwarded to appropriate persons

Observation

After having applied the energy saving process, compare the energy usage and prepare the comparison chart to be included in the report Presentation & assessment.

The students will need to provide the conclusion on the idea regarding the further energy reduction plan. The conclusion is assessed.

EKAS	Delivery & assessment System
KS01-EK151A Energy efficient building design Evidence shall show an understanding of energy efficient building design to an extent indicated by the following aspects: T1 Climate and thermal comfort encompassing: characteristics of the different Australian climatic types. use of climatic data in published and electronic forms to extract the quantities relevant to energy efficient design. relationship between climate and comfort using bioclimatic or psychrometric charts. calculation of heating or cooling degree days or degree hours for various locations. calculation of thermal neutrality for a given	Record2016/Students/TAFE/Sem 1-2016/Sem1 2016 Students work Assessment 1/K151 Assessment 2 /Question Marking scheme Building Design+Material Science-K041+E047.zip Energy Efficient Building Design K041 Lesson 1-Solar Design.zip http://youtu.be/KF3jT7Wm60I K041 Lesson 2-Basic psychrometric chart.zip http://youtu.be/iVU9d2OrN_c K041 Lesson 3-Total heat resistance.zip

location. T2 Solar geometry and radiation encompassing: - definition of the terms: declination, hour angle, zenith angle, azimuth and altitude angles, the equation of time. - conversion of solar time to local time and vice versa. - position of the sun and the length of shadows with the aid of algorithms, tables, sun charts or computer software. - daily irradiation incident on a wall, window or roof of a given tilt and orientation. - relative summer and winter irradiation of windows facing the cardinal orientations. T3 Heat transfer encompassing: - thermal processes of conduction, convection and radiation apply to the transfer of heat in buildings. - calculation of the summer and winter U-values of building elements using tables and software. - calculation of the infiltration heat transfer in a building. T4 Glazing Systems encompassing: - different types of glazing systems and their characteristics. - different types of shading devices and the window orientations for which they are most appropriate. - solar heat gain for different glazing types and	http://youtu.be/QEC3CFN0C0A K041 Lesson 4-U value Heat conductance calculation.zip http://youtu.be/qJWiSnYVYwI K041 Lesson 5-Glazing+Net Heat gain heat loss.zip http://youtu.be/az4jFnDn4eQ K041 Lesson 6-Shading.zip http://youtu.be/srTWLtaPpgg K041 Lesson 7-Insulation+ Thermal mass.zip http://youtu.be/T8D_KeXhB2Q http://youtu.be/Ws5H152tgEo K041 Lesson 8-Thermal mass insulation.zip http://youtu.be/R5Qv2EFjUVU K041 Lesson 9-Airconditioning load calculation.zip http://youtu.be/KrHJkNwbr0I http://youtu.be/mxP4thaiS88 K041 Lesson 10-Heat gain per day.zip http://youtu.be/X5B99-Q6ddU

angles of incidence - calculation of the average daily irradiation of a window partly shaded by eaves, using computer software. - calculation of the average daily heat gain through a window partly shaded by eaves. T5 Insulation encompassing: - different types of insulation and where they are used. - how different types of insulation are installed in roofs, walls and floors. - determination of the minimum R-values of roof insulation for different locations using Australian Standard AS2627 or similar standards. T6 Thermal mass encompassing: - advantages and disadvantages of using substantial thermal mass in different climate types and for different heating and cooling regimes. - where thermal mass can be located in a building. - explain what is meant by the following terms: time lag, decrement factor, admittance, response factor. T7 Comfort control strategies encompassing: - interpretation of the usefulness of a design strategy with the aid of a psychrometric chart showing control	K041 Lesson 11-Ventilation.zip http://youtu.be/LdCEptDVMlY K041 Lesson 12-Building heating load http://youtu.be/VDHl1YbcX3c http://youtu.be/FH1bPDCuLD0 K041 Lesson 13-Design Assessment Tools K041 Lesson 14-Design for Australian climate.zip http://youtu.be/6Vhv5H4Wfps K041 Lesson 15-Domestic solar hot water system.zip http://youtu.be/JCgxvzX5jHY http://youtu.be/j5bfWGOS_zA K041 Lesson 16-Energy efficiency+Lighting.zip http://youtu.be/CVvXJj28pcg K041 Lesson 17-Illumination+Smoke alarm.zip http://youtu.be/piMwahVLYhw http://youtu.be/JBvzyR-_GzA

potential zones for a particular location. - selection of the most useful comfort control strategies for Australian climatic regions. T8 Energy efficiency in buildings encompassing: - determination of the direction of the following: both true and magnetic, north winter and summer sunrise, winter and summer sunset. - solar access in summer and winter to various possible house locations on a site and room locations within the house. - how vegetation can be used to both funnel and deflect wind. - using cross ventilation as a cooling strategy. T9 Thermal performance of a building encompassing: - heating requirements of a building using the heating degree day or hour method. - dynamic performance predicted by a computer simulation program such as NatHERS or BERS. T10 Integration of active solar systems encompassing: - active solar system types available which can provide hot water, space heating and cooling. - the best location on the roof, and the optimum tilt and orientation of the collector panels. - function of the main components of an air or	K041_Lesson_18-Water_supply.zip http://youtu.be/-A96eIUfsNU K041_Lesson_19-Ventilation+Lighting_control.zip http://youtu.be/CO0ClnAFT6A K041_Lesson_20-Electrical_system_design.zip http://youtu.be/KX7E_Nc7_54 K041_Lesson_21-Building_materials.zip http://youtu.be/Gi77wNzXEj4 http://youtu.be/ZkgOHP0RESs http://youtu.be/C6sxFVofvkE http://youtu.be/8BcUJ7BDKlI http://youtu.be/ap0iMZ_Z9Qs

water-based solar space heating system. ? schematic of the fluid circuit of an air or water- based space heating system. ? main solar cooling system types. T11 Energy rating schemes encompassing: ? differences in approach used by house energy rating schemes in Australia. ? energy performance of a number of houses using a computer simulation program such as NatHERS or BERS. other methods to reduce energy consumption within and outside a building including appliance efficiency, human behaviour changes, building management strategies and transportation minimisation. ? additional cost of energy efficiency measures and cost savings using life cycle cost or simple pay back methods according to Aust. Standard AS3595 and AS4536. T12 Sustainable and safe building materials encompassing: ? common building materials and their embodied energy content. ? environmental impact of the production of various building materials. ? problems associated with the use or disposal of building	

materials.	

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	
Marking Guide to be presented for audit		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents
Students' work to be presented for		In attached USB/DVD/CD Attached Some documents in team share UEE11-1.5 Printed documents

audit	

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4	X		
1.5		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5	X	X	X
2.6	X		
2.7	X		
3.1	X	X	
3.2	X		
3.3		X	X
3.4		X	X
EKAS Assessment		X	X

Energy Efficiency References

Advanced Diploma in Electrical Engineering

Exercises Click HERE

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with IS67 assessment Mapping.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	**UETTDRIS67A Solve problems in energy supply network equipment and systems**		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve problems in energy supply network nequipment	1.1	OHS procedures for a given work area are identified, obtained and understood	Q1,2,3 of IS67 assessment Mapping.pdf Page 2		
	1.2	OHS risk control measures and procedures in preparation for the work are followed	Q4,5,6,7 of IS67 assessment Mapping.pdf Page 2		
	1.3	The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)	Q8 of IS67 assessment Mapping.pdf Page 2		
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.	Q9 to 12 of IS67 assessment Mapping.pdf Page 3		
	1.5	Sources of materials that may be required for the work are established in accordance with established procedures.			Advanced Diploma in Electrical Engineering Exercises Page 119) Q8 to 11
	1.6	Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.			Advanced Diploma in Electrical Engineering Exercises Page 119) Q18 to 23

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
2.Solve problems in energy supply network equipment.	2.1	OHS risk control measures and procedures for carrying out the work are followed.	As per 1 .1, 1.2, 1.3		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.			Advanced Diploma in Electrical Engineering Exercises Page 119) Q28 to 30
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures	As per 1.3		
	2.4	Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.	As per 1.3		
	2.5	Problem solving is approached methodically drawing on knowledge of energy network equipment using measured and calculated values of circuit/apparatus parameters.	Electrical Diastribution Test 1 Q 1 to 13	Practical EP1 to 8+ Ep19 to 23	
	2.12	Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices	Electrical Diastribution Test 1 Q 1 to 5	Practical EP1 to 8+ Ep19 to 23	
	2.6	Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage		Practical EP1 to 8+ Ep19 to 23	Advanced Diploma in Electrical Engineering Exercises Page 119) Q31 to 32

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	2.7	Circuits/components are rechecked and their operational status is confirmed.			Advanced Diploma in Electrical Engineering Exercises Page 119) Q40 to 42
	2.8	Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.		Practical EP1 to 8+ Ep19 to 23	Advanced Diploma in Electrical Engineering Exercises Page 119) Q18 to 21
	2.9	Effectiveness of the repair is tested in accordance with established procedures.		Practical EP1 to 8+ Ep19 to 23	As above
	2.10	Apparatus is reassembled, finally tested and prepared for return to service.			As above
	2.11	Unexpected situations are dealt with safely and with the approval of an authorised person.	As Per 1.3		
	2.12	Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable	As Per 2.5		
3.Completion and report for problem solving in energy supply network equipment	3.1	OHS work completion risk control measures and procedures are followed.	As Per 1.3		
	3.2	Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.		Transmission Line Design Project	
	3.3	Maintenance work activities are documented in accordance with established procedures.		Transmission Line Design Project	

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Receiving end voltage comparison between short/ medium and long transmission lines		EP1	
Long transmission line PI equivalent circuit		EP2	
Long transmission line T equivalent circuit		EP3	
Transmission line efficiency/ Transformer effect on line efficiency		EP4	
Reactive power and power factor improvement		EP5	
PF effect on line current		EP6	
Corona Video		EP7	
Phase sequence measurement		EP8	
Underground cable capacitance test		EP19	
High tension line design		EP20	
Line insulator test & capacitance grading		EP21	
Voltage profile chart of distribution system		EP22	
Load centre-Power loss comparison		EP23	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Generation	Test 1 Q 1,5 Test 3 Q 1,2,3		
T2 Transmission	Test 1 Q 2,3,4 Test 3 Q 4,5,6		
T3 Distribution	Test 1 Q 3,6,7,9 Test 3 Q 8,9,10		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T7 Voltage problems			Advanced Diploma in Electrical Engineering Exercises Page 119) Q333, 34
T9 Control of OLTC encompassing			Advanced Diploma in Electrical Engineering Exercises Page 123) Q 1 to 4
T10 Power distribution system faults			Advanced Diploma in Electrical Engineering Exercises Page 199) Q 21 to Q25
T11 Voltage surges in a power distribution system			Advanced Diploma in Electrical Engineering Exercises Page 199) Q 13 to Q 17
T12 Metering and metered quantities		EP10	
T13 Energy and demand meters encompassing:			Online Research Assignment
T5 Overhead and underground systems	Test 2 Q 1 to 5		
T6 Power distribution system electrical characteristics	Test 1 Q 3,4,10,13 Test 3 Q 1,2		
T8 Voltage regulation	Test 3 Q 11		

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
<Insert Assessment conditions >	**Insert question number/task skill number/evidence**	**Insert question number/task skill number/evidence**	**Insert question number/task skill number/evidence**

	from assessment tool that address the specific, assessment conditions	from assessment tool that address the specific, assessment conditions	from assessment tool that address the specific, assessment conditions
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test 1,2,3	Practical EP1 to 8+ Ep19 to 23	Design Assignment & Theory Assignments

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UETTDRIS67A Solve problems in energy supply network equipment and systems ONLINE
RESOURCES ARE SUPPORTED THE STUDENTS TO ACQUIRE THE COMPETENCIES

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve problems in energy supply network nequipment

1.1 OHS procedures for a given work area are identified, obtained and understood

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q15+16

www.electricaldiploma2013.webs.com Then access Click **HERE** to download the Exercises
http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf
Relevant Instruction Lessons

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons
http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22

Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q11.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.5 Sources of materials that may be required for the work are established in accordance with established procedures.

Submit the following assignment questions

Ref-Advanced Diploma in Electrical Engineering Exercises Page 119)

Pole & line installation technique

Slide 1

Q8.Describe pole and line installation techniques.

Q9.Sketch line profile diagram.

Slide 2

Q10.What are the requirement for line planning?

Q11.What are the scales to be utilized for preparing line design drawing.

1.6 Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 120)

Slide 5

Q18.Write down the methods and requirement for staying of pole and support.

Slide 6

Q19.Sketch the diagram for essential components of staying pole.

Slide 7

Q20.What are the requirement of conductor size and separation of conductors?

Slide 8

Q21.Show the table for span & spacing relationship

Slide 9

Q22.Do the review question exercises.

Slide 10

Q23.What are the methods to reduce the stress in UG cable?

Line survey & line design

Study slides 1 to 14 and perform the given line design.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		

		Assessment Feedback Sheet
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

2 Solve problems in energy supply network equipment.

2.1 OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 121)

UG cable capacitances, testing , connection
Slide 1+2

Q28.Sketch the UG cable & indicate capacitance . Express the equation to calculate capacitance.
Slide 3+4

Q29.A single core 66KV cable has a conductor diameter of 2.5 cm and sheath inside diameter 6 cm. Find the maximum stress if two inter-sheaths are used. .Find the best position. The maximum stress & the voltage on inter sheaths.
Slide 5

Q30.In testing of UG cable , conductor 2 & 3 are connected . By measurement of capacitance between conductor 1 and 2-3 combination is 7 µF. When all conductors are connected, the measured capacitance is 5 µF. Calculate the capacitance between conductors & the capacitance between conductor & sheath

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

2.4 Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.

As per 1.3

2.5 Problem solving is approached methodically drawing on knowledge of energy network equipment using measured and calculated values of circuit/apparatus parameters.

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

	Assessment Method	Question
EKAS Topics T1 Generation encompassing: primary energy sources power stations power station output acts and legislation relating to generation renewable energy sources and techniques T2 Transmission encompassing: system requirements principal components of a power system voltage levels grid systems acts/legislation relating to transmission future trends T3 Distribution encompassing: high voltage distribution systems medium/low voltage distribution systems radial feeders parallel feeders ring main feeders acts/legislation relating to distribution T4 Substations encompassing: purpose location layout	Multiple choice/short answer questions	**<u>Electrical Distribution (Test 1)</u>** (20 marks) 1. Name the factors that are used in the selection for overhead line conductors 2 marks 2. Name six commonly used materials for overhead line 2 marks 3. Name the three factors that determine conductor current rating 2 marks 4. What are the factors that determine the maximum conductor temperature? 2 marks 5. Sketch and explain the advantages and disadvantages of the followings Radial feeder, ring feeder, parallel feeder 2 marks 6. A crossarm is listed as 2.7P/16/100x100. Describe the meaning of each term in the list. 1 mark 7. Describe the three common types of insulators used in the distribution system

T7 Voltage problems in a power distribution system encompassing:

8.Describe the use of arcing horns.

2 marks

1 mark

low voltage unbalanced voltages voltage rises T8 Voltage regulation encompassing: autotransformers with OLTC transformers with OLTC static capacitors load control T9 Control of OLTC encompassing: regulation relays control circuits line drop compensation T10 Power distribution system faults encompassing: type/classification of fault typical causes/effects of faults three-phase symmetrical fault levels fault level limitation T11 Voltage surges in a power distribution system encompassing: lightning surges switching surges typical surge levels surge impedance, typical values significance of the system surge impedance. T12 Metering and metered quantities encompassing: purpose energy maximum demand accuracy classes for metering systems T13 Energy and demand meters encompassing:		9. Brifely explain the following pin insulator designations APL33/920 SLP 11/180 2 marks 10. The conductor to be erected over a 160m span has an equivalent weight of 4N/m diameter of 12mm and ultimate tensile strength of 33KN Determine the sag which must be provided on erection if it is desired to allow for wind loading of 500pa and safety factor of 3.5 2 marks 12. Illustrate by mean of a sketch, the method of terminating the line giving dimensions where possible. 1 mark 13. Percentage of the ultimate strength of various parts of overhead line Steel ---% Wood_____% Stay wire/Insulator_____% 1 marks

T5 Overhead and underground systems encompassing: REQUIRED SKILLS AND KNOWLEDGE applications planning installation T6 Power distribution system electrical characteristics encompassing: transmission and distribution systems inductance, capacitance and resistance T8 Voltage regulation encompassing: autotransformers with OLTC transformers with OLTC static capacitors load control	Multiple choice questions Short answer questions Practical testing of cables	**Electrical Distribution (Test 2)** **Total marks- 20** What are the factors that determine the current rating of a cable? 3 marks (2) How will you reduce the stress on electrical cable? 3 marks A single core 66KV cable has a conductor diameter of 2 cm and a sheath of inside diameter 5.3cm. Find the maximum stresses . If two inter sheaths are used. Find the best positions, the maximum stresses and the voltage on inter sheath. 5 marks In testing of a UG cable, conductor 2 & 3 are connected, by measurement of capacitance between conductor 1 and 2-3 combination it is 6 micro farad. When all conductors are connected, the measured capacitance is 4 micro farad Calculate the capacitance between conductors and the capacitance between conductor and sheath 5 marks (5) Explain the methods applied to find the fault in UG cable

		4 marks
T1 Generation encompassing: **primary energy sources** **power stations** **power station output** **acts and legislation relating to generation** **renewable energy sources and techniques** **T2 Transmission encompassing:** **system requirements** **principal components of a power system** **voltage levels** **grid systems** **acts/legislation relating to transmission** **future trends** **T3 Distribution encompassing:** **high voltage distribution systems** **medium/low voltage distribution systems** **radial feeders** **parallel feeders** **ring main feeders** **acts/legislation relating to distribution**	Short answer questions Multiple choice questions Voltage profile design assignment	**Electrical Distribution (Test 3)** **Total marks - 40** Question (1) Draw a block diagram of a power system from generation to utilization and on it show typical voltages. 2 marks Question (2) Sketch a radial feeder arrangement and state it's advantages and disadvantages. 2 marks Question (3) Explain the term joint use agreement as applied to poles in a distribution system. 2 marks Question (4) Outline a maintenance programme suitable to use by a distribution authority to ensure safety and reliability of poles used on it's system. 3 marks Question (5) Where are pole stays likely to be used on an overhead line? List the essential components for the staying of a pole. 3 marks Question (6)

		An underground cable is designed: 11KV 500 AL3 PHL SWZ. Give a full description of cable make up. 2 marks Question (7) A 3 phase load of 200KVA 50Hz is to have its power factor improved from 0.75 to 0.9. Calculate the size of capacitor bank required if the supply voltage is 415V. Sketch the connection. 3 marks Question (8) A transformer supplies a group of four feeders which have individual maximum demands of 2.5, 2.4, 4.3 and 1.6 MVA. If the diversity factor of the system is 1.82 determine the maximum demand on the transformer. 3 marks Question (9) The conductor to be erected over a 160 m span has an equivalent weight of 4 N/m, diameter of 12 mm and ultimate tensile strength of 33KN. Determine the sag which must be provided on erection if it is desired to allow for wind loading of 500 Pa and safety 3.5. 4 marks Question (10) A 3 phase , 11kV overhead rural line is to be erected between points A and B. The route of the wooden pole line is straight and the soil resistance to movement is good. Standard pin insulators on single wooden crossarms form part of the line

insulation.

Nominate the ground clearance you would recommend and indicate details relating to this decision

The maximum conductor design sag has been set at 1.0m. Indicate a suitable pole planting depth and determine the total length of pole.

If the termination poles are located at A and B, what would be the most economical number of poles for the power line of 3.0 km in length? Details of the conductor to be used are shown below:

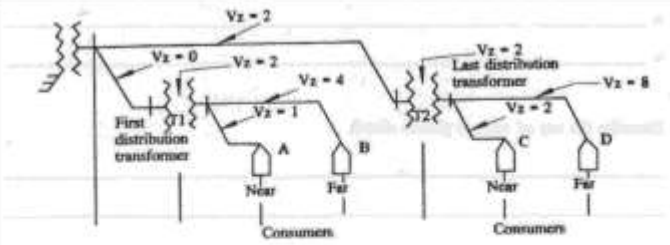
Mass per 100 m	=	43 kg
Wind loading	=	750 Pa
Equivalent diameter	=	16 mm
Design tension	=	6 kN
Ruling average sag	=	1.0 m

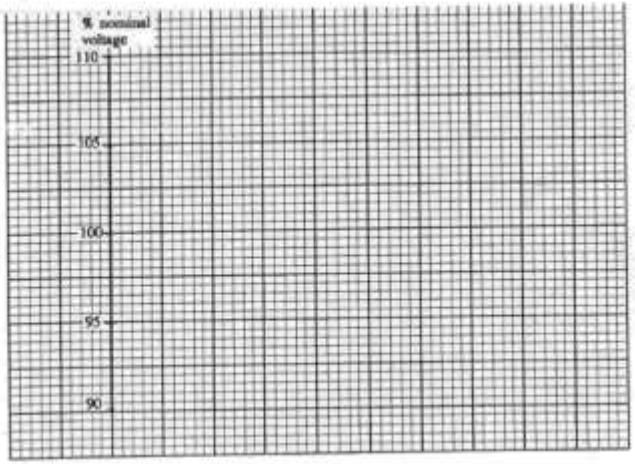
Nominate the three factors which determines the current rating of cables.

8 marks

Question (11)

For the simplified single line diagram below, plot the voltage profile for heavy load period. The voltage at point A is 110% nominal. The Vz values indicated on the diagram
Show the percent impedance voltage drop per unit of consumer heavy current.





6 marks

Question (12)

State the three general methods of voltage control.

2 marks

2.6 Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage

Ref-Advanced Diploma in Electrical Engineering Exercises Page 121)

Decision strength and fault in UG cable (You need to make the dismantling to find out the fault)
Slide 1+2+3

Q31.Conductor insulation thickness = 0.52 cm. , dielectric constant = 4, Belt thickness = 0.45 cm, Conductor diameter = 1.7 cm. Calculate the capacitance to neutral for 1.5Km long cable.
Slide 4

Q32.Explain UG cable fault finding methods.

2.7 Circuits/components are rechecked and their operational status is confirmed.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 122)

To determine the operational status, voltage status need to be confirmed. The following are the questions for that purpose

Q40.Describe the causes and effects of voltage regulation.

Slide 5

Q41.State three general methods of voltage control.

Q42.List five voltage control devices in distribution system.

2.8 Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.

2.9 Effectiveness of the repair is tested in accordance with established procedures.

2.10 Apparatus is reassembled, finally tested and prepared for return to service.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 120)

To replace the poles, the following questions assist the candidates to acquire the necessary parts

Slide 5

Q18.Write down the methods and requirement for staying of pole and support.

Slide 6

Q19.Sketch the diagram for essential components of staying pole.

Slide 7

Q20.What are the requirement of conductor size and separation of conductors?

Slide 8

Q21.Show the table for span & spacing relationship

2.11 Unexpected situations are dealt with safely and with the approval of an authorised person.

As per 1.3

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

As per 2.5

Location of Evidences (Table 1)

3. Completion and report for problem solving in energy supply network equipment

3.1 OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.

3.3 Maintenance work activities are documented in accordance with established procedures.

POWER SYSTEM PRACTICAL LINE DESIGN PROJECT

7	Short answer question Practical survey assessment Overhead line design assignment	OH Line Design Assignment 20% **TRANSMISSION LINE DESIGN PROJECT** 0 *This project will have to be completed in Week 9. But the components of the project can be done concurrently with class lessons. You also need to think about how to do the following tasks whenever you complete the lectures in the respective week shown in brackets beside the following tasks. You also need to refer the respective notes in CD as indicated in underlined sentences.* *1 You need to use ruler to do scaled drawing for line route.* Draw Line route to supply the proposed factory location from 3 Phase 11 KV line. Put on map (Week 5) Draw side view of the route that you select for power line route. Show ground levels. (Week 4) Plan profile drawing for the power line **2.5 State pole and line installation techniques in CD** refer profile drawing Fig 11.8. (Day 4) Determine the appropriate size of pole. Mention appropriate length of cross arm, height, diameter **(Refer my e-mail attachment- Page 44 –(***I will send you***) & Topic 2.2 Outline relevant factors related to installation, maintenance, cross arms, stays, pole types and choice of conductors sizes for commonly used configuration in CD**. You will see clearance in Table 1-Open supply line. You need to convert foot to metre.1 metre= 3.3 Feet (Week 2, 3)

		Select appropriate insulator and cross arm**(Disc insulator EA2/D EA3/D etc)** (Week 2) Select the size of conductor based on 2MVA 33KV 3 Phase.Refer AS 3008 (Refer my e-mail attachment: AS3008 Pages) OR **2.3 Determine mechanical limitations and physical dimensions of lines in CD** (7) Calculate sag. **(Use formula in Review Question (1) Question 10/11)** (Week 2) (8) Draw cross arm, pole, insulator. Refer **2.1. Identify relevant components use in over head line** **design in CD.** Week (3) Attach vibration damper, guy wire , line guard as necessary **Review Question (1) Number 14.** Show footing **Review Question (1) Number 15.** (Week 2) (11) Install cross arm to pole, insulator Refer **2.5 State pole and line installation techniques (Part** **2,3,4) in CD.** (12) Prepare list of materials. Cable, insulator, etc that you use. (Week 9) Sketch line diagram -----Containing-Route and pole diagram with dimension (Week 9) NOTE==== MAIN SUPPLY 33 KV is located at

		Shopping Centre from where , you take the supply

www.electricaldiploma2013.webs.com

Work performance + Practical Instruction Back up

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http://www.filefactory.com/file/cf88135/n/Practical.zip

Refer Power System Practicals

Part 1: Operational Study

LabName No	me of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1	Receiving end voltage comparison between short/ medium and long transmission lines	distribution system types	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion

EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection • surge protection • conventional relays	Research, report presentation
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead	Circuit interpretation, connection, data collection, calculation, graph

		systems	sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

(2)**Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.**

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?

To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.

The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is ,

caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in voltages	Abnormal resistance. Wrong cable selection. Abnormal circuit configuration	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of the circuit.	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.

(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated from the power line. Too much power loss and high interference to telecom line	Corona	Corona study	Will consider the ACT OF GOD	Will find the way to reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level	EP 7 Corona video	How corona occurs and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault

		Protection				protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not provide the effective protection	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason why and how to change the protection system	Will adjust CT PT ratio at the simulated fault situation and will adjust the relay setting appropriately	EP9 Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	Practical skill development in CT PT ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through	Knowledge development on various protective relays used in

					trade references	industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection. All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.

(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc extinguishing methods	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and	EP13 Study of various protective relays used in	Knowledge development on various protective

it does not work when the ground fault occurs				protection task	industry through trade references	relays used in industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other <u>Detailed explanation</u> Face to face class teaching + Online supplement multimedia notes	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other ***Detailed explanation*** A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions

Evidence **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery** www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	G-Observe the student's performance in practical class L- Student practical performance result + report preparation *Evidence Attached* **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1 On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5 Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:

A	Assignment	**B**	Written task	**C**	Role play	**D**	Exam
E	Oral questioning	**F**	Simulation	**G**	Observation	**H**	Work based
I	Portfolio	**J**	Self assessment	**K**	Case study	**L**	Practical demonstration
M	Project	**N**	Training Record Book	**O**	Other (Please specify)		

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		

EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Page 196 to 231 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-Iuu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6ogqZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69
Page 232 to 270 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41q4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

G040 + IS73

Page 271 to 284 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KIKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

Page 285 to 307 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with IS68+IS74 Assessment Mapping.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	**UETTDRIS68A Solve problems in energy supply protection equipment**		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve problems in energy supply network equipment	1.1	OHS procedures for a given work area are identified, obtained and understood	Q 1,2,3 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.2	OHS risk control measures and procedures in preparation for the work are followed	Q 4 to 7 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.3	The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)	Q 8 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.	Q 9 to 12 of IS68+IS74 Assessment Mapping.pdf (Page 3)		
	1.5	Sources of materials that may be required for the work are established in accordance with established procedures.Submit the following assignment questions			Advanced Diploma in Electrical Engineering Exercises Page 208) Q11+12 Advanced Diploma in Electrical Engineering Exercises Page 123)Q 1 to 7

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.6	Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety		Practical EP9,EP10,	Advanced Diploma in Electrical Engineering Exercises Page 128) Q52+53
2.Solve problems in energy supply network protection equipment and system.	2.1	OHS risk control measures and procedures for carrying out the work are followed.	As per 1.1 to 1.3		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures		Practical EP11.EP12	Advanced Diploma in Electrical Engineering Exercises Page 126) Q30 to 37
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures	As per 1.3		
	2.4	Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.	As per 1.3		
	2.5	Problem solving is approached methodically drawing on knowledge of energy supply network protection equipment and systems using measured and calculated values of circuit/apparatus	Test 1 Q 1 to 10		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		parameters.			
	2.6	Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage			Advanced Diploma in Electrical Engineering Exercises Page 128)Q55 to 59
	2.7	Circuits/components are rechecked and their operational status is confirmed.			Advanced Diploma in Electrical Engineering Exercises Page 128)Q64 to 70
	2.8	Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.			Advanced Diploma in Electrical Engineering Exercises Page 126) Q23 to 29
	2.9	Effectiveness of the repair is tested in accordance with established procedures.	As per 1.3		
	2.10	Apparatus is reassembled, finally tested and prepared for return to service.	As per 2.5		
3.Completion and report for problem solving in energy supply network equipment	3.1	OHS work completion risk control measures and procedures are followed.	As per 1.3		
	3.2	Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.		Project	Advanced Diploma in Electrical Engineering Exercises Page

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
					125) Q 17 to 19
	3.3	Maintenance work activities are documented in accordance with established procedures.		Project	Advanced Diploma in Electrical Engineering Exercises Page 125) Q 17 to 19

Add rows to the following table as required

		Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Connection of relay protection scheme & protective equipments by using one line diagram				EP9	
Current transformer & potential transformer connection & ratio test				EP10	
Over current relay characteristics				EP11	
Electronic relay test				EP12	
Study of various protective relays used in industry through trade references					Research Assignment

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Protection fundamentals encompassing:	Q 1,2,3 of Test 1		

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T2 Instrument transformers for protection			Advanced Diploma in Electrical Engineering Exercises Page 125) Q 38 to 52
T3 Feeder protection	Q7 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 23 to 37
T4 Transformer protection	Q10 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 10 to 15
T5 Busbar protection			Advanced Diploma in Electrical Engineering Exercises Page 125) Q 16 to 19
T6 Surge protection			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 16 to 18

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test	Practical EP 9 to 12	Research Assignment

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UETTDRIS68A Solve problems in energy supply protection Equipment

ONLINE RESOURCES ARE SUPPORTED THE STUDENTS TO ACQUIRE THE COMPETENCIES

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve problems in energy supply network equipment

1.1 OHS procedures for a given work area are identified, obtained and understood

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q15+16

www.electricaldiploma2013.webs.com Then access Click **HERE** to download the Exercises - http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf

Relevant Instruction Lessons

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22

Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q12.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.5 Sources of materials that may be required for the work are established in accordance with established procedures.

Submit the following assignment questions

Ref-Advanced Diploma in Electrical Engineering Exercises Page 123)

The practice questions are organized to find out the protection system equipments and materials together with relevant theory

Over current and earth fault protection

Slide 1+2

Q1.Sketch three phase over current protection.

Q2.Sketch three phase earth fault relay protection.

Slide 3+4+5

Q3.Explain the operation of directional element with sketch.

Slide 6

Q4.Locate the position of reverse power relay in power line.

Slide 7

Q5.Sketch the connection of combined protection scheme that contains two over current relays & one earth fault relay to provide phase to phase and earth protection.

Q6.How does directional element of relay perform?

Slide 8

Q7.Locate directional and non directional element in a ring circuit.

1.6 Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

.Testing of protection current & potential transformer and relevant questions are arranged to provide this competency component.

Slide 5

Q52.Explain (a) AC ratio check (b) DC polarity check (c)Three phase polarity test for three phase CT Slide 6

Q53.How will you interpose & sum CT & PT?

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		
Students' work in own	Summative Assessment- Formal	

record	Tests	
	Formative Assessment/Practical+ Class works	

2 Solve problems in energy supply network protection equipment and system.

2.1 OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

Live testing of protective relay system and depermination of characteristics and relevant questions are arrrranged to provide this competency component.

Distance protection scheme
Slide 1

Q30.Explain the distance protection scheme with
sketch. Slide 2

Q31.Explain the operation and construction of distance relay with sketch.
Slide 3

Q32.Explain the characteristics of distance
relay. Slide 4

Q33.Describe the directional distance relay with sketch.
Slide 5

Q34.What is the relation between maximum reach & relay characteristics.
Slide 6+7

Q35.Explain the zones for distance protection
scheme. Slide 8

Q36.Explain the operation of three phase distance relay.
Slide 9

Q37.Explain maximum reach and maximum reach angle.

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

2.4 Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.

As per 1.3

2.5 Problem solving is approached methodically drawing on knowledge of energy supply network protection equipment and systems using measured and calculated values of circuit/apparatus parameters.

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

EKAS COMPONENT	Question No	Questions
KS01-TIS68A Electrical power system protection Evidence shall show an understanding of protection methods and devices for electrical power systems to an extent indicated by the following aspects: T1 Protection fundamentals encompassing: purpose of protection features of a protection scheme T2 Instrument transformers for protection encompassing: Operating principles Applications of current transformers Applications of voltage transformers T3 Feeder protection encompassing: fuse protection overcurrent & earth fault sensitive earth fault unit schemes distance protection trip/close sequences for feeders recloser/sectionaliser systems T4 Transformer protection encompassing: overheating protection overcurrent protection	1 2 3 4 5	What is power system protection scheme? (5 marks) What equipments are included in power system protection scheme? (5 marks) Explain the functions of the following devices included in a power system protection Scheme. CT, PT, Fault Detector, Tripping Circuit (10 marks) Sketch the construction of • Balanced Beam Relay Connection Diagram of Relay Tripping Circuit (10 marks) Sketch the connection diagram of combination protection scheme that contains two Over current relays and one earth fault relay to provide phase to phase and phase to earth protection.. (10 marks)

- restricted earth fault protection
- differential protection
- oil and gas devices

T5 Busbar protection encompassing:
- types of fault
- requirements of busbar protection
- system protection
- frame-earth protection

T6 Surge protection encompassing:
- voltage surges
- surge diverters
- arcing horns

6

7

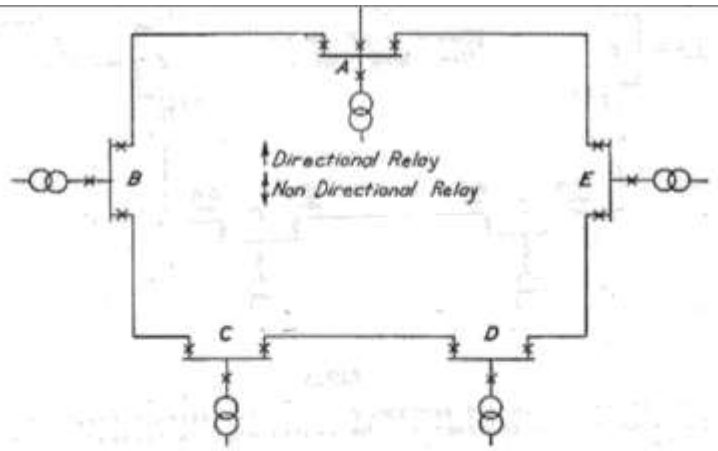
Total 70 marks

8

9

10

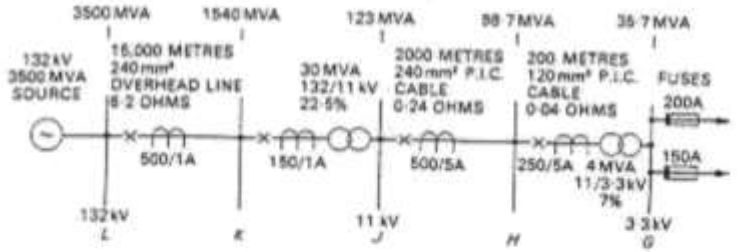
Total 100 marks



Locate relay protection scheme for given system when fault occurs at point F.

(20 marks)

Sketch curve for discrimination by both time and current of the following power system..



(20 marks)

How will you adjust Definite Minimum Time point on relay curve?

(5 marks)

What is “Pick Up” of relay?

(5 marks

Sketch the vector diagram for primary, secondary main windings of

		Star Delta Power Transformer . (10 marks)

2.6 Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage
Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

To convert the analog relaying system to digital relay system, the dismantling of origin components and assembly of new system components are to be done. The following questions and activities provide this competency component.

Digital relay+ Telecommunication for protection
Slide 1

Q54.What is digital relay?
Slide 2+4

Q55.Sketch the flow diagram of digital relay operation.
Slide 3+4

Q56.Sketch DAC
system Slide 5

Q57.Explain busbar protection with sketch
Slide 6

Q58.Write line & busbar protection with sketch.
Slide 7

Q59.Sketch the operation of digital relay.

2.7 Circuits/components are rechecked and their operational status is confirmed.
Ref-Advanced Diploma in Electrical Engineering Exercises Page 129)

To determine the operational status of protection system, it needs to ensure relay operation sequence, the sequential relay protection system and characteristics are to be investigated. The following activities and questions provide this competency.

(32)Over current & earth fault protection , Directional protection, operating
characteristics Slide 1

Q64.Sketch the diagram of over current protection

Slide 2

Q65.Sketch earth fault relay protection diagram.

Slide 3

Q66.Sketch the combined over current and earth fault protection and explain it’s operation.

Slide 4

Q67.Explain the operation of directional relay with diagram.

Slide 5+6+7+8

Q68.Locate directional & non directional elements in ring system.

Slide 9+10

Q69.Sketch the connection diagram of combinational protection scheme that contains two over current relays and one earth fault relay to provide phase to phase and phase to earth protection.

Slide 11

Q70.How will you adjust definite minimum time point on relay curve?

2.8 Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.

2.9 Effectiveness of the repair is tested in accordance with established procedures.

2.10 Apparatus is reassembled, finally tested and prepared for return to service.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

When more power loads are connected to transmission line, the current protection system needs to be modified. The following questions and activities provide this competency component.

Transmission line protection

Slide 1

Q23.Sketch transmission line differential protection

Slide 2+3

Q24.Sketch the modification diagram for transmission line protection with differential relay.

Distance relay, pilot wire with differential three phase line protection

Slide 1

Q25.Explain the operation of distance relay

Slide 2

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Q26.Explain the operation of distance relay with sketch

Slide 3+4

Q27.Sketch the characteristics curve of distance relay

Slide 5+6

Q28.Explain the zone protection of distance relay.

Slide 7+8

Q29.Sketch the protection diagram of distance relay with operating & restraining voltage and current.

2.11 Unexpected situations are dealt with safely and with the approval of an authorised person.

As per 1.3

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

As per 2.5

Location of Evidences (Table 1)

3. Completion and report for problem solving in energy supply network equipment

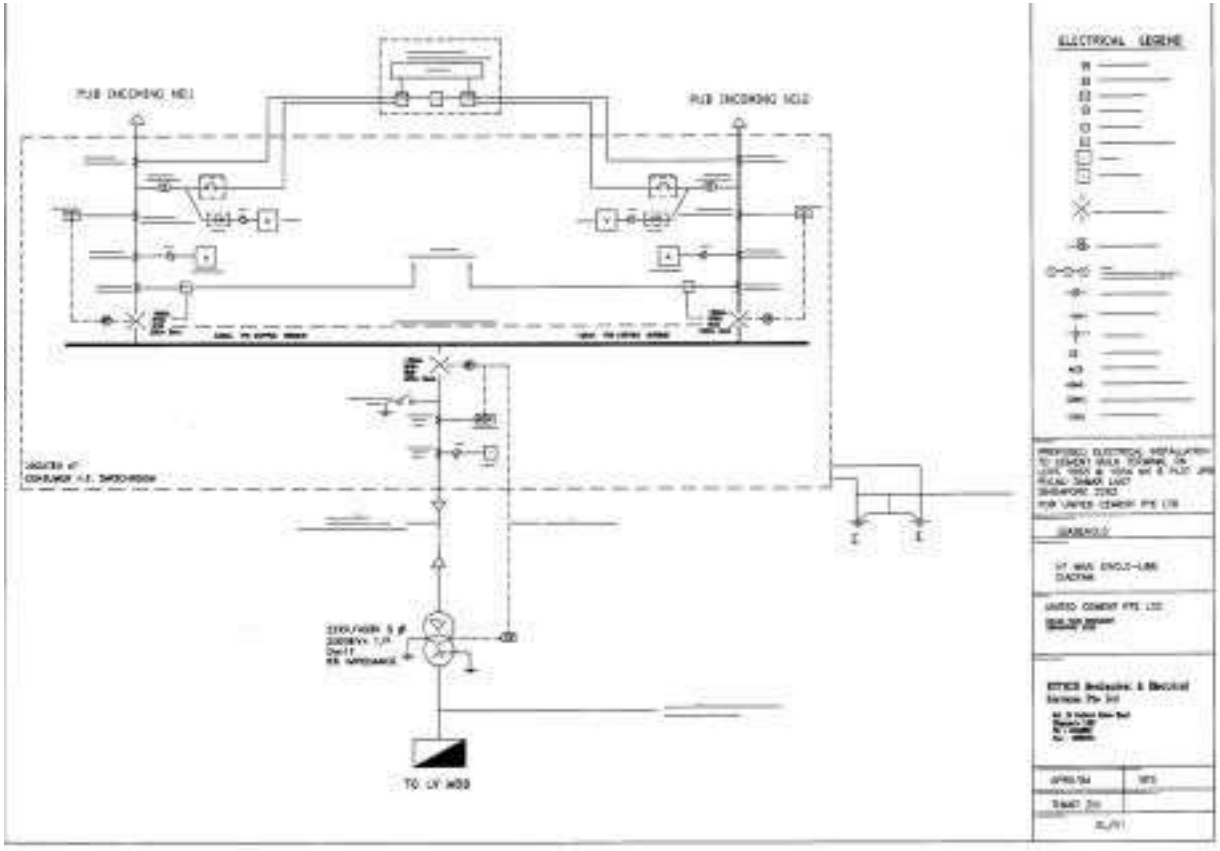
3.1 OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.

3.3 Maintenance work activities are documented in accordance with established procedures.

POWER SYSTEM PROTECTION COMMISSIONING PROJECT



The above diagram is Incoming HV supply system for a Cement Factory. It contains Star –Delta Transformer, Interchange switches for switching 2 supply, sketch of protective relay system with trip circuit and outline for measuring instruments.

(1) Develop Detail installation diagram that contain appropriate protection instruments and measurement instruments

Recommend appropriate specifications for protection and measuring instruments for power supply requiring 500Kw for the factory. By answering the following questions, the concepts for the above project can be highlighted

Ref-Advanced Diploma in Electrical Engineering Exercises Page 125)

Three phase differential relay
Slide 1

Q17.Sketch three phase star/ delta transformer protection with differential relay.
125

Slide 2

Q18.Explain the setting of differential relay.

Connection of main transformer, CT , directional relay

Slide 1+2+3

Q19.Sketch the combined earth fault and differential protection for three phase star/ delta transformer.

Work performance + Practical Instruction Back up

Click HERE to download practicals

http://www.filefactory.com/file/cf88135/n/Practical.zip

Refer Power System Practicals

Part 1: Operational Study

LabName No	me of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1Re	ceiving end voltage comparison between short/ medium and long transmission lines	distribution system types	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion

EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion
EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection	Research, report presentation

		• surge protection • conventional relays	
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified

work outcomes.

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the

surrounding environment or services and using sustainable energy practices.

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

(2) **Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.**

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?
To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.
The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is , caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in	Abnormal resistance. Wrong cable selection. Abnormal circuit	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point

voltages	configuration			the circuit.		
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.
(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated	Corona	Corona study	Will consider the ACT	Will find the way to	EP 7 Corona video	How corona occurs

from the power line. Too much power loss and high interference to telecom line			OF GOD	reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level		and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System Protection	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason	Will adjust CT PT ratio at the simulated fault	EP9 Connection of	Practical skill development in CT PT

provide the effective protection			why and how to change the protection system	situation and will adjust the relay setting appropriately	relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection.	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection

All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right						
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.
(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity

				extinguishing methods		
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but it does not work when the ground fault occurs	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and protection task	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes **Evidence** **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery**	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other ***Detailed explanation*** A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions G-Observe the student's performance in practical class L-Student practical performance result + report preparation

www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	*Evidence Attached* **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1 On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5 Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:			
A Assignment	**B** Written task	**C** Role play	**D** Exam
E Oral questioning	**F** Simulation	**G** Observation	**H** Work based
I Portfolio	**J** Self assessment	**K** Case study	**L** Practical demonstration
M Project	**N** Training Record Book	**O** Other (Please specify)	

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		
EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-Iuu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6ogqZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69
Page 232 to 270 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41g4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

G040 + IS73

Page 271 to 284 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KlKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with IS69 assessment Mapping.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	**UETTDRIS69A Diagnose and rectify faults in energy supply Apparatus**		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1.Prepare to diagnose and rectify faults	1.1	OHS procedures for a given work area are identified, obtained and understood.	Q1,2,3 of IS69 assessment Mapping.pdf (Page 1)		
	1.2	Established OHS risk control measures and procedures in preparation for the work are followed.	Q 4,5,6,7 of IS69 assessment Mapping.pdf (Page 2)		
	1.3	Safety hazards which have not previously been identified are documented and risk control measures devised and implemented in consultation with appropriate personnel			Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)
	1.4	The extent of faults is determined from reports and other documentation and fro discussion with appropriate personnel			Advanced Diploma in Electrical Engineering Exercises Page 124)Q10,11 Advanced Diploma in

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
					Electrical Engineering Exercises Page 131) Q5 to 15
	1.5	Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site	Advanced Diploma in Electrical Engineering Exercises Page 133) Q23 to 30		
	1.6	Tools, equipment and testing devices needed to diagnose faults are obtained in accordance with established procedures and checked for correct operation and safety.			Advanced Diploma in Electrical Engineering Exercises Page 133) Q38 to 43
2.Diagnose and rectify faults	2.1	OHS risk control measures and procedures for carrying out the work are followed.	**As per 1.3**		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures	Advanced Diploma in Electrical Engineering Exercises Page 126) Q35 to 37		
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures	**As per 1.3**		
	2.4	Logical diagnostic methods are applied to diagnose energy supply apparatus faults employing measurements and estimations of system operating parameters referenced to system operational requirements.			Advanced Diploma in Electrical Engineering

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
					Exercises Page 128) Q57 to 60
	2.5	Suspected fault scenarios are tested as being the source of system problems	Q24,25 of IS69 assessment Mapping.pdf (Page 9+10)		
	2.6	Cause of the faults are identified and appropriately competent persons are engaged to rectify the fault where it is outside the scope of the control system			Advanced Diploma in Electrical Engineering Exercises Page 131)Q14 to 16
	2.7	Faults in the apparatus components are rectified to raise energy supply apparatus to its operation standard.			Advanced Diploma in Electrical Engineering Exercises Page 132) Q19 to 21
	2.8	Apparatus is tested to verify that it operates as intended and to specified requirements	Advanced Diploma in Electrical Engineering Exercises Page 134) Q45,46		
	2.9	Decisions for dealing with unexpected situations are made from discussions with appropriate persons and job specifications and requirements	**As per 1.3**		
	2.10	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.			Advanced Diploma in Electrical Engineering Exercises Page 211) Q50 to 54
	2.11	Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or			Advanced Diploma in

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		damage to apparatus and the surrounding environment or services and using sustainable energy practices.			Electrical Engineering Exercises Page 128) Q54 to 59
3.Complete and report fault diagnosis and rectification activities	3.1	OHS work completion risk control measures and procedures are followed.	**As per 1.3**		
	3.2	Work site is made safe in accordance with established safety procedures.	**As per 1.3**		
	3.3	Rectification of faults is documented in accordance with established procedures.	Test 1 All Questions		
	3.4	Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified	Test 2 All Questions		

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Receiving end voltage comparison between short/ medium and long transmission lines		EP1	
Long transmission line PI equivalent circuit		EP2	
Long transmission line T equivalent circuit		EP3	

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Transmission line efficiency/ Transformer effect on line efficiency		EP4	
Reactive power and power factor improvement		EP5	
PF effect on line current		EP6	
Corona Video		EP7	
Phase sequence measurement		EP8	
Underground cable capacitance test		EP19	
High tension line design		EP20	
Line insulator test & capacitance grading		EP21	
Voltage profile chart of distribution system		EP22	
Load centre-Power loss comparison		EP23	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Control of voltage encompassing			Advanced Diploma in Electrical Engineering Exercises Page 122) Q40 ,43,44
T2 The importance of the location in the system of voltage control devices			Advanced Diploma in Electrical Engineering Exercises Page 122) Q41,42
T3 The use of graphical methods to calculate the size of VAr regulating plant			Advanced Diploma in Electrical Engineering Exercises Page 132) Q19 to 21

Add rows to the following table as required

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical &	Assessment event 3 Assignment

				Observation	
T4 Control of power					Advanced Diploma in Electrical Engineering Exercises Page 133) Q23 to 30
T5 The relationship between power and frequency					Advanced Diploma in Electrical Engineering Exercises Page 130) Q1,2,3,4
T6 Types of communication systems					Advanced Diploma in Electrical Engineering Exercises Page 133) Q23 to 30
T7 Transient over-voltages in power systems					Advanced Diploma in Electrical Engineering Exercises Page 133) Q40
T8 Factors leading to the generation of corona					Advanced Diploma in Electrical Engineering Exercises Page 131) Q5 to 10
T9 Power System Protection					Advanced Diploma in Electrical Engineering Exercises Page 133) Q 38 to 43

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UETTDRIS69A Diagnose and rectify faults in energy supply Apparatus

Prepare to diagnose and rectify faults

1.1 OHS procedures for a given work area are identified, obtained and understood.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q15+16

www.electricaldiploma2013.webs.com Then access Click **HERE** to download the Exercises

http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf

Relevant Instruction Lessons

Study Option (1)
Guided study (Online)Resources+Online exercises+Online Practicals

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Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.1 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22

Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.2 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

1.3 Safety hazards which have not previously been identified are documented and risk control measures devised and implemented in consultation with appropriate personnel.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q12.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.4 The extent of faults is determined from reports and other documentation and fro discussion with appropriate personnel Ref-Advanced Diploma in Electrical Engineering Exercises Page 124)

The following questions are developed to assess the fault.

Power transformer protection
Slide 1+3

Q10.What are the types of faults in power transformer?
Slide 2

Q11.Wat are the causes of transformer faults.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 131)

Corona+ short circuit current+ Transient fault + voltage surge+ Reflection
Slide 1

Q5.What is corona?

Q6.Explain the concept of disruptive critical voltage.
Slide 2+3

131

Q7.How does corona happen? And express the factors related to occurance of corona.
Slide 4

Q8.Write the formula to calculate break down voltage
Slide 5

Q9.What are the disadvantages of
corona? Slide 6+7

Q10.What are to be done to prevent the corona?
Slide 8

Q11.Sketch the short circuit current in AC
network. Slide 10

Q12.Sketch the connection of current limiting reactor.
Slide 11

Q13.Sketch the power response by line voltage surge graph.
Slide 12
Q14.What are the causes of voltage surge?
Q15.Write the equation for switching e.m.f velocity.

1.5 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site
Ref-Advanced Diploma in Electrical Engineering Exercises Page 133)

The practice questions are organized to find out the protection system equipments and materials together with relevant theory
(38)Computerised control + Supervisory control+ IP based network + Digital control Slide 1

Q23.Explain the application of telecom system in power line with sketch.
Slide 2+4+5
Q24.Explain telecom based differential protection system.
Slide 6
Q25.Explain distributed real time computer network for power system.
Slide 7+8+9
Q26.Explain remote and computer control in power system.
Slide 10.
Q27.Why is phase comparison relaying provided?
Q28.Sketch ADC control.
133
Slide 11+12+13+14
Q29.Sketch internal & external fault discrimination diagram.
Slide 15+16
Q30.Explain the application of computerised control and power network.

1.6 Tools, equipment and testing devices needed to diagnose faults are obtained in accordance with established procedures and checked for correct operation and safety

Ref-Advanced Diploma in Electrical Engineering Exercises Page 133)

Metering + Location of CT+ Power Surge +Grounding +Harmonic
Slide 1

Q38.Sketch the basic metering arrangement in substation. Slide 9

Q39.Sketch the location of CT in power line Slide 10

Q40.Explain power surge protection for transmission line. Slide 11+12

134

Q41.Explain grounding in power system. Slide 13+14+15

Q42.A square wave has amplitude of 70V , fundamental is 90V. Calculate (a) Effective value of square wave. (b) Effective value of fundamental (c) Total harmonic distortion

Slide 6

Q43.Sketch the diagram of harmonic filter.

2 Diagnose and rectify faults

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		

Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

2.1 OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

Live testing of protective relay system and depermination of characteristics and relevant questions are arrrranged to provide this competency component.

Slide 21

Q35.Sketch the typical protection scheme

Slide 22

Q36.Sketch the computer flow chart for power system protection.

Slide 23

Q37.Sketch electronic control system for power system protection.

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

2.4 Logical diagnostic methods are applied to diagnose energy supply apparatus faults employing measurements and estimations of system operating parameters referenced to system operational requirements.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

Slide 5

Q57.Explain busbar protection with sketch

Slide 6

Q58.Write line & busbar protection with sketch.

Slide 7

Q59.Sketch the operation of digital relay.

Slide 8+9

Q60.Sketch the flow chart for the software of digital protective relay.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 130)

Slide 7

Q4.Write the machine angular acceleration formula

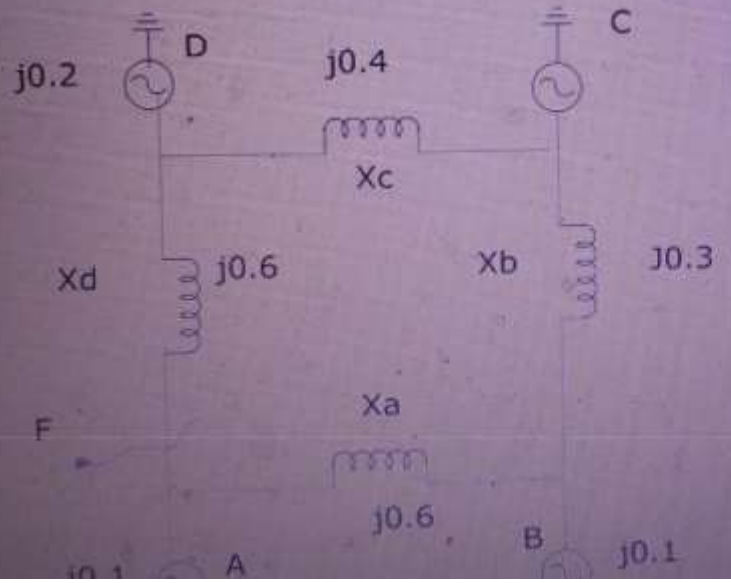
2.5 Suspected fault scenarios are tested as being the source of system problems..

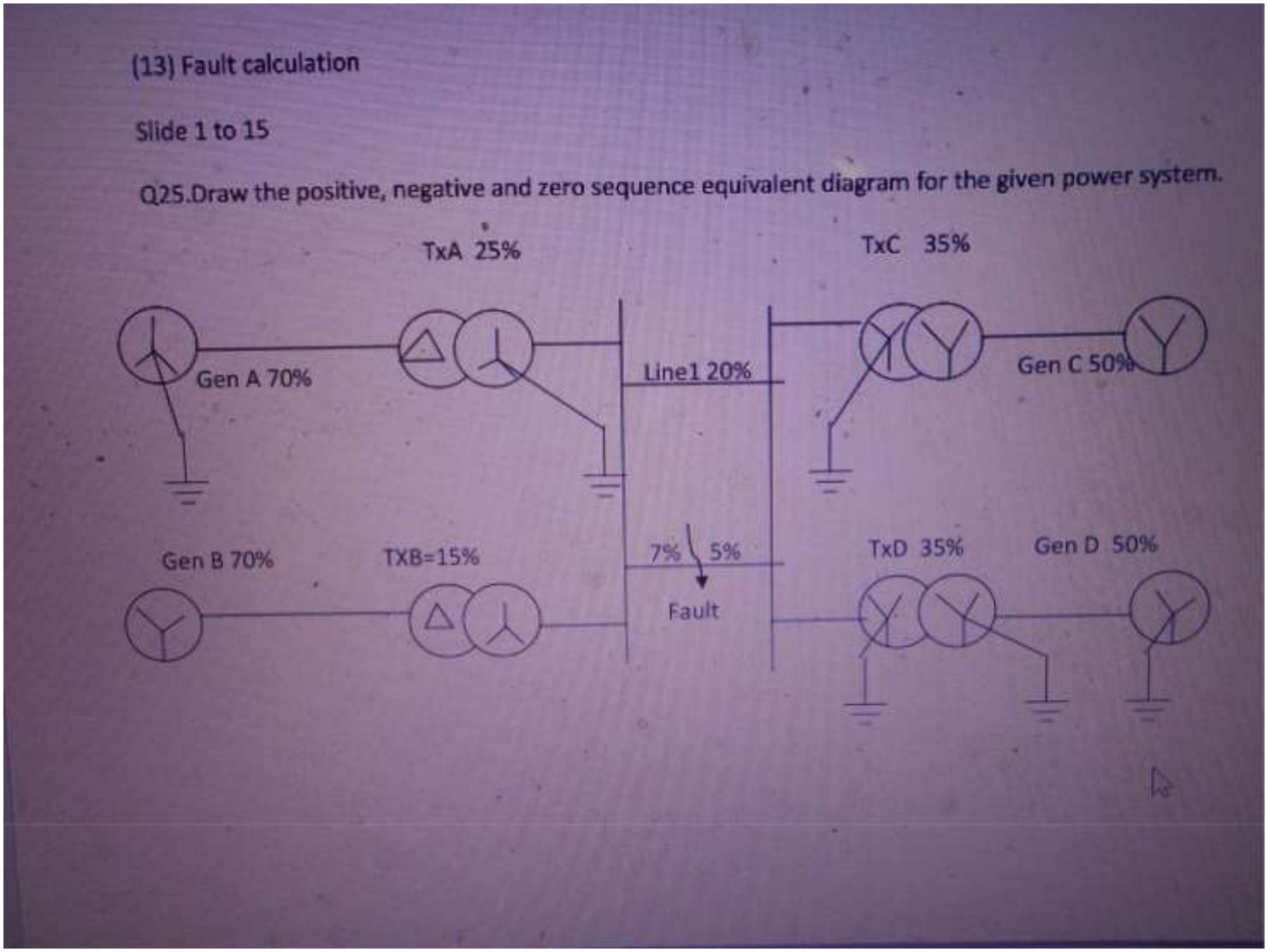
Ref-Advanced Diploma in Electrical Engineering Exercises Page 204/205)

(12) Per unit system

Slide 1+2+3+4+5+6

Q24.In the given network, three phase fault occurs at point F . Calculate fault MVA per unit value of reactance. All refer to 200MVA base , resistance may be neglected.





2.6 Cause of the faults are identified and appropriately competent persons are engaged to rectify the fault where it is outside the scope of the control system

Ref-Advanced Diploma in Electrical Engineering Exercises Page 131)

Slide 12

Q14.What are the causes of voltage surge?

Q15.Write the equation for switching e.m.f velocity.

Slide 13

Q16.Sketch voltage surge & protection diagram .

2.7 Faults in the apparatus components are rectified to raise energy supply apparatus to its operation standard.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 132)

Reactive power control static VAR compensation

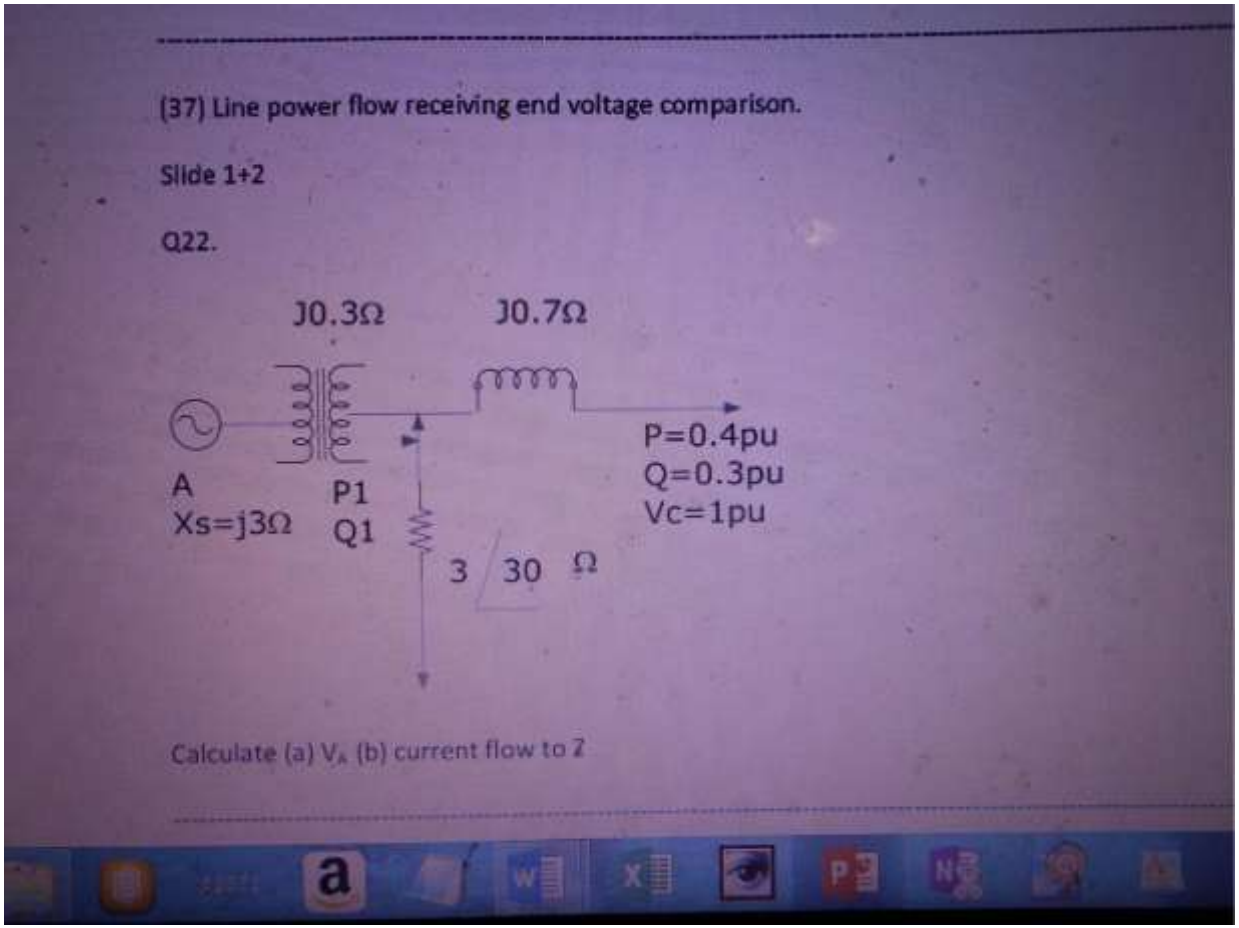
Slide 1+2+3

132

Q19.How will you connect the reactive power control capacitor bank to three phase system.

Q20.Sketch synchronous motor reactive power control diagram.

Q21.Explain how reactive power is controlled by static VAR compensation system.



2.8 Apparatus is tested to verify that it operates as intended and to specified requirements

Ref-Advanced Diploma in Electrical Engineering Exercises Page 134)

Slide 4
Q45.Sketch (a) Arcing horn (b) Lightning arrester (c) Surge absorber
Slide 5

Q46.Sketch the arrangement of instrument in sub station.

2.9 Decisions for dealing with unexpected situations are made from discussions with appropriate persons and job specifications and requirements.

As per 1.3

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 211)

Change control
Slide 1
Q50.Describe the overview of change control system.
Slide 2
Q51.Explain the establishment of contracts
Slide 3
Q52.Outline the project control system responding the disturbances.
Slide 4
Q53.Sketch the procedure for preparing quality
manual. Slide 5+6
Q54.Explain management leadership.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 130)

Original design

Q1.Generator A with 100MW, 4% drop and generator B of 200 MW 4% drop. Are supplying the 200MW load. Calculate their load share.

But in reality, the situation is changed to

Q2.Generator A with 200MW 6% drop and generator B with 400MW 7% drop are supplying 300MW load , calculate their load share.

Provide the solution

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to apparatus and the surrounding environment or services and using sustainable energy practices Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

To convert the analog relaying system to digital relay system, the dismantling of origin components and assembly of new system components are to be done. The following questions and activities provide this competency component.

Digital relay+ Telecommunication for protection
Slide 1

Q54.What is digital relay?
Slide 2+4

Q55.Sketch the flow diagram of digital relay operation.
Slide 3+4

Q56.Sketch DAC
system Slide 5

Q57.Explain busbar protection with sketch
Slide 6

Q58.Write line & busbar protection with sketch.
Slide 7

Q59.Sketch the operation of digital relay.

Location of Evidences (Table 1)

3 Complete and report fault diagnosis and rectification activities

3.1 OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Work site is made safe in accordance with established safety procedures.

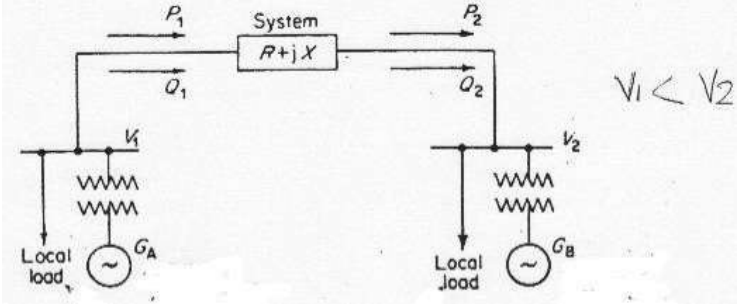
As per 1.3

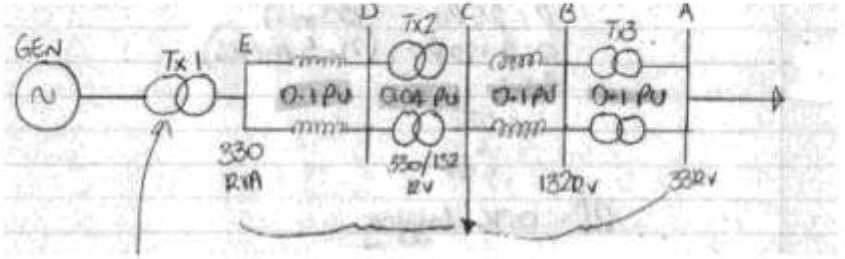
3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified

Assessment Criteria	Question No	Questions
KS01-TIS69A Electrical power system operations Evidence shall show an understanding of electrical power system operations to an extent indicated by the following aspects: T1 Control of voltage encompassing: ? Conditions leading to voltage collapse and system disintegration. ? Effects on the system of high/low volts ? Voltage control devices - voltage regulators applied to generators and synchronous phase modifiers, electromagnetic voltage regulators, series and parallel capacitors, OLTC transformers and static Var compensations (SVCs) such as saturated reactor compensations (SRs), thyristor controlled reactor compensators (TCRs), combined TCR/TSCs and the production of wave-form distorting harmonics and control devices. T2 The importance of the location in the system of voltage control devices. T3 The use of graphical methods to calculate the size of VAr regulating plant.	1SCT1	What are the major divisions of electricity supply system.? (5 marks)
	2 SCT1	Sketch the schematic diagram of a hydro power generation system. (5 marks)
	3 SCT1	Define the followings • Base load • Peak load (5 marks)
	4 SCT1	Sketch the winding diagram for stator winding of following 3 phase aletrnator. 3 phase, 4 poles, 50HZ, (15 marks)
	5SCT1	An alternator has the following single phase equivalent values. E0= 22kv Et = 24kv Xs=2 ohm E0 leads Et by 20 degree. (a) Calculate the total real power output of the alternator (b) Draw a single phase phasor diagram. (10 marks)
	6SCT1	Sketch the phasor diagram of a synchronous generator for the following loads.

	8 Total 60 marks	Lagging power factor , Leading power factor, Unity power factor (10 marks) Explain the complete turboalternator control system with sketch. (10 marks)

Assessment Criteria	Question No	Questions
T4 Control of power encompassing: - Base load and spinning reserve - Regulating machines - Rapid start plant, - Phase shifting transformers and various forms of load shedding. - Principles and practices of automated control of individual machines - Stations and transmission/tie-line elements. - Synchronising power T5 The relationship between power and frequency encompassing:	1	Find the real power supplied by Generator A and Generator B 

Limiting values Machine stabilising - steam by-pass, rapid valving, slip stabilisers and over speed limiting. Use of single pole generator CB's. Use of machine AVR's as angular stabilisers. Damped and un-damped system oscillations. Relationship between fault clearance times and system stability. Calculation of critical clearance angles based on equal area criteria.	2 3 4 5 Total 40 marks	GA- Generator A 200MW 6% Drop GB- Generator B 400MW 7% Drop (10 marks)  Generator TX/330kv Load 300MW 0.9PF Lagg Base 100MVA In above diagram, what total MW and MVAR must the generator supply and at what power factor? (10 marks) Sketch power angle curve of synchronous machine. (5 marks) Explain how reactive power is controlled by using Static Var Compensation system (10 marks) How will you connect reactive power control capacitor bank to 3 phase power supply system? (5 marks)

Assessment Criteria	Question No	Questions

T6 Types of communication systems encompassing:

- Telephone, power line carrier, dedicated cable, microwave links and fibre optics.
- Quantities and signals to be communicated.
- Advantages and disadvantages of the various systems.
- Equipment requirements.

T7 Transient over-voltages in power systems encompassing:

- Switching and lightning overvoltages and their effect on different plant items.
- Transient over-voltage control and reduction using surge diverters, shield wires and CB are control.
- Insulation systems, insulation coordination, insulation grading in plant items, bushings and capacitor bushings.

T8 Factors leading to the generation of corona encompassing:

Consequences of corona.

- Reduction of corona
- Conductor bundling, grading rings and conductor surface treatment.

T9 Power System Protection encompassing:

- Location of CT's in major plant items.
- Earthing principles and devices.
- Fault current control/limitation using neutral earthing compensators (NEC's), neutral point earth impedances, high conductivity shield wires and parallel feed interlocking.
- Application of different types of protection.

1

An alternator has a six pole rotor rotating at 3000 rpm. Calculate the frequency of the induced voltages in the stator winding.

(5marks)

2

Why are EHV and HV lines used for power transmission?

(5 marks)

3

Why transformers are used in the transmission system?

(5 marks)

4

(10 marks)

QUESTION 1.

Briefly explain how the Real Power in watts and Reactive Power in Vars delivered by a Turbo-alternator are controlled.

5

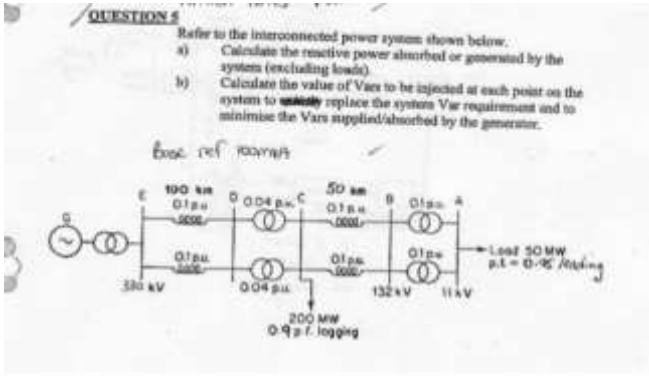
(15 marks)

QUESTION 5

Refer to the interconnected power system shown below.

a) Calculate the reactive power absorbed or generated by the system (excluding loads).

b) Calculate the value of Vars to be injected at each point on the system to ~~minimise~~ replace the system Var requirement and to minimise the Vars supplied/absorbed by the generator.



6

(10

QUESTION 1.

Explain how vibrations may be set up in overhead conductors of a high voltage transmission line and how their effects may be reduced.

QUESTION 2.

A transmission line has a span of 200 metres between level supports. The conductor has a weight of 10 N/m and the tension in the conductor is 11.5kN.

Calculate the midpoint vertical sag of the conductor.

$S = \frac{wL^2}{8T}$

(Ans: 4.34m)

marks)

7
(10

marks)

8
(10

marks)

9
(10
marks)

10
(10

marks)

QUESTION 5

Briefly describe how the capacitance of a transmission line can produce a power factor correcting effect and cause a rise in voltage along a lightly loaded line.

QUESTION 6.

Describe the difference between solid paper and oil insulated high voltage cables.

QUESTION 7

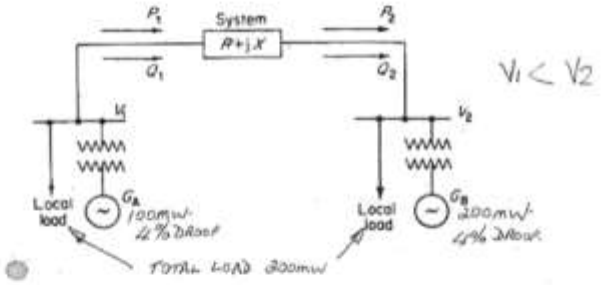
An alternator connected to an infinite busbar, has the following single phase equivalent values:

$E_O = 20kV$
$E_T = 23kV$
$X_S = 2\Omega$
E_O leads E_T by 25°.

a) Calculate the total "ACTIVE" power output of the alternator.

b) Draw a phasor diagram for one phase of the alternator.

(Ans: 291.6MW)



How is 200MW load shared by two machines?

	11 (10 marks) Total 100 marks	

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Work performance + Practical Instruction Back up

Click HERE to download practicals

Refer Power System Practicals

Part 1: Operational Study

LabNo	Name of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1R	eceiving end voltage comparison between	distribution system	Circuit interpretation, connection, data collection, calculation, graph

	short/ medium and long transmission lines	types	sketch, report presentation, conclusion
EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion
EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential	Research, report presentation

		protection busbar protection • surge protection • conventional relays	
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the surrounding environment or services and using sustainable energy practices.

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

(2)**Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.**

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?
To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.
The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is , caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in voltages	Abnormal resistance. Wrong cable selection. Abnormal circuit configuration	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of the circuit.	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by	Sag calculation. Wrong tension,	Sag/ line design	Pull up the cable. After some time, it	Will examine the related parameters and find the	EP 20 High Tension Line Design	Develop the skill on line design and to know the

traffic and then broken	safety factor, weight		will fall again	way		technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	**Reason**	**Related theory**	**The person who does not know the theory will do**	**The person who knows the theory will do**	**Related Practical**	**Development of skill**
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG	Wrong method in UG	UG cable joining			UG cable joining	UG cable joining

cable joint	cable joining	methods. Theory study			method in my prepared 7762 AA Electrical Distribution textbook	methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.
(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated from the power line. Too much power loss and high interference to telecom line	Corona	Corona study	Will consider the ACT OF GOD	Will find the way to reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level	EP 7 Corona video	How corona occurs and find the way to prevent .
(14) Control telecommunication for power line down, no	Application of telecommunication system in power	Application of telecommunication system in power	Will not be aware of the role of telecommunication	Will check the function of telecom equipment for power system	Application of telecommunication system in power	Web based control/ IP based control and telecomm: concepts

relay operates	system operation	system operation 7762AG Power System Operation	system	control and protection and perform the preventive maintenance	system operation	practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System Protection	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not provide the effective protection	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason why and how to change the protection system	Will adjust CT PT ratio at the simulated fault situation and will adjust the relay setting appropriately	EP9 Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency	Practical skill development in CT PT ratio adjustment

					development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection. All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact

				change		
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.
(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc extinguishing methods	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part	Will consider allowable tension/	7762AA Project-Over head line design	Line electrical & mechanical design

			replacement is applied, will use the same size of cable. After sometime, line will break gain	minimum conductor size		practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but it does not work when the ground fault occurs	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and protection task	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	

1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		
EKAS Assessment		X	X

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic **<u>Key for delivery mode</u>** 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation

	G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other
Detailed explanation Face to face class teaching + Online supplement multimedia notes	Detailed explanation A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions
Evidence	G-Observe the student's performance in practical class L- Student practical performance result + report preparation
Part 1- Evidence of teaching & learning	**Evidence Attached**
Plan for concurrently delivery www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request)	**Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record
Part 2- Evidence of lesson planning Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	

1 On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5 Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:			
A Assignment	**B** Written task	**C** Role play	**D** Exam
E Oral questioning	**F** Simulation	**G** Observation	**H** Work based
I Portfolio	**J** Self assessment	**K** Case study	**L** Practical demonstration
M Project	**N** Training Record Book	**O** Other (Please specify)	

Location of Evidences (Table 1)

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Page 196 to 231 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-Iuu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6ogqZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69
Page 232 to 270 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41q4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

G040 + IS73

Page 271 to 284 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KlKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with IS71 Assessment Mapping.pdf

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	**UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems**		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to diagnose and rectify faults. Work performance	1.1	OHS procedures for a given work area are identified, obtained and understood	Advanced Diploma in Electrical Engineering Exercises Page 3 - Q15+16		
	1.2	OHS risk control measures and procedures in preparation for the work are followed	Advanced Diploma in Electrical Engineering Exercises Page 3 - Q17+18 Page 4 Q21+22		
	1.3	The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)	Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)		
	1.4	The extent of faults is determined from reports and other documentation and from discussion with appropriate personnel.	Advanced Diploma in Electrical Engineering Exercises Page 203) Q21 to 23		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.5	Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.			Advanced Diploma in Electrical Engineering Exercises Page 150) Q 23 to 25
	1.6	Tools, equipment and testing devices needed to diagnose faults are obtained in accordance with established procedures and checked for correct operation and safety		**EP1,EP2,EP3 EP4**	Advanced Diploma in Electrical Engineering Exercises Page 153) Q 41 to 47
2.Diagnose and rectify faults.	2.1	OHS risk control measures and procedures for carrying out the work are followed.	As per 1.3		
	2.2	The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures			Advanced Diploma in Electrical Engineering Exercises Page 149) Q 13 to 20
	2.3	Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures	Advanced Diploma in Electrical Engineering Exercises Page 147) Q 1 to 10		
	2.4	Logical diagnostic methods are applied to diagnose electrical energy transmission system faults employing measurements and estimation of system operating parameters referenced to system operational requirements.		**Fault finding activities**	Advanced Diploma in Electrical Engineering Exercises Page 129) Q 64 to 70

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	2.5	Suspected fault scenarios are tested as being the source of system problems.			As above
	2.6	Source of the fault is identified and appropriately competent persons are engaged to rectify the fault where it is outside the scope of the control system			As above
	2.7	Faults in the system components are rectified to raise electrical energy transmission system to its operation standard.			Advanced Diploma in Electrical Engineering Exercises Page 211) Q 50 to 54
	2.8	System is tested to verify that it operates as intended and to specified requirements.			As above
	2.9	Decisions for dealing with unexpected situations are made from discussions with appropriate persons and job specifications and requirements			As above
	2.10	Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes		Fault finding activities Page 13 of IS71 Assessment Mapping.pdf	
	2.10	Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the surrounding environment or services and using sustainable energy practices.		As above	
3. Complete and report fault diagnosis and	3.1	OHS work completion risk control measures and procedures are followed.	As per 1.3		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
rectification activities.					
	3.2	Work site is made safe in accordance with established safety procedures.	As per 1.3		
	3.3	Rectification of faults is documented in accordance with established procedures.		Fault finding activities Page 14 to 20 of IS71 Assessment Mapping.pdf	
	3.4	Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.		Fault finding activities Page 14 to 20 of IS71 Assessment Mapping.pdf	

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Receiving end voltage comparison between short/ medium and long transmission lines		EP1	
Long transmission line PI equivalent circuit Investigation		EP2	
Long transmission line T equivalent circuit Investigation		EP3	
Finding Transmission line efficiency/ Transformer effect on line efficiency		EP4	
Reactive power and power factor improvement		EP5	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
<Insert knowledge evidence >	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.	**Insert question number or task skill number** from assessment tool that address the specific, knowledge evidence.
T1 Overview of the transmission system	Advanced Diploma in Electrical Engineering Exercises Page 153) Q 41 to 47		
T2 The principles involved in high voltage a.c. transmission			Advanced Diploma in Electrical Engineering Exercises Page 149) Q 16 to 18
T3 The principles involved in d.c. transmission	Advanced Diploma in Electrical Engineering Exercises Page 147) Q 5 to 7		
T4 The principles of operation, voltage and current range, breaking capacity and field of use			Advanced Diploma in Electrical Engineering Exercises Page 147) Q 10 to 12
T5 The types of isolators in use			Advanced Diploma in Electrical Engineering Exercises Page 147) Q4
T6 Circuit breaker auxiliary systems			Advanced Diploma in Electrical Engineering Exercises Page 123) Q 1 to 4

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T7 The characteristics of lines and cables			Advanced Diploma in Electrical Engineering Exercises Page 117) Q 1 to 5 Q 24 to 30
T8 Control of voltage. Conditions leading to voltage collapse			Advanced Diploma in Electrical Engineering Exercises Page 117) Q 40 to 43
T9 Range of devices covered by SVCs	Advanced Diploma in Electrical Engineering Exercises Page 132) Q 19 to 21		
T10 Importance of the location in the system of voltage control devices			Advanced Diploma in Electrical Engineering Exercises Page 122) Q 23 to 44
T11 Use of graphical methods to calculate the size of VAr regulating plant			Advanced Diploma in Electrical Engineering Exercises Page 131) Q 19 to 21
T12 Types of communication systems including telephone, power line carrier,			Advanced Diploma in Electrical Engineering Exercises Page 132) Q 23 to 37
T13 Transient over-voltages in power systems	Advanced Diploma in Electrical Engineering Exercises Page 131) Q 14 to 18		
T14 Factors leading to the generation of corona.			Advanced Diploma in Electrical Engineering Exercises Page 130) Q 5 to 12

Add rows to the following table as required

Assessment Conditions	Assessment	Assessment	Assessment

	event 1 Written Test	event 2 Practical & Observation	event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test 1 + 2	Practical EP1 to 5	All assignments

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

(1) Delivery & collection of evidence

1 Prepare to diagnose and rectify faults. Work performance

1.1 OHS procedures for a given work area are identified, obtained and understood Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q15+16 www.electricaldiploma2013.webs.com Then access

Click **HERE** to download the Exercises

http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf

Relevant Instruction Lessons

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22

Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q12.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.4 The extent of faults is determined from reports and other documentation and from discussion with appropriate personnel.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 203)

Positive, negative and zero sequence
Slide 1+2+3+4

Q21.Z1= 20% Z2= 15% 200MVA base A to B fault at 33KV Find fault currents.
Slide 5

Q22.Z1 = 5% Z2 = 10% Zo = 20%, 200MVA 132 KV line to ground fault. Find fault current. Slide 6+7+8

Q23. Z1 = 70% Z2= 70% Zo = 30 % Base MVA = 200 MVA E = 66KV 2 Line to ground fault. Calculate fault current.

1.5 Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.

1.6 Tools, equipment and testing devices needed to diagnose faults are obtained in accordance with established procedures and checked for correct operation and safety

Ref-Advanced Diploma in Electrical Engineering Exercises Page 150)

Slide 15+16+17

Q23.A three phase 66KV line is supplying 500 KW at 0.85 PF lagging. Line resistance, inductive reactance and capacitive reactance are 1Ω, 4Ω and 3000Ω respectively. Calculate the sending end voltage by using equivalent Pi circuit.

Slide 18+19

Q24. What factors are to be considered for power system planning.

Slide 20+21

Q25.A sum of $2000 is invested at 5% for 15 years at compound interest.

Calculate the sum at the end of 15 years

If instead of lump sum at the end of 15 years, the loan of $2000 is to be paid by the fixed around each year, calculate the annual amount.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 153)

Slide 1+2+3
Q41.What is transmission line . Explain the components of it.
Slide 4_6
Q42.Explain maximum transfer of electrical energy.
Slide 5+7+8
Q43.Explain surge impedance loading.
Slide 9
Q44.Describe long and short transmission lines.
Slide 10+11+12+13
Q45.Explain (a)Propagation constant (b) Line model & SIL
Slide 14+15
Q46.Write the equations to calculate complex power.
Slide 16
Q47.What are the difference between balanced line & unbalance line.

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		
Students' work in own	Summative Assessment- Formal	

record	Tests	
	Formative Assessment/Practical+ Class works	

2 Diagnose and rectify faults.

2.1 OHS risk control measures and procedures for carrying out the work are followed.

As per 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 149)

Power factor connection
Slide 1+2+3+4+5+6+7

Q13.What is power factor. What are the effects of poor power factor

Q14.Four three phase 415V 50HZ loads are connected together in an industrial installation. Determine (a) Total load (b) Total power factor (c) The value of capacitor required PF to 0.98
Slide 8+9

Q15.A load with a PF 0.7 lagging dissipates 1500W from 240V , 50HZ supply. It is required to correct the PF to 0.95 lagging. Find (a) The original and final currents (b) The value of the component to be added in parallel with the original load to achieve the required PF correction.

---

(5) Overhead transmission line
Slide 1+2

Q16.Sketch Tee and Pi equivalent circuits of transmission line and vector diagram.
Slide 3+4

Q17.Sketch two ports network equivalent circuit and write the equation.
Slide 5

Q18.By doing open circuit test and short circuit test for parallel line model, the following values are obtained.

OCT—Vs= 12V , Vr=12.5V Is = 0.1 amp
SCT---Vs = 13V, Ir = 0.4A Is = 0.48 amp
Find the generalized equation
Slide 6
Q19.Sketch power transformer protection circuit.
Slide 7
Q20.Sketch recloser

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 147)

Slide 1+2+3
Q1.Compare the copper weight of 3 phase 3 wires system & simple dc system
Slide 4+5
Q2.Explain voltage variations in power system
Slide 6
Q3.Sketch induction motor & synchronous motor
Slide 7
Q4.Explain the components of circuit breaker

Ref-Advanced Diploma in Electrical Engineering Exercises Page 148)

Reflection in transmission line
Slide 1+2+3+4+5
Q8.A 60Ω transmission line connected to load impedance 100+j70 Ω. The forward RMS valresiue on line is 30V. Line impedance is 30Ω
Calculate (a) Power delivered to resistance part of load impedance
(b) RMS current in impedance, reflected wave voltage
(c) Peak voltage forward & backward wave
(d) Voltage standing wave ratio (VSWR)
(e) Return loss in decibel Slide 6
Q9.Explain the impact of switching in power line

Slide 7+8+9+10

Q10.A coil of 20H inductance and 10Ω resistance is connected in parallel with a 30Ω resistor across a 150V dc supply which is suddenly disconnected.

Find

Initial rate change of current after switching

The voltage across 30Ω resistor initially after 0.4 sec

The voltage across the switch contacts at the instance of separation

The rate at which the coil is losing stored energy 0.3 sec after switching

2.4 Logical diagnostic methods are applied to diagnose electrical energy transmission system faults employing measurements and estimation of system operating parameters referenced to system operational requirements.

2.5 Suspected fault scenarios are tested as being the source of system problems.

2.6 Source of the fault is identified and appropriately competent persons are engaged to rectify the fault where it is outside the scope of the control system.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 129)

To determine the quality of the operational status of protection system, it needs to ensure relay operation sequence, the sequential relay protection system and characteristics are to be investigated. The following activities and questions provide this competency.

(32)Over current & earth fault protection , Directional protection, operating characteristics

Slide 1

Q64.Sketch the diagram of over current protection

Slide 2

Q65.Sketch earth fault relay protection diagram.

Slide 3

Q66.Sketch the combined over current and earth fault protection and explain it’s operation.

Slide 4

Q67.Explain the operation of directional relay with diagram.

Slide 5+6+7+8

Q68.Locate directional & non directional elements in ring system.

Slide 9+10

Q69.Sketch the connection diagram of combinational protection scheme that contains two over current relays and one earth fault relay to provide phase to phase and phase to earth protection.

Slide 11

Q70.How will you adjust definite minimum time point on relay curve?

2.7 Faults in the system components are rectified to raise electrical energy transmission system to its operation standard.

2.8 System is tested to verify that it operates as intended and to specified requirements.

2.9 Decisions for dealing with unexpected situations are made from discussions with appropriate persons and job specifications and requirements.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 211)

Change control
Slide 1
Q50.Describe the overview of change control system.
Slide 2
Q51.Explain the establishment of contracts
Slide 3
Q52.Outline the project control system responding the disturbances.
Slide 4
Q53.Sketch the procedure for preparing quality
manual. Slide 5+6
Q54.Explain management leadership.

Work performance + Practical Instruction Back up

Click HERE to download practicals

Refer Power System Practicals

Part 1: Operational Study

Lab No	Name of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1	Receiving end voltage comparison between short/ medium and long transmission lines	distribution system types	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion
EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment

EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential protection busbar protection • surge protection • conventional relays	Research, report presentation
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above

EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the surrounding environment or services and using sustainable energy practices.

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

(2) **Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.**

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?
To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.
The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is , caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in voltages	Abnormal resistance. Wrong cable selection. Abnormal circuit configuration	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of the circuit.	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

Location of Evidences (Table 1)

1 Complete and report fault diagnosis and rectification activities.

1.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	**Reason**	**Related theory**	**The person who does not know the theory will do**	**The person who knows the theory will do**	**Related Practical**	**Development of skill**
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.
(11) Line reactive	Problem related to	Load flow study	Will not take account	Take account on load	EP 42 Maximum	Develop the load flow

power too much. The equipment capacity is unnecessarily increased	load flow		on load flow concept.	flow and optimize the loading	power transfer theorem EP43 Load flow study	concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated from the power line. Too much power loss and high interference to telecom line	Corona	Corona study	Will consider the ACT OF GOD	Will find the way to reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level	EP 7 Corona video	How corona occurs and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System Protection	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault protection

(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not provide the effective protection	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason why and how to change the protection system	Will adjust CT PT ratio at the simulated fault situation and will adjust the relay setting appropriately	EP9 Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	Practical skill development in CT PT ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through

						trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection. All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.

(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc extinguishing methods	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but it does not work when	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and protection task	EP13 Study of various protective relays used in	Knowledge development on various protective relays used in

the ground fault occurs					industry through trade references	industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other Detailed explanation A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions G-Observe the student's performance in practical class L-Student practical performance result + report preparation

Evidence **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery** www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	**Evidence Attached** **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1 On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5 Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:							
A	Assignment	**B**	Written task	**C**	Role play	**D**	Exam
E	Oral questioning	**F**	Simulation	**G**	Observation	**H**	Work based
I	Portfolio	**J**	Self assessment	**K**	Case study	**L**	Practical demonstration
M	Project	**N**	Training Record Book	**O**	Other (Please specify)		

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		

3.4	X		
EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Page 196 to 231 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-Iuu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6oggZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41g4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

G040 + IS73

Page 271 to 284 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KlKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

Page 285 to 307 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with IS73 Assessment Mapping.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	**UETTDRIS73A Develop engineering solutions for energy supply power transformer problems**		

Copy and paste the following table for each element as required

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to diagnose and rectify faults. Work performance	1.1	OHS procedures for a given work area are identified, obtained and understood	Q 1 to 3 of IS73 Assessment Mapping.pdf Page 1		
	1.2	OHS risk control measures and procedures in preparation for the work are followed			Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22 Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)
	1.3	The extent of the transformer problem is determined from performance specifications and situation reports and in consultations with relevant persons.	Q 1 to 4 of IS73 Assessment Mapping.pdf Page 2		
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.	Q 9 to 12 of IS73 Assessment Mapping.pdf Page 3		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	1.5	Effective strategies are formed to ensure solution development and implementation is carried out efficiently.			Advanced Diploma in Electrical Engineering Exercises Page 208) Q11+12
2 Develop engineering solutions for energy supply power transformer problems.	2.1	OHS risk control measures and procedures for carrying out the work are followed.	As per 1.3		
	2.2	Knowledge of supply power transformer arrangements, operation, device characteristics and applications are applied to developing solutions to supply power transformer problem			Advanced Diploma in Electrical Engineering Exercises Page 135,136,) Q 8,12,22
	2.3	Parameters, specifications and performance requirements in relation to each transformer problem are obtained in accordance with established procedures.			Advanced Diploma in Electrical Engineering Exercises Page 138,) Q 25 to 27
	2.4	Approaches to resolving supply power transformer problems are analysed to provide most effective solutions			Advanced Diploma in Electrical Engineering Exercises Page 135,) Q 5 to 7 Advanced Diploma

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
					in Electrical Engineering Exercises Page 141) Q39 to 44
	2.5	Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.			Advanced Diploma in Electrical Engineering Exercises Page 211 Q50 to 54
	2.6	Quality of work is monitored against personal performance agreement and/or established organizational or professional standards.			As above
3.Test, document and implement engineering solution for energy supply power transformer problems.	3.1	Solutions to transformer problems are tested to determine their effectiveness and modified where necessary.			Advanced Diploma in Electrical Engineering Exercises Page145) Q64 to 72
	3.2	Adopted solutions are documented including instruction for their implementation that incorporates risk control measure to be followed.			Advanced Diploma in Electrical Engineering Exercises Page145) Q73 to 80
	3.3	Appropriately competent and qualified person(s) required to implement solutions to supply power transformer problems are coordinated in accordance with regulatory requirements and enterprise policy. (Note)	Practical TR1, Tr2,Tr3		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
	3.4	Justification for solutions used to solve supply power transformer problems is documented for inclusion in work/project development records in accordance with professional standards.	Practical TR4		

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Transformer polarity test		Practical TR1	
Three phase transformer connection & vector group		Practical TR2	
Transformer parallel operation		Practical TR3	
Transformer winding design		Practical TR4	

Add rows to the following table as required

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Transformer construction and operating principles	Q1,2 of Test 1		
T2 Transformer parameters	Q 3,4 of Test 1		
T3 Cooling methods			Advanced Diploma in Electrical Engineering Exercises Page145) Q73 to 80
T4 Instrument transformers			Advanced Diploma in Electrical Engineering Exercises Page127) Q38 to 52
T5 Transformer connection	Test 2 Q2, Q7		
T6 Parallel operation	Test 2 Q10		
T7 Harmonics in transformers	Test 2 Q8,9		
T8 High voltage isolation			Advanced Diploma in Electrical Engineering Exercises Page124) Q10 to 15

Add rows to the following table as required

Assessment Conditions	Assessment	Assessment	Assessment

			event 1 Written Test	event 2 Practical & Observation	event 3 Assignment
Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources			Test 1, 2	Practical TR1, TR2, TR3, TR4	All Assignment Task

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UETTDRIS73A Develop engineering solutions for energy supply power transformer problems

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to diagnose and rectify faults. Work performance

1.1 OHS procedures for a given work area are identified, obtained and understood Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q15+16 www.electricaldiploma2013.webs.com Then access

Click **HERE** to download the Exercises

http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf

Relevant Instruction Lessons

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Guided study (Online)Resources+Online exercises+Online Practicals
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http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22

Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.3 The extent of the transformer problem is determined from performance specifications and situation reports and in consultations with relevant persons.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 135)

Transformer construction
Slide 1

Q1.Sketch shell & core type transformer constructions.

Q2.Write the transformer voltage equation.

Q3.Write voltage, current and turn relations of transformer. Slide 2

Q4.Calculate iron core flux density & RMS magnetizing current for the following single phase transformer.

Np=500 Ep=2000V (RMS), Core CSA = 100 sq-cm where length = 200 cm Air gap 0.5mm ,μ 0= 1900

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?
Q10.How are the risks classified?
Q11.How can the risk be evaluated?
Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

.

1.5 Effective strategies are formed to ensure solution development and implementation is carried out efficiently.
Ref-Advanced Diploma in Electrical Engineering Exercises Page 208)

(3) Strategy objective

Slide 1+2
Q11.What are the developing of strategies in project?
Q12.How will you examine the effectiveness of activities in project management?

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		Record2016/Students/TAFE/Sem 1-2016/Sem1 2016 Students work Assessment 1/IS73 Assessment 1 /Question Marking scheme Record2016/Students/TAFE/Sem 1-2016/Sem1 2016 Students work Assessment 1/IS73 Assessment 1/ Assessment Cover Sheet Record2016/Students/TAFE/Sem 1-2016/Sem1 2016 Students work Assessment 2/IS73 Assessment 1/ Assessment Feedback Sheet
Students' work in own record	Summative Assessment- Formal Tests	Record2016/Students/TAFE/Sem 1-2016/Sem1 2016 Students work Assessment 2/IS73 Assessment 1 / Student Work

	Formative Assessment/Practical+ Class works	Record2016/Students/TAFE/Sem 1-2016/Sem1 2016 Students work Assessment 2/IS73 Assessment 1 / Student Work Record2016/Students/TAFE/Sem 1-2016/Sem1 2016/Sem 1 2016 Attendance Records+Record Book

2 Develop engineering solutions for energy supply power transformer problems.

2.1 OHS risk control measures and procedures for carrying out the work are followed.

As per 1.3

2.2 Knowledge of supply power transformer arrangements, operation, device characteristics and applications are applied to developing solutions to supply power transformer problem

Ref-Advanced Diploma in Electrical Engineering Exercises Page 135,136,)

Slide 5
Transformer equivalent circuit.
Q8.Write the equations to do transformer open circuit and short circuit tests.
Slide 9+10
Q12.A 2000KVA 6600/415V three phase delta/ star transformer %R = 2.8, %X = 6 Maximum efficiency occurs at one third load. Calculate (a) Iron loss (b) Maximum efficiency at 0.9 power factor.

Slide 19
Q22(A).What is per unit rating of power transformer.
Slide 20
Q22(B).Primary turn = 400
Primary voltage = 2400V rms
Frequency = 50HZ
CSA = 300 cm 2 , length of winding = 130 cm. Calculate the magnetic flux density of above single phase transformer.

2.3 Parameters, specifications and performance requirements in relation to each transformer problem are obtained in accordance with established procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 138,)

Transformer equivalent circuit
Slide 1+2

Q25.Explain the principle of operation of power transformer.
Slide 9
Q26.Find primary and secondary current of 5KVA 300/150V single phase transformer.
Slide 10+11
Q27.Explain power losses in transformer

2.4 Approaches to resolving supply power transformer problems are analysed to provide most effective solutions.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 135,)

Q5.Describe transformer cooling.
Q6.How will you check the polarity to operate transformers in parallel.
Q7.Transformer A, rated 10MVA, %Za = 1+j2 %
Transformer B, rated 20MVA %Zb = 2+j3%
Calculate % Z of 20MVA transformer based on 10MVA.
MVA supplied by each transformer when they are supplying 15MVA unity PF.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 141)

Q39.Np = 500, Ns = 100, Rp = 0.2Ω, Rs =0.015Ω, Xp=0.1Ω, Xs=0.4Ω, Vp= 2000V, Vs= 500V Find Zeq ' . Vs ' , % Regulation for 0.9 PF lagging, % Regulation for 0.95 PF leading
Q40.Write the equation for % regulation at maximum efficiency. Slide 6

Q41.If % R = 4 % X=6 Find % Regulation at PF lagging.
Slide 7
Q42.Write the equation for transformer loss and efficiency.
Slide 8+9
Q43.Single phase 6000KVA transformer 7000/450V Iron loss = 3 KW , Full load copper loss 5 KW .
Find (a) % Efficiency at full load 0.9 pF lagging (b) % Efficiency at half load 0.9 PF lagging.
Slide 10+11
Q44.Find the load at maximum efficiency of the following single phase transformer. KVA = 2000, Voltage ratio = 7000/500, Iron loss = 5 KW, Full load copper loss = 7KW, Maximum efficiency is achieved at 0.7 PF lagging.

2.5 Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.

2.6 Quality of work is monitored against personal performance agreement and/or established organizational or professional standards.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 211)

Change control
Slide 1
Q50.Describe the overview of change control system.
Slide 2
Q51.Explain the establishment of contracts
Slide 3
Q52.Outline the project control system responding the disturbances.
Slide 4
Q53.Sketch the procedure for preparing quality
manual. Slide 5+6
Q54.Explain management leadership.

3 Test, document and implement engineering solution for energy supply power transformer problems.

3.1 Solutions to transformer problems are tested to determine their effectiveness and modified where necessary.

Ref-Advanced Diploma in Electrical Engineering Exercises Page145)

Unbalanced load+ Parallel+ Cooling +Tap changing+ Efficiency
Slide 1+2+3
Q64.Describe briefly the various stages of on-load tap changers used in power system.
Q65.List two fundamental features of no load tap changing circuits.
Slide 4
Q66.Briefly describe the effect of tap changing on the limitation of power system
operation. Slide 5+6+7
Q67.2000KVA, 6600/415V three phase delta/ star transformer %R=2 %X=5 Maximum
efficiency occurs at 1/3 load
Calculate (a) Iron loss (b) Full load efficiency at 0.9 PF lagging (c) Maximum efficiency at 0.7 PF lagging.
Slide 8
Q68.How does the unbalanced load on three phase transformer cause the magnetomotive force in it?
Slide 9
Q69.Describe the examples of unbalanced loading

Slide 11
Q70.What are the requirement for parallel operation of three phase
transformers Slide 12+13+14

Q71.Tr A = 3+j6 % 15MVA , Tr B= 4+j8 % 25MVA
Calculate
% Impedance of 25 MVA transformer to base 15MVA
MVA supplied by each transformer if load is 20 MVA at unity PF.
Slide 15+16
Q72.Do the exercises on slide 15+16

3.2 Adopted solutions are documented including instruction for their implementation that incorporates risk control measure to be followed.

Ref-Advanced Diploma in Electrical Engineering Exercises Page145)

Rating + Conservator system
Slide 1+2+3
Q73.Sketch the following cooling arrangements : AN, AF, ONAF, OFAF, ONAN,
OFWF Slide 4
Q74.Briefly describe the methods used in measuring oil and winding
temperatures. Slide 5
Q75.Describe the construction and use of dry type transformer.
Q76.List two types of windings used in dry type
Q77.List the requirements for oil in oil immersed transformer
Q78.List the important characteristics for oil testing
Slide 6+7+8
Q79.Describe the tests to determine the characteristics of transformer.
Slide 9
Q80.Describe dissolved GAS analysis (DGA) of insulating oil.

3.3 Appropriately competent and qualified person(s) required to implement solutions to supply power transformer problems are coordinated in accordance with regulatory requirements and enterprise policy. (Note)

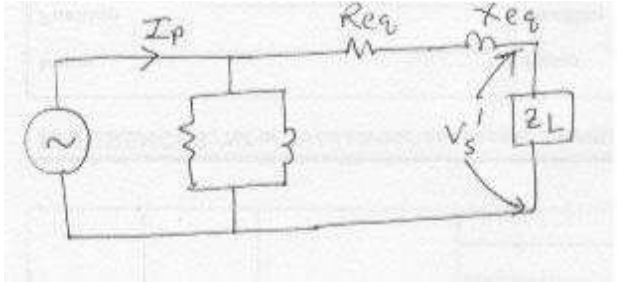
3.4 Justification for solutions used to solve supply power transformer problems is documented for inclusion in work/project development records in accordance with professional standards.

Part 1: Operational Study

Lab No	Name of Practical	IS73 Equipments	Assessment
TR1	Transformer polarity test	• distributor equipment	Practical Observation

TR2	Three phase transformer connection & vector group	• distributor equipment	Practical Observation
TR3	Transformer parallel operation	• distributor equipment	Practical Observation

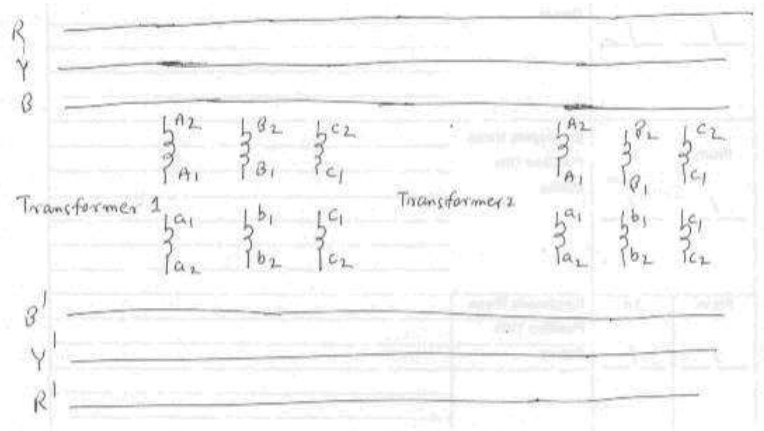
POWER TRANSFORMER ASSESSMENT (1)

Assessment Criteria	Question No	Question
KS01-TIS73A Power transformers diagnostics **Evidence shall show an understanding of power transformers to an extent indicated by** **the following aspects:** **T1 Transformer construction and operating principles encompassing:** **various types of lamination style and core construction used in single phase, three** **phase, double wound and auto transformers.** **different winding styles/types used in transformers.** **how input current is limited on no load and how power is transferred from primary** **to secondary when a load is connected.** **using the transformation ratio to determine an unknown quantity of V, I, VA.** **significance of nameplate data items.**	1 2 3	Why is the laminated core used in transformer? (5 marks) Calculate Iron core flux density & RMS magnetizing current for the following single phase transformer. Np= 400 Ep= 3000v RMS F=60HZ, Core CSA= 200 sq cm, Core length= 230 cm, Air gap= 0.4 mm, $_r$ = 1900 (10 marks) In the following transformer ,  Req = 0.2 ohm Xeq = j0.8 ohm Ro = 300 ohm Xo = j400 ohm V =250 0 Z2 = 6 + j3 ohm

operation of a transformer under load/no load conditions. **the reason any particular type of transformer is used in a specific application.** **safety features specified in regulatory standards with respect to transformers.** **safety features specified in regulatory standards with respect to isolating** **transformers.** **basic insulation resistance, continuity and winding identification tests.** **T2 Transformer parameters encompassing:** **the percentage impedance of a transformer by test.** **percentage impedance of a transformer by calculation.** **the equivalent circuit of a transformer.** **calculation of voltage regulation.** **losses that occur in a transformer.** **tests to determine losses.** **efficiency and state typical values.** **the all day efficiency of a transformer.** **T3 Cooling methods encompassing:** **methods of natural and forced cooling.** **properties of transformer oil.** **tests performed on transformer oil.** **auxiliary equipment** **the purpose and operation of the types of auxiliary equipment used on** **transformers - bushings, explosion vents, surge diverters, tap changers,** **conservator, breathers and desiccants, gas relays, temperature indicators.** **T4 Instrument transformers encompassing:** **construction of current transformers.** **uses and ratings of current transformers.** **construction of voltage transformers.**	4 5 6 7	Find (a) Iron loss (b) No load current (c) Secondary load current (d) Total Primary Current (e) Copper losses (f) Secondary terminal voltage (g) Power in watts consumed by the load (h) % Efficiency (20marks) A single phase 300 KVA transformer has the following values. Primary turn= 600 Secondary turn= 300 Primary winding resistance = 0.2 ohm Secondary winding resistance = 0.005 ohm, Primary winding inductive reactance= 0.8 ohm Secondary winding inductive reactance= 0.04 ohm, Primary voltage= 2200v Secondary voltage=440v Calculate (a) Total equivalent impedance of winding % Regulation at Full load 0.8 PF leading © % Regulation at Full load 0.6 PF lagging Secondary terminal voltage (20 marks) Find all day efficiency of the following transformer. 200 KVA Single phase Iron loss = 700 watt Full load copper loss= 900 watt 24 hr load cycle 8 hr PF 0.9 lagging 180 watts 5hr PF 0.8 lagging 1000 KVA 4hr 30 KVA and 20 KW 3hr Energized with no load The rest of time De energized (20marks) What are the requirements to connect two transformers in parallel. (5 marks) .How will you check the polarity of transformer for parallel operation . Explain with sketch. (5 marks) Transformer A Rated 15 MVA %Za = 3 + j 6 % Transformer B Rated 30 MVA %Zb = 4 + j 8% Calculate (a) % Z of 30 MVA Transformer B based on 15 MVA (b) MVA supplied by each transformer when combination of

uses and ratings of voltage transformers. **safety techniques when using instrument transformers.**	8 100 marks	them are supplying total load 12 MVA unity PF © If the combination is supplying 45 MVA unity PF , calculate the amount of over load on one transformer.. (15 marks)

POWER TRANSFORMER ASSESSMENT (2)

Assessment Criteria	Question No	Question
T5 Transformer connections encompassing: **vector group of a transformer from a connection diagram.** **connections of a three-phase transformer to create a particular vector group.** **reasons for using the different vector groups.** **purpose of tertiary windings.** **consequences/effect of an incorrect connection.** **T6 Parallel operation encompassing:** **polarity markings for the windings of a transformer.** **conditions/restrictions for parallel operation of transformers.** **calculation of loading on transformers operating in parallel.** **connection of transformers in parallel to supply a common load.** **the consequences/effect of an incorrect connection.** **T7 Harmonics in transformers encompassing:** **how harmonics are generated in transformers.** **problems caused by harmonics in transformers.** **measurement of the harmonics in a transformer.** **methods/equipment used to overcome harmonics in transformers.**	1 2	Compare VA of Step down auto transformer and 2 winding transformer. 400/200v 2 winding Transformer 1 phase rated 5 KVA . The transformer is to supply 600/200v, draw the circuit diagram how to supply the required load. Also find its rating while supplying 600/200 v. (15marks)  Connect TR1--- Yy0 TR2--- Dd0 , TR1 ---Yy0 TR2 --- Dd6 TR1---Dy11 TR2--- Yd11 , TR1--- Dy1 TR2 ---Yd1 (15 marks) . The followings are test results of 3 phase 66/11KV 30MVA Star/ Star connected transformer.
T8 High voltage isolation encompassing: **the term high voltage.**	3	No load test LV Side voltage = 11 kv, LV side current 50 amp, Power = 250 watt

- **procedures for isolating high voltage apparatus.**
- **regulations with respect to access permits.**
- **clearances to be observed with respect to high voltages up to 33 kV.**
- **the term 'step' and 'touch' potential.**

	Short circuit test Line voltage = 1650 v Line to line , Line current = rated current Power = 200 watt (10 marks)
	Draw the equivalent circuit of transformer with all components referred to primary side.
4	If primary and secondary magneto motive force are not equal, what will happen to transformer? (5 marks)
5	With sketch, provide one example of three phase unbalanced condition on three phase transformer. (5marks)
6	In the following connections of three phase transformers, which one can carry harmonic current and which one can not? Dd Yd Dy YY without neutral YY with neutral
7	(5marks) If the transformer can not carry harmonic current, which addition is required to be added to transformer to carry it. (5 marks)
8	What are the disadvantages of harmonic? (5 marks)
9	Transformer A Rated 15 MVA %Za = 3 + j 6 % Transformer B Rated 30 MVA %Zb = 4 + j 8%
10	Calculate (a) % Z of 30 MVA Transformer B based on 15 MVA (b) MVA supplied by each transformer when combination of them are supplying total load 12 MVA unity PF . © If the combination is supplying 45 MVA unity PF , calculate the amount of over load on one transformer..

	11 12 100 marks	(15 marks) Sketch 3rd harmonic flux. (5 marks) A 1500 KVA 6600/ 415 v 3 phase Delta / Star transformer %R= 1.8, % X= 5 Maximum efficiency occurs at ¼ load.. Calculate (a) Iron loss Full load efficiency at 0.9 PF Lagging Maximum efficiency at 0.9 PF lagging Full load % Regulation at 0.8 PF lagging. (15 marks)

POWER TRANSFORMER ASSESSMENT (3)

Practical assessment (Open Circuit Test & Short Circuit Test of Single Phase Transformer)

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X

1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
3.1	X	X	
3.2	X		
3.3	X		
3.4	X		
EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Page 196 to 231 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

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G015(AA)Lesson 2-Demand factor.zip

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G015(AE)Lesson 1-Power system protection scheme.zip

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http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

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G015(AE)Lesson 5-Current time grading.zip

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G015AE Lesson 6

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G015(AE)Lesson_7-CT_PT.zip

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G015(AG)Lesson 5-Surge in power system.zip

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G015(AG)Lesson 6-CTPT Harmonic filter.zip

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G015(AG)Lesson 7-Short circuit in alternator.zip

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G015(AG)Lesson 8-Corona.zip

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G015(AG)Lesson 9-Power surge.zip

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Power System (2)

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G037+G038+G039 Lesson 2-Site Earthing.zip

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G037+G038+G039 Lesson 3-Power System Control Equipments.zip

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G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

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G037+G038+G039 Lesson 5-Harmonic.zip

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G037+G038+G039 Lesson 6-Harmonic Calculation.zip

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G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

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G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

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G037+G038+G039 Lesson 9-Insulator.zip

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G037+G038+G039 Lesson 10-Reliability of Power System.zip

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G037+G038+G039 Lesson 11-Harmonic Reduction.zip

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G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

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G037+G038+G039 Lesson 13-Power Quality.zip

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G037+G038+G039 Lesson 14-Harmonic Model.zip

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G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

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http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

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G037+G038+G039 Lesson 17-Preparation for emergency.zip

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G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

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G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

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G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

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G037+G038+G039 Lesson 22-Power System Protection.zip

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G037+G038+G039 Lesson 23-Switch Gear.zip

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G040 + IS73

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Power transformer

G040 Lesson 1 Power transformer rating 1.zip

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G040 Lesson 1 Power transformer rating 2.zip

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G040 Lesson 2 Open circuit short circuit test.zip

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G040 Lesson 3 Transformer regulation.zip

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G040 Lesson 4 Power transformer connection.zip

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G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

Assessment Mapping - Template

(streamlined training package)

This template to be used for "new" endorsed streamlined training packages.

Instruction for use: These instructions in RED should be deleted from the completed document. Instructions in **BLUE** should be written over with appropriate information.

This template is to be completed by the assessment developer to ensure the assessments meet the training package requirements for the unit of competency.

It must be used during the assessment validation process.

Record of this document must be retained in the faculty TAS teamshare teaching section.

Add rows and columns as required below.

This document should be viewed concurrently with IS68+IS74 Assessment Mapping.pdf

Click HERE

Faculty:	Construction, Engineering & Transport (CET)	**College:**	
Teaching Section:	Electrical Engineering		
Qualification Number and Name:	Advanced Diploma of Engineering Technology-Electrical/ Advanced Diploma of Electrical Engineering		
Unit of Competency Number and Name:	**UETTDRIS74A Solve problems in energy supply protection equipment**		

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
1 Prepare to solve problems in energy supply network equipment	1.1	OHS procedures for a given work area are identified, obtained and understood	Q 1,2,3 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.2	OHS risk control measures and procedures in preparation for the work are followed	Q 4 to 7 of IS68+IS74 Assessment Mapping.pdf (Page 2)		
	1.3	1.3 The extent of the protection problem is determined from performance specifications and situation reports and in consultations with relevant persons. (IS74)			Advanced Diploma in Electrical Engineering Exercises Page 208) Q11+12 Advanced Diploma in Electrical Engineering Exercises Page 123)Q 1 to 7
	1.4	Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers			Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)
	1.5	Effective strategies are formed to ensure solution development and implementation is carried out efficiently.			Advanced Diploma in Electrical

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		(IS74)			Engineering Exercises Page 208) Q11+12 Advanced Diploma in Electrical Engineering Exercises Page 123)Q 1 to 7
2.Solve problems in energy supply network protection equipment and system.	2.1	OHS risk control measures and procedures for carrying out the work are followed.	As per 1.1 to 1.3		
	2.2	Knowledge of supply system protection arrangements, operation, device characteristics and applications are applied to developing solutions to supply system protection problems. (IS74)	Test 1 Q 1 to 10		
	2.3	Parameters, specifications and performance requirements in relation to each protection problem are obtained in accordance with established procedures. (IS74)	Test 1 Q 1 to 10		
	2.4	Approaches to resolving supply system protection problems are analysed to provide	Test 1 Q 1 to 10		
	2.5	Unplanned events are dealt with safely and effectively consistent with regulatory requirements and enterprise policy.	As per 1.5		
	2.6	Quality of work is monitored against personal performance agreement and/or established			Advanced Diploma in Electrical

Elements & Performance Criteria			Assessment event(s)		
Element(s)	**PC No**	**Performance Criteria (PC)**	**Assessment event 1 Written Test**	**Assessment event 2 Practical & Observation**	**Assessment event 3 Assignment**
		organizational or professional standards.			Engineering Exercises Page 210)Q 45 to 49
3.Completion and report for problem solving in energy supply network equipment	3.1	OHS work completion risk control measures and procedures are followed.	As per 1.3		
	3.2	Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.		Project	Advanced Diploma in Electrical Engineering Exercises Page 125) Q 17 to 19
	3.3	Appropriately competent and qualified person(s) required to implement solutions to supply systemprotection problems are coordinated in accordance with regulatory requirements and enterprise policy. (IS74) .	Test 1 Q 1 to 10		
	3.4	Justification for solutions used to solve supply system protection problems is documented for inclusion in work/project development records in accordance with professional standards. (IS74)	Test 1 Q 1 to 10		

Add rows to the following table as required

Performance Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
Connection of relay protection scheme & protective equipments by using one line diagram		EP9	
Current transformer & potential transformer connection & ratio test		EP10	
Over current relay characteristics		EP11	
Electronic relay test		EP12	
Study of various protective relays used in industry through trade references			Research Assignment

Knowledge Evidence	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment
T1 Protection scheme requirements	Q 1,2,3 of Test 1		
T2 Discrete protection systems+T3 Interdependent protection			Advanced Diploma in Electrical Engineering Exercises Page 125) Q1 to 8
T4 Complex protection systems	Q7 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 25 to 29
T4 Complex protection systems	Q10 of Test 1		Advanced Diploma in Electrical Engineering Exercises Page 125) Q 52 to 63

Assessment Conditions	Assessment event 1 Written Test	Assessment event 2 Practical & Observation	Assessment event 3 Assignment

Gather evidence to demonstrate consistent performance in conditions that are safe and replicate the welectrical workshop K2.11. Application of safe working practice & regarding the housekeeping rules are to be observed. Emergency procedures are to be informed. Safety equipments & first aids equipments are to be available. The students get the access to • Relevant practical equipments Records relating to electrical engineering resources	Test	Practical EP 9 to 12	Research Assignment

Created by (Name)		**Date created**	
Approved by (Name)		**Date approved**	
Signature		**Date modified**	

UETTDRIS74A Develop engineering solutions for energy supply system protection problems
ONLINE RESOURCES ARE SUPPORTED THE STUDENTS TO ACQUIRE THE COMPETENCIES

ASSESSMENT QUESTIONS & TESTS ARE BASED ON THE FOLLOWINGS,THEY ARE MODIFIED, EXTRACTED SOME PARTS, APPLIED THE SIMILAR ONES,ALTER AND UTILIZED IN ASSESSMENT TASKS & THEORY TESTS FROM TIME TO TIME.

1 Prepare to solve problems in energy supply network equipment

1.1 OHS procedures for a given work area are identified, obtained and understood

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q15+16

www.electricaldiploma2013.webs.com Then access Click **HERE** to download the Exercises - http://www.mongroupsydney1.com/Advanced_Diploma_in_Electrical_Engineering_Exercises_EE011.pdf
Relevant Instruction Lessons

Study Option (1)

Guided study (Online)Resources+Online exercises+Online Practicals

Click HERE

&

Youtube Videos for Electrical Engineering Lessons

http://www.mongroupsydney1.com/youtubevideos.htm

Q1.Describe the risks and dangers in power station and outline the recommended safety

Q2.equipments and emergency procedures.

Q3.Outline the process of maintenance work in substation.

1.2 OHS risk control measures and procedures in preparation for the work are followed

Ref-Advanced Diploma in Electrical Engineering Exercises Page 3 -Q17+18 Page 4 Q21+22

Q4. Write down the check list to perform the tasks in substation.

Q5. Write down the safety procedures and methods to assess the risk and to reduce the risk.

Q6..Write down the code of practice for working near exposed main and apparatus.

Q7.Which precautions are to be emphasized when working in substation?

1.3 The likely extent of work to be undertaken is envisaged from reports and/or discussions with appropriate person(s)

Q8. Write down the risk reduction procedures in maintenance work to discuss with work manager. (Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q12)

1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively withothers.

Answer the following questions to seek the advice from work supervisor in the following aspects.

Q9. What are the risks?

Q10.How are the risks classified?

Q12.How can the risk be evaluated?

Q12.How will you manage the risk? Ref-Advanced Diploma in Electrical Engineering Exercises Page 2 Q8 to 11)

1.5 Sources of materials that may be required for the work are established in accordance with established procedures.

Submit the following assignment questions

Ref-Advanced Diploma in Electrical Engineering Exercises Page 123)

The practice questions are organized to find out the protection system equipments and materials together with relevant theory

15) Over current and earth fault protection

Slide 1+2

Q1.Sketch three phase over current protection.

Q2.Sketch three phase earth fault relay protection.

Slide 3+4+5

Q3.Explain the operation of directional element with sketch.

Slide 6

Q4.Locate the position of reverse power relay in power line.

Slide 7

Q5.Sketch the connection of combined protection scheme that contains two over current relays & one earth fault relay to provide phase to phase and earth protection.

Q6.How does directional element of relay perform?

Slide 8

Q7.Locate directional and non directional element in a ring circuit.

1.6 Tools, equipment and testing devices needed to take measurements are obtained in accordance with established procedures and checked for correct operation and safety.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

.Testing of protection current & potential transformer and relevant questions are arranged to provide this competency component.

Slide 5

Q52.Explain (a) AC ratio check (b) DC polarity check (c)Three phase polarity test for three phase CT Slide 6

Q53.How will you interpose & sum CT & PT?

Location of Evidences (Table 1)

Performnce Criteria	Above	Location of Evidences
Marking Guide/ Assessment Cover/ Feedback own record		

		Assessment Feedback Sheet
Students' work in own record	Summative Assessment- Formal Tests	
	Formative Assessment/Practical+ Class works	

2 Solve problems in energy supply network protection equipment and system.

2.1 OHS risk control measures and procedures for carrying out the work are followed.

As per 1.1 to 1.3

2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

Live testing of protective relay system and depermination of characteristics and relevant questions are arrrranged to provide this competency component.

Distance protection scheme
Slide 1

Q30.Explain the distance protection scheme with
sketch. Slide 2

Q31.Explain the operation and construction of distance relay with sketch.
Slide 3

Q32.Explain the characteristics of distance
relay. Slide 4

Q33.Describe the directional distance relay with sketch.
Slide 5

Q34.What is the relation between maximum reach & relay characteristics.
Slide 6+7

Q35.Explain the zones for distance protection scheme.

Slide 8

Q36.Explain the operation of three phase distance relay.

Slide 9

Q37.Explain maximum reach and maximum reach angle.

2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures

As per 1.3

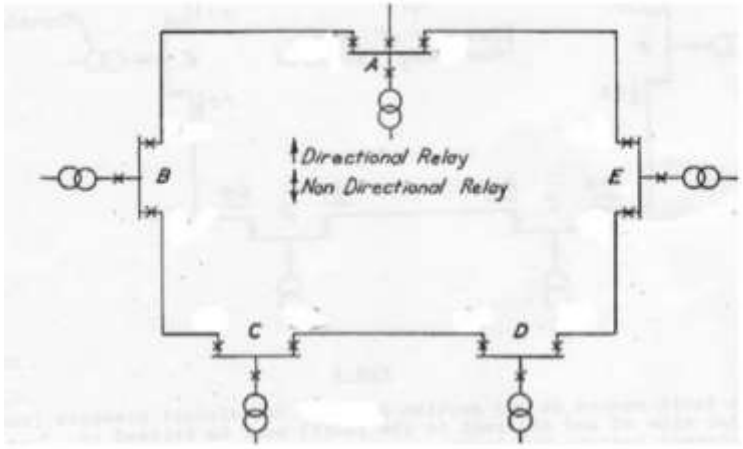
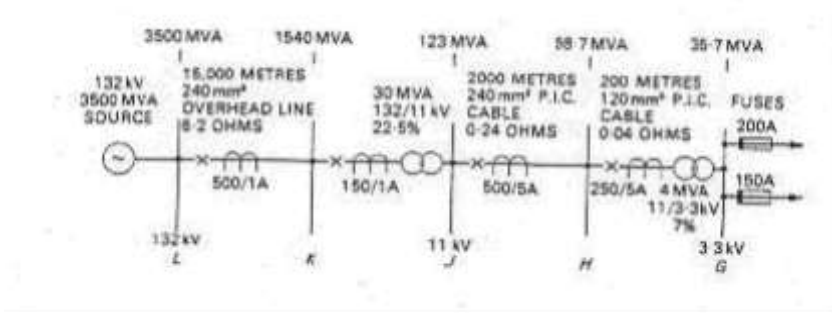
2.4 Safety hazards resulting from the reports and risk control measures devised and implemented in consultation with appropriate personnel.

As per 1.3

2.5 Problem solving is approached methodically drawing on knowledge of energy supply network protection equipment and systems using measured and calculated values of circuit/apparatus parameters.

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.

EKAS COMPONENT	Question No	Questions
KS01-TIS68A Electrical power system protection Evidence shall show an understanding of protection methods and devices for electrical power systems to an extent indicated by the following aspects: T1 Protection fundamentals encompassing: purpose of protection features of a protection scheme T2 Instrument transformers for protection encompassing: Operating principles Applications of current transformers Applications of voltage transformers T3 Feeder protection encompassing: fuse protection overcurrent & earth fault sensitive earth fault unit schemes distance protection trip/close sequences for feeders	1 2 3 4 5	What is power system protection scheme? (5 marks) What equipments are included in power system protection scheme? (5 marks) Explain the functions of the following devices included in a power system protection Scheme. CT, PT, Fault Detector, Tripping Circuit (10 marks) Sketch the construction of • Balanced Beam Relay Connection Diagram of Relay Tripping Circuit (10 marks) Sketch the connection diagram of combination protection scheme that contains two Over current relays and one earth fault relay to provide phase to phase and phase to earth protection.. (10 marks)

recloser/sectionaliser systems T4 Transformer protection encompassing: overheating protection overcurrent protection restricted earth fault protection differential protection oil and gas devices T5 Busbar protection encompassing: types of fault requirements of busbar protection system protection frame-earth protection T6 Surge protection encompassing: voltage surges surge diverters arcing horns	6 7 Total 70 marks 8 9 10 Total 100 marks	 Locate relay protection scheme for given system when fault occurs at point F. (20 marks) Sketch curve for discrimination by both time and current of the following power system..  (20 marks) How will you adjust Definite Minimum Time point on relay curve? (5 marks) What is “Pick Up” of relay? (5 marks

		Sketch the vector diagram for primary, secondary main windings of Star Delta Power Transformer . (10 marks)

2.6 Circuit/apparatus components are dismantled where necessary and parts stored to protect them against loss or damage

Ref-Advanced Diploma in Electrical Engineering Exercises Page 128)

To convert the analog relaying system to digital relay system, the dismantling of origin components and assembly of new system components are to be done. The following questions and activities provide this competency component.

Digital relay+ Telecommunication for protection
Slide 1

Q54.What is digital relay?
Slide 2+4

Q55.Sketch the flow diagram of digital relay operation.
Slide 3+4

Q56.Sketch DAC
system Slide 5

Q57.Explain busbar protection with sketch
Slide 6

Q58.Write line & busbar protection with sketch.
Slide 7

Q59.Sketch the operation of digital relay.

2.7 Circuits/components are rechecked and their operational status is confirmed.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 129)

To determine the operational status of protection system, it needs to ensure relay operation sequence, the sequential relay protection system and characteristics are to be investigated. The following activities and questions provide this competency.

(32)Over current & earth fault protection , Directional protection, operating
characteristics Slide 1

Q64.Sketch the diagram of over current protection

Slide 2

Q65.Sketch earth fault relay protection diagram.

Slide 3

Q66.Sketch the combined over current and earth fault protection and explain it’s operation.

Slide 4

Q67.Explain the operation of directional relay with diagram.

Slide 5+6+7+8

Q68.Locate directional & non directional elements in ring system.

Slide 9+10

Q69.Sketch the connection diagram of combinational protection scheme that contains two over current relays and one earth fault relay to provide phase to phase and phase to earth protection.

Slide 11

Q70.How will you adjust definite minimum time point on relay curve?

2.8 Materials/replacement parts required to solve problems are sourced and obtained in accordance with established procedures.

2.9 Effectiveness of the repair is tested in accordance with established procedures.

2.10 Apparatus is reassembled, finally tested and prepared for return to service.

Ref-Advanced Diploma in Electrical Engineering Exercises Page 126)

When more power loads are connected to transmission line, the current protection system needs to be modified. The following questions and activities provide this competency component.

Transmission line protection

Slide 1

Q23.Sketch transmission line differential protection

Slide 2+3

Q24.Sketch the modification diagram for transmission line protection with differential relay.

Distance relay, pilot wire with differential three phase line protection

Slide 1

Q25.Explain the operation of distance relay

Slide 2

126

Q26.Explain the operation of distance relay with sketch

Slide 3+4

Q27.Sketch the characteristics curve of distance relay

Slide 5+6

Q28.Explain the zone protection of distance relay.

Slide 7+8

Q29.Sketch the protection diagram of distance relay with operating & restraining voltage and current.

2.11 Unexpected situations are dealt with safely and with the approval of an authorised person.

As per 1.3

2.12 Problem solving activities are carried out without damage to apparatus, circuits, the surrounding environment or services and using sustainable

energy practices.

As per 2.5

Location of Evidences (Table 1)

3. Completion and report for problem solving in energy supply network equipment

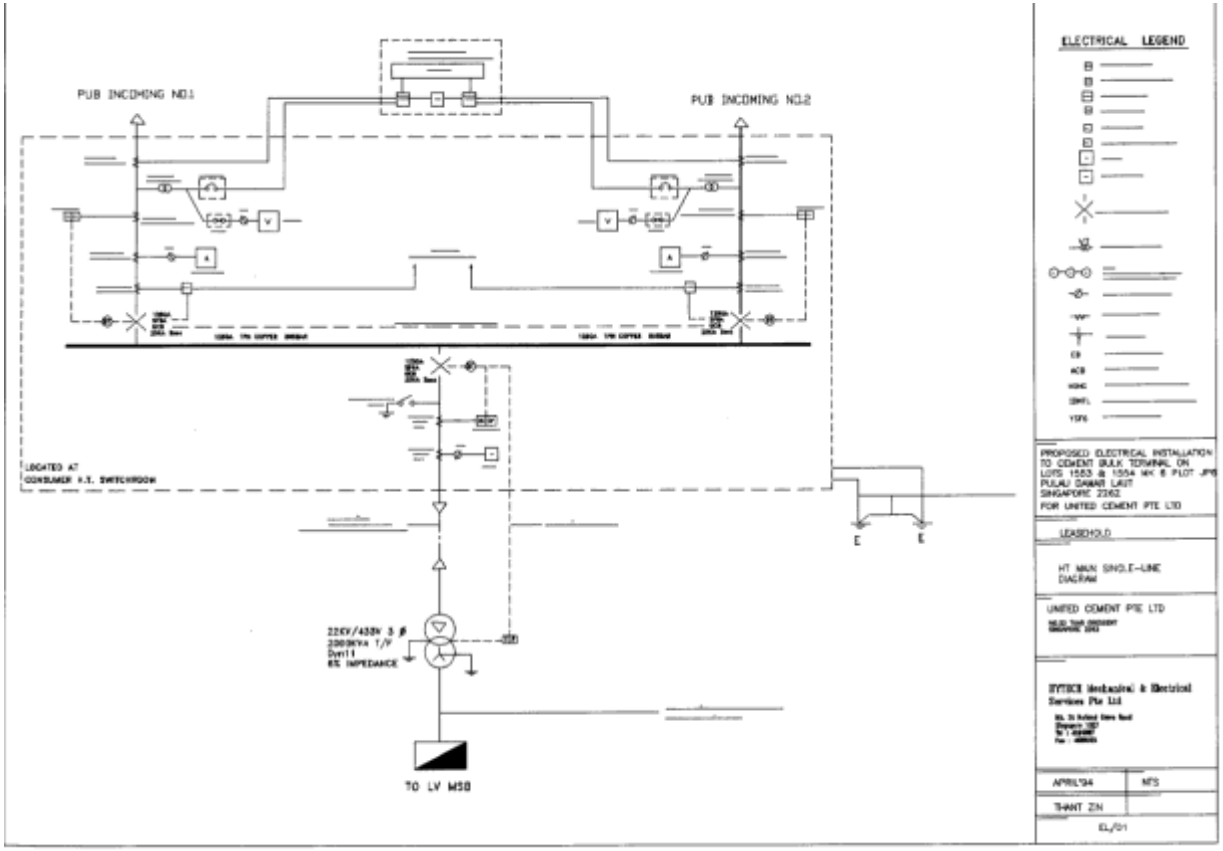
3.1 OHS work completion risk control measures and procedures are followed.

As per 1.3

3.2 Reusable, faulty or worn components are tagged and dispatched for repair to maintain adequate spares.

3.3 Maintenance work activities are documented in accordance with established procedures.

POWER SYSTEM PROTECTION COMMISSIONING PROJECT



The above diagram is Incoming HV supply system for a Cement Factory. It contains Star –Delta Transformer, Interchange switches for switching 2 supply, sketch of protective relay system with trip circuit and outline for measuring instruments.

Develop Detail installation diagram that contain appropriate protection instruments and measurement instruments

Recommend appropriate specifications for protection and measuring instruments for power supply requiring 500Kw for the factory. By answering the following questions, the concepts for the above project can be highlighted

Ref-Advanced Diploma in Electrical Engineering Exercises Page 125)

Three phase differential relay
Slide 1

Q17.Sketch three phase star/ delta transformer protection with differential relay.
125

Slide 2

Q18.Explain the setting of differential relay.

Connection of main transformer, CT , directional relay

Slide 1+2+3

Q19.Sketch the combined earth fault and differential protection for three phase star/ delta transformer.

Work performance + Practical Instruction Back up

Click HERE to download practicals

Refer Power System Practicals

Part 1: Operational Study

LabName No	me of Practical	Equipments	Assessment
	Group 1 Power & Line		
EP1Re	ceiving end voltage comparison between	distribution system	Circuit interpretation, connection, data collection, calculation, graph

	short/ medium and long transmission lines	types	sketch, report presentation, conclusion
EP2	Long transmission line PI equivalent circuit	overhead systems	As above
EP3	Long transmission line T equivalent circuit	distribution system types	As above
EP4	Transmission line efficiency/ Transformer effect on line efficiency	energy metering • demand meters	As above
EP5	Reactive power and power factor improvement	energy metering • demand meters	As above
EP6	PF effect on line current	energy metering • demand meters	As above
EP7	Corona Video	• surge protection	Report presentation, conclusion
EP8	Phase sequence measurement		Competency assessment
	GROUP 2- Protection equipments		
EP9	Connection of relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply)	protection equipment and systems	Competency assessment
EP10	Current transformer & potential transformer connection & ratio test	current transformers • potential transformers	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP11	Over current relay characteristics	protection equipment and systems • over-current protection	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP12	Electronic relay test	conventional relays • electronic relays	As above
EP13	Study of various protective relays used in industry through trade references	• earth fault protection • differential	Research, report presentation

		protection busbar protection • surge protection • conventional relays	
	Group 3- Supply System		
EP19	Underground cable capacitance test	underground systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP20	High tension line design	• overhead systems	Design project
EP21	Line insulator test & capacitance grading	• overhead systems	Circuit interpretation, connection, data collection, calculation, graph sketch, report presentation, conclusion
EP22	Voltage profile chart of distribution system	• voltage regulation equipment • on load tap changers	As above
EP23	Load centre-Power loss comparison	• distributor equipment	As above
EP30	Transformer polarity test	• distributor equipment	As above
EP42	Maximum power transfer theorem with power circuit	• load control	As above
EP43	Load flow study	• load control	As above
EP45	Trade reference study, switch board, busbar, insulator, circuit breakers	reclosers / sectionalisers.	As above

2.10 Methods for dealing with unexpected situations are selected on the basis of safety and specified

work outcomes.

2.11 Diagnosis and rectification activities are carried out efficiently without unnecessary waste of materials or damage to system and the

surrounding environment or services and using sustainable energy practices.

General faults including: open-circuit; short-circuit; incorrect connections; insulation failure; unsafe condition; apparatus/component failure; related mechanical failure for the equipments in the range

(2)**Explore some of the faults in power system/ energy supply that can be rectified only by utilizing para-professional knowledge background and how the arranged simulated practical can provide the hand on experience and work performance for the students and how it is different from the performance only based on trade level activities.**

In range of performance, it outlines the real equipments used in the industry. There will be the arguments that the setting of practical in lab room only includes rheostat, resistor, varic, capacitor etc. How it meets the outlined competencies?
To exactly find out and rectify the faults in energy supply system , the tasks and complexity level more than the trade level- (check the continuity, check the connection, visual inspection, testing and measurement)will be included.
The following is the various power system faults which I draw out from my power engineer work records that the technical knowledge higher than trade level is required to successfully rectify the fault and determine the appropriate solutions. In the table, I summarize how the fault is , caused, background theory, how the person who knows the theory will do, how the person who does not know the theory will do and how my simulated practical / and practical related background theory will assist to develop the fault finding skill.

Typical fault	Cause	Related Theory	How the person who does not know the theory will do	How the person who knows theory will do	Name of simulated practical	How to develop the skill
(1)In reticulation system, there is abnormally different in	Abnormal resistance. Wrong cable selection. Abnormal circuit	Voltage profile chart.	May give he other idea to change the load	Measure voltage, sketch the voltage profile chart. Then identify the portion of	EP 23 Voltage profile chart	Develop the analytical skills to identify the fault point

voltages	configuration			the circuit.		
(2)Line conductor slips from the pin insulator	Line deviation is too high, combination of wind, conductor tension will take away the conductor from pin insulator	Line deviation angle calculation	Will reinstall the line. After some period, he same thing will happen again	Will examine line deviation angle. Tension, wind force. Will rearrange the line or provide shackle insulator	Theory instruction. Line deviation	Develop the problem solving skill on line construction.
(3)Conductor sag too low. Hit by traffic and then broken	Sag calculation. Wrong tension, safety factor, weight	Sag/ line design	Pull up the cable. After some time, it will fall again	Will examine the related parameters and find the way	EP 20 High Tension Line Design	Develop the skill on line design and to know the technical factors for sag.
(4)Discharge current flows out from underground insulator and cause the injury	UG cable capacitance. Charging current	UG Cable capacitance test	Will think about current flow, leakage etc.	Will examine the UG cable capacitance and produce the procedure for discharging	EP 19 Underground cable capacitance test	Develop the skill in UG cable testing focus on capacitance and estimate the amount of charging current
(5)Line pole broken without natural disaster	In appropriate pole strength	Pole mechanical design	Will erect the pole. Some time after, broken gain	Will examine he tension, wind force, conductor weight, then will calculate the pole strength and select appropriate diameter of pole and appropriate pole material	Pole mechanical design lesson + EP 20 High tension line design	Develop the skill on line design and to know the technical factors for pole.

2 Complete and report fault diagnosis and rectification activities.

3.1 OHS work completion risk control measures and procedures are followed.

3.2 Work site is made safe in accordance with established safety procedures.

As per 1.3

3.3 Rectification of faults is documented in accordance with established procedures.

3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified.

Fault	Reason	Related theory	The person who does not know the theory will do	The person who knows the theory will do	Related Practical	Development of skill
(6)There are too much power loss. Line efficiency is poor	If all connected loads are all right, wrong location of power station/ load centre	Load centre study	Will not take account on load centre	Will take account on load centre	EP23 Load centre power loss comparison	How the location of supply source affect line losses/ efficiency and % voltage regulation
(7)Problem with UG cable joint	Wrong method in UG cable joining	UG cable joining methods. Theory study			UG cable joining method in my prepared 7762 AA Electrical Distribution textbook	UG cable joining methods. Theory PLUS photographs
(8)Generator got motor action. Reverse power relay cuts off	Out of synchronism. Up to 180 degree out of phase	Synchronizing	Will neglect synchronism. Just run and switch on	Will focus on synchronizing process. Avoid reverse power relay operation	Synchronizing	Synchronism, generator parallel operation requirement practical knowledge development.
(9)Generator vibration/ hunting	Stability concept	System stability	Do not care on machine hunting. Will continue to run . As consequence, face the short life of bearing/ shaft	Will take care on transient and steady state system stability and prevent the hunting	Moment of inertia/ machine stability	Moment of inertia/ machine stability practical knowledge development.
(10)Relay operates on fault. But the system loss the synchronism	System stability/ critical fault clearing angle aspect.	System stability/ critical fault clearing angle	Do not care on the relay setting to provide both fault protection and maintain the system stability. Re-synchronize the generators when ever the relay operates	Will set the proper relay setting to maintain the stability	Critical fault clearing angle. Equal area criteria	Critical fault clearing angle. Equal area criteria practical knowledge development.
(11) Line reactive power too much. The equipment capacity is unnecessarily increased	Problem related to load flow	Load flow study	Will not take account on load flow concept.	Take account on load flow and optimize the loading	EP 42 Maximum power transfer theorem EP43 Load flow study	Develop the load flow concept and practical optimizing skill
(12)There is nothing wrong with the line but the transformer placed near the switch heat up and cooked	Switching surge	Switching voltage surge	Just replace the transformer. After some time, the same problem will be faced	Take account on switching voltage surge and plan tom install the surge diverter.	Switching voltage surge	Switching voltage surge practical knowledge development.
(13)Light radiated	Corona	Corona study	Will consider the ACT	Will find the way to	EP 7 Corona video	How corona occurs

from the power line. Too much power loss and high interference to telecom line			OF GOD	reduce corona such as application of hollow conductor to increase diameter of conductor to raise the critical voltage level		and find the way to prevent .
(14) Control telecommunication for power line down, no relay operates	Application of telecommunication system in power system operation	Application of telecommunication system in power system operation 7762AG Power System Operation	Will not be aware of the role of telecommunication system	Will check the function of telecom equipment for power system control and protection and perform the preventive maintenance	Application of telecommunication system in power system operation	Web based control/ IP based control and telecomm: concepts practical knowledge development.
(15)Too much flickering of lamps	Harmonics	Harmonics in power system	Will not know what happens	Will check the harmonics source/ increase the size of neutral wire to allow the harmonics current flows	Harmonic source scope observation	Development of identifying the harmonics
(16)Lightning strike	Lightning arrester	Lightning arrester	Will reinstall LA. But not sure it will be safe or not.	Will check the coverage provided by lightning arrester	Lightning arrester study	Lightning arrester practical knowledge development.
(17)Earth fault/ earth leakage can not be protected	Grounding in power system	Grounding in power system 7762AE Power System Protection	--	Will measure the ground resistance, will implement the additional ground connections	Power system grounding study	Power system grounding practical knowledge development.
(18)Occurance of over current	Over current protection	Over current relay 7762AE Power System Protection	Will not exactly know how to set/ adjust the over current relay	Will set/ adjust the over current relay	EP11 Over current relay characteristics	Practical skill development in over current relay
(19)Earth leakage fault	Earth leakage protection	Earth leakage protection 7762AE Power System Protection	Will not exactly know how to set/ adjust the earth leakage relay	Will set/ adjust the earth leakage relay/ CT arrangement	CT arrangement for earth leakage fault & fault in protected zone	Practical skill development in earth leakage fault protection
(20)Transformer protection	Differential relay	Differential relay	Will not exactly know how to set/ adjust the differential relay	Will set/ adjust the differential relay	CT arrangement for fault in protected zone	Practical skill development in differential protection
(21)Line is protected by differential/ over current relay. But it is not effective when the load are fed from some part of the line	Distance relay	Distance relay	Will not exactly determine the reason why and how to change the protection system	Will change the protection system and will calculate earth fault impedance	Earth fault calculation	Problem solving skill development in earth fault calculation
(22)Fault happens but the relay can not	CT/ PT ratio for relay	Relay protection scheme	Will not exactly determine the reason	Will adjust CT PT ratio at the simulated fault	EP9 Connection of	Practical skill development in CT PT

provide the effective protection			why and how to change the protection system	situation and will adjust the relay setting appropriately	relay protection scheme & protective equipments by using one line diagram (Circuit interpreting & connection competency development without electrical supply) EP10 Current transformer & potential transformer connection & ratio test	ratio adjustment
(23) I accidently open the CT secondary and it got explosion	Current transformer	Current transformer		Will make sure not to open circuit the CT secondary	EP10 Current transformer & potential transformer connection & ratio test	Develop the skill on CT/ PT connection & applications.
(24) we use old type gravity relay, it does not provide the effective protection	Restrainting system of relay	Relay types & characteristics		Will make sure to correctly arrange the relay position	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references
(25) Relay operates at wrong current	Operation/ setting of relay	Relay types & characteristics	Trial error approach will be used	Will make sure to correctly arrange the relay setting	EP11 Over current relay characteristics	Practical skill development in over current relay
(26)In power transformer protection. Transformer is Star/Delta connection.	Transformer Star Delta & relay star/delta matching	Star delta vector diagram. Transformer star side –Relay delta & transformer delta—Relay star	Will not know what happens and how to rectify the fault	Will check the connection and will consider the vector difference causes the wrong operation	EP10-CT & PT connection/ ratio check	Practical skill development in CT/PT Connection

All relay settings are correct. But relay wrongly operates. I checked all continuity. Every thing all right						
(27)Regulator is set to meet the system voltage condition. But later time, it is blown out	Voltage ratio/ regulator setting	Voltage regulator	Will emphasize in solving the problem for a short moment. Will not consider the long term impact	Will consider whether the setting to upgrade the voltage will impact on future system voltage change	EP22 Voltage profile chart of distribution system	The skill training to develop the judgment of voltage level and future impact
(28)Fault spread from one busbar to another busbar	Busbar arrangement/ sectionalization	Busbar arrangement	Will assemble he busbar to install the equipment, will not consider how the arrangement can contribute the spread of fault	Will consider the way to insert section circuit breakers	Busbar layout/ arrangement study	Busbar arrangement sketch/ plan practice development
(29)Equipment suffers over voltage and blown out after the capacitor value is changed for PF improvement	Inappropriate capacitor setting. Cause of overvoltage. Vector diagram	PF improvement/ Capacitive reactance effect on load	Will only see the way to improvement the PF. Will not know the consequences	Will posses the knowledge of capacitor impact on load voltage and will take account on optimal setting of capacitor value	EP5-capactance effect on line EP6-PF Improvement	PF improvement method is judgment with capacitor effect causes over voltage. This skill is trained.
(30)Directional relay does not work to protect the reverse power flow	Directional relay operation	Study on directional relay.		Wrong connection to direction coil will be identified	EP 13 Protective relays used in industry	Guide to acquire the relevant technical knowledge
(31)Voltage flashing over capacitor string	Capacitor string	Study on capacitor string	Will change the capacitor string	Will provide the preventive protection such as arcing horns OR take account on line capacitor grading	EP21 Line insulator capacitance test	Develop the skill to measure line capacitor value . Capacitance grading.
(32)Circuit Breaker itself is blown out	Circuit Breaker capacity	Study on capacity of circuit breaker	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault	EP13 Relay & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity
(33)CB too hot and meltdown	CB capacity/ Arc development	Study on capacity of circuit breaker/electric arc	Will change CB. After sometime, it will blow up again.	Will consider the CB capacity & possible over current developed in line fault Will consider the arc	EP13 Rely & CB used in system Fault current	Develop the skill in fault current estimate and choosing CB capacity

				extinguishing methods		
(34)Need to expand the line in emergency. I am only in-charge	Line design	Line design project	Will not know how to design a line	Will utilize references/ methods to design and construct the line	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(35)HV current flows into LV line	Separation between HV & LV line	Rules & regulations related to line	Will not know the regulation	Will apply the regulation in real wok	7762AA Line pole/ cross arm design and conductor arrangement	Line electrical & mechanical design practice development
(36) Line wire fracture	Sag calculation	Sag calculation/ minimum cable size	Reinstall the line wire. Like part to like part replacement is applied, will use the same size of cable. After sometime, line will break gain	Will consider allowable tension/ minimum conductor size	7762AA Project-Over head line design	Line electrical & mechanical design practice development
(37)Electronics equipment used for line protection is blown up	Voltage surge	Signal condition sub system. Surge filter	Will replace the electronic board. But the same fault happens again	Will consider the cause of surge. Surge filter / absorber/ diverter will be installed	7762AE Line surge/ application of electronic control system	Develop the skill in line surge/ electronic control.
(38) Receiving end voltage is greater than the sending end	Capacitance effect on long line	Long line 7762AG Power System Operation	Will think that the equipments are designed to operate at the sending end voltage level, it will be enough	Will consider the line configuration and will provide the appropriate arrangement for over voltage caused by capacitance effect on long line.	EP2/EP3 Long Line PI & TEE equivalent circuits	Develop the practical skill in determination of possible voltage rise in simulated line model.
(39)Can not run the generators in parallel	Synchronism problem	Synchronizing	Will not properly know the synchronism	Will consider the synchronism	Alternator parallel operation- Procedure	Develop he knowledge in synchronizing
(40) Over current relay is provided to protect the system but it does not work when the ground fault occurs	Characteristics of relays	Relay types and characteristics	Will think that one relay will protect everything	Will select the appropriate relay for appropriate place and protection task	EP13 Study of various protective relays used in industry through trade references	Knowledge development on various protective relays used in industry through trade references

Method of delivery	**Method of collection of evidence**
7-Face to face 6-Electronic Key for delivery mode 1-On the job 2-Simulated 3-Blended 4-Self paced 5-Distance 6-Electronic 7-Face to face 8-Other Detailed explanation Face to face class teaching + Online supplement multimedia notes **Evidence** **Part 1- Evidence of teaching & learning** **Plan for concurrently delivery**	A,B,D,E,F,G,L Key for Methods for Collecting Evidence: A-Assignment B-Written Task C-Role play D-Exam E-Oral questioning F-Simulation G-Observation H-Work based I-Portfolio J-Self assessment K-Case study L-Practical demonstration M-Project N-Training Record O-Other ***Detailed explanation*** A+B-Test 1, 2, 3, 4 E-Oral question in practical class F-Simulated practical for line & power system comprising mathematical equations & functions G-Observe the student's performance in practical class L-Student practical performance result + report preparation

www.powerlearning1.zoomshare.com Both digitised notes + multimedia notes including audio files Notes in USB (Available on request) **Part 2- Evidence of lesson planning** Delivery & assessment matrix excel form Semester plan Students study progress plan (Available on request)	*Evidence Attached* **Part (1)- Test questions** 2 tests **Part (2)-Evidence of students participation** Signed attendance sheet Signed Test attendance sheet Sample answer paper & practical report Either hard or scanned copy (Will be available on request within 6 months of the assessment event EBS attendance & grade record

1 On the job	**2** Simulated	**3** Blended	**4** Self-paced (facilitated)
5 Distance	**6** Electronic	**7** Face to Face	**8** Other (Please specify)

Key for Methods for Collecting Evidence:			
A Assignment	**B** Written task	**C** Role play	**D** Exam
E Oral questioning	**F** Simulation	**G** Observation	**H** Work based
I Portfolio	**J** Self assessment	**K** Case study	**L** Practical demonstration
M Project	**N** Training Record Book	**O** Other (Please specify)	

Location of Evidences (Table 1)

ASSESSMENT SCHEDULE

Performance Criteria	Assessment 1 Practical		Assessment 2 Theory
	Continuous Observation	Written Assessment as part of Practical	Written Assessment
1.1		X	
1.2		X	
1.3		X	X
1.4		X	X
1.5		X	X
1.6		X	X
2.1		X	
2.2		X	X
2.3		X	X
2.4		X	X
2.5		X	X
2.6		X	X
2.7		X	X
2.8		X	X
2.9		X	X
2.10		X	X
2.11		X	X
2.12		X	X
3.1	X	X	
3.2	X		
3.3	X		
EKAS Assessment		X	X

POWER SYSTEM Youtube video Lessons to provide the sufficient EKAS

G015/ IS67+68+ IS74

Power System (1)

G015(AA)Lesson 1-Distribution system.zip

http://youtu.be/VuzjXkRx4UI

G015(AA)Lesson 2-Demand factor.zip

http://youtu.be/cUGbxhBT-Dc

http://youtu.be/DCCl4cO3Vu8

G015(AA)Lesson 3-Sag.zip

http://youtu.be/1s496h-Iuu8

G015(AA)Lesson 4-OH Line mechanical design.zip

http://youtu.be/T0BnyqV9T6E

http://youtu.be/hu1TrUv2_OY

G015(AA)Lesson 5-UG Cable.zip

http://youtu.be/hHCLzMnVmT0

http://youtu.be/A5AieaBBZHo

G015(AA)Lesson 6-Voltage control.zip

http://youtu.be/y1vTM5fvfyU

http://youtu.be/Z9HBGsVgymA

G015(AE)Lesson 1-Power system protection scheme.zip

http://youtu.be/ihpd3cDAhBU

http://youtu.be/EGXkLRM2L9M

http://youtu.be/zOIUYQ7OJfs

G015(AE)Lesson 2-Differential relay.zip

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson_3-Over_current_&_earth_fault_protection.zip

http://youtu.be/hvGjdO9jEhk

G015(AE)Lesson 4-Three phase differential relay.zip

http://youtu.be/2iW0oEScMsw

http://youtu.be/VuzjXkRx4UI

http://youtu.be/2iW0oEScMsw

G015(AE)Lesson 5-Current time grading.zip

http://youtu.be/r0qkLrmkKsM

G015AE Lesson 6

http://youtu.be/InsTLh7_N5k

G015(AE)Lesson_7-CT_PT.zip

http://youtu.be/ZF_y65xsM_M

G015(AE)Lesson 8-Distance relay.zip

http://youtu.be/NKzMVquFLu8

http://www.filefactory.com/file/c386a2e/n/G015_AE_Lesson_8-Distance_relay.zip

G015(AE)Lesson 9-Telecom in power protection.zip

http://youtu.be/9C6ogqZAKRg

http://youtu.be/XRpffA6hU_U

http://youtu.be/X-kz3cyL9fU

G015(AG)Lesson 1-Stability.zip

http://youtu.be/fUyNqcXtBXg

G015(AG)Lesson 2-Generator load sharing.zip

http://youtu.be/A-t7XH4rK4M

http://youtu.be/OTsis_KIRuk

http://youtu.be/8j1nD9nY2hU

G015(AG)Lesson 3-Power Flow.zip

http://youtu.be/0OzT4Pol-Jc

http://youtu.be/fK0wcaTY_rw

G015(AG)Lesson 4-IP based system.zip

http://youtu.be/ve5O8K9fL7k

G015(AG)Lesson 5-Surge in power system.zip

http://youtu.be/6WkezTcOzX4

G015(AG)Lesson 6-CTPT Harmonic filter.zip

http://youtu.be/Uy7q9SsaOYs

G015(AG)Lesson 7-Short circuit in alternator.zip

http://youtu.be/b-46Kvn8kJI

G015(AG)Lesson 8-Corona.zip

http://youtu.be/XYGRAWOqzsc

G015(AG)Lesson 9-Power surge.zip

http://youtu.be/uzFS-otIn-g

http://youtu.be/IsZ_ccy630w

G015(AG)Lesson_10-Static_Var_Compensation.zip

http://youtu.be/y-of5oLojCU

G015(AG)Lesson 11-PF Control+Fuel cell.zip

http://youtu.be/AXbCcoQeLns

G015(AG)Lesson_12-Exercises.zip

http://youtu.be/nRGScOH9aSM

G037+G038+G039 Part 1/2/3+IS69
Page 232 to 270 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power System (2)

G037+G038+G039 Lesson 1-Power Flow.zip

http://youtu.be/mzwGGXRTtvw

G037+G038+G039 Lesson 2-Site Earthing.zip

http://youtu.be/PATkXVBF9kc

http://youtu.be/H4Dj1K238BE

G037+G038+G039 Lesson 3-Power System Control Equipments.zip

http://youtu.be/JJczbYVWOoI

G037+G038+G039 Lesson 4-Auxiliary System+Harmonic.zip

http://youtu.be/5mDNHGFLA0c

G037+G038+G039 Lesson 5-Harmonic.zip

http://youtu.be/n41g4Rmz2p0

http://youtu.be/8CelGV5AElk

G037+G038+G039 Lesson 6-Harmonic Calculation.zip

http://youtu.be/NHSzu6HkOgI

http://youtu.be/fSLrPIC6Mho

G037+G038+G039 Lesson 7-Synchronous Generator Loading.zip

:http://youtu.be/jv1q7Mtg7Gs

http://www.filefactory.com/file/c39be2f/n/G037_G038_G039_Lesson_7-Synchronous_Generator_Loading.zip

G037+G038+G039 Lesson 8-Turbine Control+Power Line Earthing.zip

http://youtu.be/0CvgkmDE3Kw

G037+G038+G039 Lesson 9-Insulator.zip

http://youtu.be/l4jqs8MLBFA

http://youtu.be/TiQezIA9Z-c

G037+G038+G039 Lesson 10-Reliability of Power System.zip

http://youtu.be/tIUk3nc1IxE

G037+G038+G039 Lesson 11-Harmonic Reduction.zip

http://youtu.be/8dYX-11kRcc

http://youtu.be/A684Agej8-w

G037+G038+G039 Lesson 12-Grounding + Power Quality.zip

http://youtu.be/QQPUj3WXJnA

G037+G038+G039 Lesson 13-Power Quality.zip

http://youtu.be/feI7SCb_QTY

http://youtu.be/mcK2YhDsnr0

G037+G038+G039 Lesson 14-Harmonic Model.zip

http://youtu.be/dwWBOq-BsLY

G037+G038+G039 Lesson 15-Harmonic Losses in Transformer.zip

http://youtu.be/mwEJgEEgPVc

http://youtu.be/1A6FY5f5ijM

http://youtu.be/yLiOKy7uJj0

G037+G038+G039 Lesson 16-Reliability Improvement.zip

http://youtu.be/cn-CfDWnUN8

G037+G038+G039 Lesson 17-Preparation for emergency.zip

http://youtu.be/La7Xip8GI2I

G037+G038+G039 Lesson 18-Harmonic problems.zip

http://youtu.be/0Urnkee_

http://youtu.be/zM_Xcwckicw

G037+G038+G039 Lesson 19-Synchronous machine problems.zip

http://youtu.be/Lx2S-NATr20

G037+G038+G039 Lesson 20-Power Generation + Generator Control.zip

http://youtu.be/56Ks8sArQxc

G037+G038+G039 Lesson 21-Turbine Control+ Digital Excitation.zip

http://youtu.be/uCsvv18qKwQ

http://youtu.be/I4vCDI2CZS0

G037+G038+G039 Lesson 22-Power System Protection.zip

http://youtu.be/c6iXRwfCYBU

G037+G038+G039 Lesson 23-Switch Gear.zip

http://youtu.be/DDpbzgNYTiM

http://youtu.be/2cl-nOdBNro

G040 + IS73

Page 271 to 284 of http://www.filefactory.com/file/cf9bf8f/n/Video_Lessons.pdf

Power transformer

G040 Lesson 1 Power transformer rating 1.zip

http://youtu.be/qjWJVQAh_jA

G040 Lesson 1 Power transformer rating 2.zip

http://youtu.be/JonzO8JD-k4

G040 Lesson 2 Open circuit short circuit test.zip

http://youtu.be/Ru-KlKv40OY

G040 Lesson 3 Transformer regulation.zip

http://youtu.be/t6IZMwMj-B4

G040 Lesson 4 Power transformer connection.zip

http://youtu.be/iig8PISDN1I

G040 Lesson 5 Maximum efficiency.zip

http://youtu.be/Qa7l0eHTWTU

G040 Lesson 6 Transformer parallel operation.zip

http://youtu.be/dkRxoaozrOk

http://youtu.be/Sz5QY727w-8

G040 Lesson 7 Harmonic in transformer.zip

http://youtu.be/_YOlWb3e574

G040 Lesson 8 Transformer problem + auto transformer.zip

http://youtu.be/0KCscbCIUjk

G040_Lesson_9_Transformer_rating_cooling_connection_tap_changing.zip

http://youtu.be/d3XHm-wguzQ

http://youtu.be/XwiIkZnKFqQ

http://youtu.be/uOHBk840Bhw

G040 Lesson 10 Phase shift transformer.zip

http://youtu.be/7aWhg9DIoWI

G042+IS71

Transmission Line

G042 Lesson 1-Transmission line introduction.zip

http://youtu.be/DrOOgcKeaL4

G042 Lesson 2-DC Line+Line reflection.zip

http://youtu.be/jvVdecp-clk

G042 Lesson 3-Power line calculation.zip

http://youtu.be/3TgVt67DhvY

http://youtu.be/QT6aqsaM7a0

http://youtu.be/WxjQIkdJjQ8

G042 Lesson 4-Line model+Economic aspect.zip

http://youtu.be/1HRdGZXp_-w

G042 Lesson 5-Time value of money+Line reflection.zip

http://youtu.be/n9mupLQWANY

http://youtu.be/YdfiX2gL-3c

G042 Lesson 6-Line matching+Wave guide.zip

http://youtu.be/1WyP5_Cek40

G042 Lesson 7-Wave guide.zip

http://youtu.be/BuGtjZ3QBXk

http://youtu.be/pftevsnbl0w

G042 Lesson 8-Microstrip line.zip

http://youtu.be/eINq1kKuiec

G042 Lesson 9-Per unit value of line.zip

http://youtu.be/66Y-Lm3EntI

G042 Lesson 10-Line constants.zip

http://youtu.be/2XYnZZ-zXII

G042 Lesson 11-Smith chart.zip

http://youtu.be/dv-NQh4vlrg

http://youtu.be/KfM8XZd9Wqc

http://youtu.be/3NYVQvW8-Nk

http://youtu.be/5qBwLsbtfTA

http://youtu.be/ViamcvqAy_I

http://youtu.be/j_nx9n7mGec

http://youtu.be/d53B3-zV2ec

G042 Lesson 12-Four terminals network.zip

http://youtu.be/HCO4P1qrPbA

G042 Lesson 13-Exercises.zip

http://youtu.be/LeyJf1PhpCY

Power References

http://electricaldiploma2013.zoomshare.com/files/powerreference.htm

Advanced Diploma in Electrical Engineering Exercises Click HERE

Part 2

Assessment Observation

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Qualification Number and Name:	**UEE62220/UEE62122**		
Unit of Competency Number and Name:	**UEENEEE101A+102A+105A+108A+137A+G106A** **OR** **Relevant UEE30820 Units** UEECD0007+UEECD0019+UEECD0020+ UEECD0025+UEECD0016+UEEEL0023		
Assessment Task:		**Duration:** (Hours and minutes)	
Assessment Date:		**Location:**	

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields
- Do not use Pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (mobile phones / IPad) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

List the performance criteria and performance evidence being assessed by **this** assessment task.

Resources to be supplied by students: delete or add dot points as required

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment: delete or add dot points as required

- Standard Dictionaries
- Technical Dictionaries
- Bilingual Dictionaries
- Programmable Calculators
- Non-programmable Calculators

Student Name:			
Student ID:		**Group:**	
Student signature:		**Date:**	

Performance criteria and performance evidence being observed	Y	N	Assessor comments
1. Identify & insert performance criteria / performance evidence of assessment	Y		
Preparation process to perform the task as described in assessment mapping			
2. Identify & insert performance criteria / performance evidence of assessment	Y		
Progress processes in performing the tasks as described in assessment mapping			
3. Identify & insert performance criteria / performance evidence of assessment	Y		
Application of theoretical knowledge as described in assessment mapping			
4. Identify & insert performance criteria / performance evidence of assessment	Y		
Application of practical methods as described in assessment mapping			
5. Identify & insert performance criteria / performance evidence of assessment	Y		
Presentation of final output & record keeping as described in assessment mapping			
6. Identify & insert performance criteria / performance evidence of assessment	Y		
Review/Revise/OHS as described in assessment mapping			

UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace

1.Prepare to enter a work area
Apply safe working practices.
Follow workplace procedures for hazard identification and risk control

UEECD0019 Fabricate, assemble and dismantle utilities industry components

1.Prepare for dismantling, assembling and fabrication work
Dismantle and assemble utilities industry apparatus.
Fabricate utilities industry components

UEECD0020 Fix and secure electrotechnology equipment

1.Prepare to fix and secure equipment
Install fixing and support devices
Complete fixing and support work

UEECD0025 Lay wiring/cabling and terminate accessories for extra-low voltage (ELV) circuits

1.Prepare to lay wiring/cabling and connect accessories for extra-low voltage circuits.
Lay wiring/cabling and connect accessories for extra-low voltage circuits
Complete and report work activities.

UEECD0016 Document and apply measures to control OHS risks associated with electrotechnology work

1.Identify and document hazards and risks.
Assign levels of risk and develop and document control measures.
Monitor and review the control measures.

UEEEL0023 **Terminate cables, cords and accessories for low voltage circuits**

1.Prepare to terminate cables, cords and conductors
Terminate cables, cords and conductors
Test terminated cables and cords

Assessment Outcome:	☐ **[Satisfactory - S]** √ ☐ **[Not Satisfactory - NS]** ☐ **Resubmission (RS)**
Assessor's comment regarding student performance	
Assessor's comment should be specific and based on the marking criteria for the specific assessment event.	
Assessor's recommendation on how to improve the performance (if there is any gap)	
Assessor's comment should be specific and based on the marking criteria for the specific assessment event.	

Assessor Name/ Signature:	**U Kyaw Naing**	**Date:**	

Student Feedback on Outcome(s):

☐√ The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature:		**Date:**	

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Qualification Number and Name:	**Advanced Diploma of Engineering Technology Electrical**		
Unit of Competency Number and Name:	UEECD0044 Solve problems in multiple path circuits+UEECD0046 Solve problems in single path circuits*		
Assessment Task:	**Practical Test**	**Duration:** (Hours and minutes)	**2 hours**
Assessment Date:		**Location:**	**Room K2.18**

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields below
- Do not use pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (USBs / mobile phones / IPads etc) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

The assessment criteria is listed under each performance criteria for each of the 3 element sections listed below. This assessment observation task's aims to evaluate each performance criteria to prove that the performance evidence has being assessed.

Resources to be supplied by students:

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment:

Standard Dictionaries
Technical Dictionaries
Bilingual Dictionaries
Programmable Calculators
Non-programmable Calculators

Student Name:			
Student ID:		**Group:**	
Student signature:		Date:	

Performance criteria and performance evidence being observed	Y	N	Assessor comments
1. Prepare to work on D.C. electrical circuits.			
1.1 OHS procedures for a given work area are identified, obtained and understood.			
Has the student completed a E104 Risk Assessment form?			
Is the area to be used for the performance of the test free from hazards?			
Is the student wearing proper rubber shoes?			
Is the student wearing loose clothing?			
Is the student wearing metallic chain or bracelets			
What possible hazards does the student envisage in performing the practical test?			
1.2 OHS risk control work preparation measures and procedures are followed.			
Is the student able to understand and follow the requirements and outcomes of the practical test ?			
Do the required components match what is required for the test?			
1.3 The nature of the circuit problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.			
Does the practical reflect any of the theory covered in the lecture?			
1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.			
a. This practical test is of an individualistic nature			
1.5 Sources of materials that may be required for the work are identified and accessed in accordance with established procedures.			
Has the student read and understood the given information and required test prerequisites?			
1.6 Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.			
Has the student checked that tools and equipment are adequate for the test?			
Has the student verified that the measuring equipment is fully operational for the test purpose?			
Is the student aware of the proper connections to be made on the equipment/			
Does the student have enough leads for the connections?			
Resolve any D.C. circuit problem found in the practical test.			
2.1 OHS risk control work measures and procedures are followed.			
Is the student ensuring that the power is secure off before proceeding with the test?			
2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.			
Has student checked with teacher before turning the power on?			

2.3 Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures.			
Verify by measurement that with switch off, there is absolutely no power to the circuit.			
2.4 Established methodological techniques are used to solve d.c. circuit problems from measure and calculated values as they apply to electrical circuit.			
With the knowledge of the theory covered in class, compare your theoretical with the practical results, and explain any discrepancies			
2.5 Unexpected situations are dealt with safely and with the approval of an authorised person.			
Has the student encountered any functional anomalies of the circuit in question and has she/he reported to the teacher?			
2.6 Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.			
Is the student handling of the equipment safe and sustainably acceptable/			
Complete work and document problem solving activities.			
3.1 OHS work completion risk control measures and procedures are followed..			
Is the student disconnecting the equipment power before dismantling the circuit?			
3.2 Work site is cleaned and made safe in accordance with established procedures.			
After finishing the test and dismantling the circuit, has the student checked that the work area is cleaned properly and left tidy with all the power switches secured off?			
3.3 Justification for solutions used to solve circuit problems is documented.			
Which theoretical methods did you use to calculate the answers to the practical test?			
3.4 Work completion is documented and appropriate person(s) notified in accordance with established procedures.			
Before leaving the test, has the student submitted proper documentation of the theoretical and practical test results, plus the conclusions.?			

Assessment Outcome:	☐ **[Satisfactory - S]** ☐ **[Not Satisfactory - NS]** ☐ Resubmission (RS)
Assessor's comment regarding student performance	

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor's recommendation on how to improve the performance (if there is any gap)

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor Name/ Signature:		**Date:**	

Student Feedback on Outcome(s):
The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature:		**Date:**	

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Qualification Number and Name:	**Advanced Diploma of Engineering Technology Electrical**		
Unit of Competency Number and Name:	UEECD0036 Provide engineering solutions for problems in complex multiple path circuits		
Assessment Task:		**Duration:** (Hours and minutes)	
Assessment Date:		**Location:**	

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields below
- Do not use pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (USBs / mobile phones / IPads etc) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

The assessment criteria is listed under each performance criteria for each of the 3 element sections listed below. This assessment observation task's aims to evaluate each performance criteria to prove that the performance evidence has being assessed.

Resources to be supplied by students:

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment:

Standard Dictionaries
Technical Dictionaries
Bilingual Dictionaries
Programmable Calculators
Non-programmable Calculators

Student Name:			
Student ID:		**Group:**	
Student signature:		Date:	

Performance criteria and performance evidence being observed	Y	N	Assessor comments
1. Prepare to work on D.C. electrical circuits.			
1.1 OHS procedures for a given work area are identified, obtained and understood.			
Has the student completed a E104 Risk Assessment form?			
Is the area to be used for the performance of the test free from hazards?			
Is the student wearing proper rubber shoes?			
Is the student wearing loose clothing?			
Is the student wearing metallic chain or bracelets			
What possible hazards does the student envisage in performing the practical test?			
1.2 OHS risk control work preparation measures and procedures are followed.			
Is the student able to understand and follow the requirements and outcomes of the practical test ?			
Do the required components match what is required for the test?			
1.3 The nature of the circuit problem is obtained from documentation or from work supervisor to establish the scope of work to be undertaken.			
Does the practical reflect any of the theory covered in the lecture?			
1.4 Advice is sought from the work supervisor to ensure the work is coordinated effectively with others.			
a. This practical test is of an individualistic nature			
1.5 Sources of materials that may be required for the work are identified and accessed in accordance with established procedures.			
Has the student read and understood the given information and required test prerequisites?			
1.6 Tools, equipment and testing devices needed to carry out the work are obtained and checked for correct operation and safety.			
Has the student checked that tools and equipment are adequate for the test?			
Has the student verified that the measuring equipment is fully operational for the test purpose?			
Is the student aware of the proper connections to be made on the equipment/			
Does the student have enough leads for the connections?			
Resolve any D.C. circuit problem found in the practical test.			
2.1 OHS risk control work measures and procedures are followed.			
Is the student ensuring that the power is secure off before proceeding with the test?			
2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.			
Has student checked with teacher before turning the power on?			

2.3 Circuits are checked as being isolated where necessary in strict accordance OHS requirements and procedures.			
Verify by measurement that with switch off, there is absolutely no power to the circuit.			
2.4 Established methodological techniques are used to solve d.c. circuit problems from measure and calculated values as they apply to electrical circuit.			
With the knowledge of the theory covered in class, compare your theoretical with the practical results, and explain any discrepancies			
2.5 Unexpected situations are dealt with safely and with the approval of an authorised person.			
Has the student encountered any functional anomalies of the circuit in question and has she/he reported to the teacher?			
2.6 Problems are solved without damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practices.			
Is the student handling of the equipment safe and sustainably acceptable/			
Complete work and document problem solving activities.			
3.1 OHS work completion risk control measures and procedures are followed..			
Is the student disconnecting the equipment power before dismantling the circuit?			
3.2 Work site is cleaned and made safe in accordance with established procedures.			
After finishing the test and dismantling the circuit, has the student checked that the work area is cleaned properly and left tidy with all the power switches secured off?			
3.3 Justification for solutions used to solve circuit problems is documented.			
Which theoretical methods did you use to calculate the answers to the practical test?			
3.4 Work completion is documented and appropriate person(s) notified in accordance with established procedures.			
Before leaving the test, has the student submitted proper documentation of the theoretical and practical test results, plus the conclusions.?			

Assessment Outcome:	☐ **[Satisfactory - S]** ☐ **[Not Satisfactory - NS]** ☐ Resubmission (RS)
Assessor's comment regarding student performance	

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor's recommendation on how to improve the performance (if there is any gap)

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor Name/ Signature:		**Date:**	

Student Feedback on Outcome(s):
The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature:		**Date:**	

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Qualification Number and Name:	**UEE62220/UEE62122**		
Unit of Competency Number and Name:	UEEEL0024+ UEEEL0025+ UEEEL0008 + UEEEL0009+ UEEEL0010+ UEEEL0003		
Assessment Task:		**Duration:** (Hours and minutes)	
Assessment Date:		**Location:**	

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields
- Do not use Pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (mobile phones / IPad) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

List the performance criteria and performance evidence being assessed by **this** assessment task.

Resources to be supplied by students: delete or add dot points as required

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment: delete or add dot points as required

- Standard Dictionaries
- Technical Dictionaries
- Bilingual Dictionaries
- Programmable Calculators
- Non-programmable Calculators

Student Name:			
Student ID:		**Group:**	
Student signature:		Date:	

Performance criteria and performance evidence being observed	Y	N	Assessor comments
1. Identify & insert performance criteria / performance evidence of assessment Preparation process to perform the task as described in assessment mapping	Y		
2. Identify & insert performance criteria / performance evidence of assessment Progress processes in performing the tasks as described in assessment mapping	Y		
3. Identify & insert performance criteria / performance evidence of assessment Application of theoretical knowledge as described in assessment mapping	Y		
4. Identify & insert performance criteria / performance evidence of assessment Application of practical methods as described in assessment mapping	Y		
5. Identify & insert performance criteria / performance evidence of assessment Presentation of final output & record keeping as described in assessment mapping	Y		
6. Identify & insert performance criteria / performance evidence of assessment Review/Revise/OHS as described in assessment mapping	Y		

UEEEL0024+ UEEEL0025 Solve problems in single and three phase low voltage machines Transformers + Induction Machines

1. Prepare to solve single and three phase low voltage machines problems.
2. Solve single and three phase low voltage machine problems.
3. Complete work and document problem solving activities.

UEENEEG033A Solve problems in single and three phase low voltage electrical apparatus and circuits

UEEEL0008 Evaluate and modify low voltage heating equipment and controls*
UEEEL0009 Evaluate and modify low voltage lighting circuits, equipment and controls*
EEEL0010 Evaluate and modify low voltage socket outlets circuits*

1. Prepare to solve single and three phase low voltage electrical apparatus/ circuit problems.
2. Solve single and three phase low voltage electrical apparatus/circuit problems.
3. Complete work and document problem solving activities.

UEEEL0003A Arrange circuits, control and protection for general electrical installations

1. Prepare to arrange electrical installations circuits, control and protection
2. Arrange electrical installations circuits, control and protection
3. Document electrical installation circuits, control and protection arrangements

Assessment Outcome:	☐ **[Satisfactory - S]** √	☐ **[Not Satisfactory - NS]**	☐ **Resubmission (RS)**
Assessor's comment regarding student performance			

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor's recommendation on how to improve the performance (if there is any gap)

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor Name/ Signature:	**U Kyaw Naing**	**Date:**	

Student Feedback on Outcome(s):

☐√ The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature:		**Date:**	

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Qualification Number and Name:			
Unit of Competency Number and Name:	UEEEL0018		
Assessment Task:		**Duration:** (Hours and minutes)	
Assessment Date:		**Location:**	

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields
- Do not use Pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (mobile phones / IPad) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

List the performance criteria and performance evidence being assessed by **this** assessment task.

Resources to be supplied by students: delete or add dot points as required

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment: delete or add dot points as required

- Standard Dictionaries
- Technical Dictionaries
- Bilingual Dictionaries
- Programmable Calculators
- Non-programmable Calculators

Student Name:			
		Group:	
Student signature:		**Date:**	

Performance criteria and performance evidence being observed	**Y**	**N**	Assessor comments

1. Identify & insert performance criteria / performance evidence of assessment Preparation process to perform the task as described in assessment mapping	**Y**		
2. Identify & insert performance criteria / performance evidence of assessment Progress processes in performing the tasks as described in assessment mapping	**Y**		
3. Identify & insert performance criteria / performance evidence of assessment Application of theoretical knowledge as described in assessment mapping	**Y**		
4. Identify & insert performance criteria / performance evidence of assessment Application of practical methods as described in assessment mapping	**Y**		
5. Identify & insert performance criteria / performance evidence of assessment Presentation of final output & record keeping as described in assessment mapping	**Y**		
6. Identify & insert performance criteria / performance evidence of assessment Review/Revise/OHS as described in assessment mapping	**Y**		

UEEEL0018 Select wiring systems and cables for low voltage general electrical installations

1. Prepare to select wiring systems and cables for general electrical installations
Select wiring systems and cables for general electrical installations
Document electrical installation

UEECO0003 Manage contract variations

1. Ascertain the terms of the contract.
2. Manage contract variations.

Assessment Outcome:	☐ **[Satisfactory - S]** √ ☐ **[Not Satisfactory - NS]** ☐ **Resubmission (RS)**
Assessor's comment regarding student performance	
Assessor's comment should be specific and based on the marking criteria for the specific assessment event.	
Assessor's recommendation on how to improve the performance (if there is any gap)	

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor Name/ Signature: **U Kyaw Naing** **Date:**

Student Feedback on Outcome(s):

☐√ The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature: **Date:**

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Qualification Number and Name:			
Unit of Competency Number and Name:	UEEEL0043+ UEEEL0041+ UEEIC0017		
Assessment Task:		**Duration:** (Hours and minutes)	
Assessment Date:		**Location:**	

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields
- Do not use Pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (mobile phones / IPad) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

List the performance criteria and performance evidence being assessed by **this** assessment task.

Resources to be supplied by students: delete or add dot points as required

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment: delete or add dot points as required

- Standard Dictionaries
- Technical Dictionaries
- Bilingual Dictionaries
- Programmable Calculators
- Non-programmable Calculators

Student Name:			
		Group:	
Student signature:		**Date:**	

Performance criteria and performance evidence being observed	**Y**	**N**	Assessor comments

1. Identify & insert performance criteria / performance evidence of assessment Preparation process to perform the task as described in assessment mapping	**Y**		
2. Identify & insert performance criteria / performance evidence of assessment Progress processes in performing the tasks as described in assessment mapping	**Y**		
3. Identify & insert performance criteria / performance evidence of assessment Application of theoretical knowledge as described in assessment mapping	**Y**		
4. Identify & insert performance criteria / performance evidence of assessment Application of practical methods as described in assessment mapping	**Y**		
5. Identify & insert performance criteria / performance evidence of assessment Presentation of final output & record keeping as described in assessment mapping	**Y**		
6. Identify & insert performance criteria / performance evidence of assessment Review/Revise/OHS as described in assessment mapping	**Y**		

UEEEL0041 Develop engineering solution for synchronous machine and control problems

1. Prepare to develop engineering solution for synchronous machine problems.
Develop engineering solution for synchronous machine problems.
Test, document and implement engineering solution for synchronous machine problem.

UEEIC0017 Develop engineering solutions for d.c. machine and control problems

1. Prepare to develop engineering solution for d.c. machine problems.
2. Develop engineering solution for d.c. machine problems.
3. Test, document and implement engineering solution for d.c. machine problems.

UEEEL0043 Develop engineering solutions for induction machine and control problems

1. Prepare to develop engineering solution for induction machine problems.
Develop engineering solution for induction machine problems.
Test, document and implement engineering solution for induction machine problems.

Assessment Outcome:	☐ **[Satisfactory - S]** √ ☐ **[Not Satisfactory - NS]** ☐ **Resubmission (RS)**
Assessor's comment regarding student performance	

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor's recommendation on how to improve the performance (if there is any gap)

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor Name/ Signature:	**U Kyaw Naing**	**Date:**	

Student Feedback on Outcome(s):

☐√ The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature:		**Date:**	

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Unit of Competency Number and Name:	**UETTDRIS67A+68A+69A+71A+73A+74A**		
Assessment Task:		**Duration:** (Hours and minutes)	
Assessment Date:		**Location:**	

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields
- Do not use Pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (mobile phones / IPad) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

List the performance criteria and performance evidence being assessed by **this** assessment task.

Resources to be supplied by students: delete or add dot points as required

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment: delete or add dot points as required

- Standard Dictionaries
- Technical Dictionaries
- Bilingual Dictionaries
- Programmable Calculators
- Non-programmable Calculators

Student Name:			
Student ID:		**Group:**	
Student signature:		**Date:**	

Performance criteria and performance evidence being observed	**Y**	**N**	Assessor comments

1. Identify & insert performance criteria / performance evidence of assessment Preparation process to perform the task as described in assessment mapping	Y		
2. Identify & insert performance criteria / performance evidence of assessment Progress processes in performing the tasks as described in assessment mapping	Y		
3. Identify & insert performance criteria / performance evidence of assessment Application of theoretical knowledge as described in assessment mapping	Y		
4. Identify & insert performance criteria / performance evidence of assessment Application of practical methods as described in assessment mapping	Y		
5. Identify & insert performance criteria / performance evidence of assessment Presentation of final output & record keeping as described in assessment mapping	Y		
6. Identify & insert performance criteria / performance evidence of assessment Review/Revise/OHS as described in assessment mapping	Y		

UETTDRIS67A Solve problems in energy supply network equipment

1. Prepare to solve problems in energy supply network equipment
2. Solve problems in energy supply network equipment
3. Completion and report for problem solving in energy supply network equipment

UETTDRIS68A Solve problems in energy supply network protection equipment

1. Prepare to solve problems in energy supply network protection equipment and systems

Solve problems in energy supply network protection equipment and systems.

3. Completion and report for problem solving in energy supply network protection equipment and systems

UETTDRIS69A Diagnose and rectify faults in energy supply apparatus

1. Prepare to diagnose and rectify faults
2. Diagnose and rectify faults
3. Complete and report fault diagnosis and rectification activities

UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems

1. Prepare to diagnose and rectify faults.

Diagnose and rectify faults.

Complete and report fault diagnosis and rectification activities.

UETTDRIS73A Develop engineering solutions for energy supply power transformer problems

1. Prepare to develop engineering solution for energy supply power transformer problems
2. Develop engineering solutions for energy supply power transformer problems.
3. Test, document and implement engineering solution for energy supply power transformer problems.

UETTDRIS74A Develop engineering solutions for energy supply system protection problems

1. Prepare to develop engineering solution for energy supply system protection problems
2. Develop engineering solution for energy supply system protection.
3. Test, document and implement engineering solution for energy supply system protection problems.

Assessment Outcome:	☐ **[Satisfactory - S]** √ ☐ **[Not Satisfactory - NS]** ☐ **Resubmission (RS)**
Assessor's comment regarding student performance	
Assessor's comment should be specific and based on the marking criteria for the specific assessment event.	
Assessor's recommendation on how to improve the performance (if there is any gap)	
Assessor's comment should be specific and based on the marking criteria for the specific assessment event.	
Assessor Name/ Signature:	**Date:**

Student Feedback on Outcome(s):

☐√ The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature:	**Date:**

Instruction for use: These instructions should be deleted from the completed assessment cover sheet.
This template is to be used by teaching sections to create an assessment Observation checklist for an assessment(s) conducted in the presence of an assessor. The completed Observation checklist must be signed by the student/s and retained by the teaching section.

Faculty:		**Campus:**	
Teaching section:	**Electrical Engineering**		
Qualification Number and Name:	**UEE62220/UEE62122**		
Unit of Competency Number and Name:	UEERE0012 **Rewnewable Energy**		
Assessment Task:		**Duration:** (Hours and minutes)	
Assessment Date:		**Location:**	

Assessment instructions: delete or add dot points as required

- Write your name and student number in the appropriate fields
- Do not use Pencil unless otherwise specified by the assessor (e.g. for technical drawings etc)
- This assessment must be completed within the allocated duration.
- Personal electronic devices (mobile phones / IPad) are not permitted.
- You will be observed performing skills by your teacher and assessed accordingly

Assessment Criteria:

List the performance criteria and performance evidence being assessed by **this** assessment task.

Resources to be supplied by students: delete or add dot points as required

Pen, pencil, eraser, ruler, toolkit, uniform, safety PPE, etc.

Resources permitted during assessment: delete or add dot points as required

- Standard Dictionaries
- Technical Dictionaries
- Bilingual Dictionaries
- Programmable Calculators
- Non-programmable Calculators

Student Name:			
Student ID:		**Group:**	
Student signature:		Date:	

Performance criteria and performance evidence being observed	Y	N	Assessor comments
1. Identify & insert performance criteria / performance evidence of assessment Preparation process to perform the task as described in assessment mapping	Y		
2. Identify & insert performance criteria / performance evidence of assessment Progress processes in performing the tasks as described in assessment mapping	Y		
3. Identify & insert performance criteria / performance evidence of assessment Application of theoretical knowledge as described in assessment mapping	Y		
4. Identify & insert performance criteria / performance evidence of assessment Application of practical methods as described in assessment mapping	Y		
5. Identify & insert performance criteria / performance evidence of assessment Presentation of final output & record keeping as described in assessment mapping	Y		
6. Identify & insert performance criteria / performance evidence of assessment Review/Revise/OHS as described in assessment mapping	Y		

UEERE0012 Develop effective engineering strategies for energy reduction in buildings

1. Prepare to develop strategies for effective energy reduction in buildings
2. Develop strategies for effective energy reduction in buildings
3. Document and report strategies for effective energy reduction in buildings

Assessment Outcome:	☐ **[Satisfactory - S]** √ ☐ **[Not Satisfactory - NS]** ☐ **Resubmission (RS)**

Assessor's comment regarding student performance

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor's recommendation on how to improve the performance (if there is any gap)

Assessor's comment should be specific and based on the marking criteria for the specific assessment event.

Assessor Name/ Signature:		**Date:**	

Student Feedback on Outcome(s):

☐√ The results of my performance have been discussed and explained to me.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

Student's signature:		**Date:**	

Part 3
RPL Validation Form

This form is to be used at assessment validation meetings when validating assessments (including RPL tools). The priority order of assessment validation activities is determined by the Head Teacher in conjunction with the Assistant Director Faculty based on the Assessment Validation Risk Matrix, Assessment Validation Plan – Faculty and Assessment Validation Plan – Section. Please refer to Sydney Institute Assessment Validation Policy and Assessment Validation Procedure before undertaking validation. This form is to be used for completing:

Section A: Principles of Assessment - validating one assessment tool and instruments.

Section B: Rules of Evidence - statistically significant sample of judgments (student assessments) made.

Faculty:		Section name and College:	
Qualification Number and Name			
Unit of Competency /Module) Number and Name:			
Assessment Task (e.g. Written Assessment 1)			

Team Validation Members must collectively have the following: (Boxes 1-3 must be crossed ☒)

☒1. Vocational competency and current industry skill

☐2. Current knowledge of vocational teaching and learning

☒3. Current Training and Assessment qualification or Assessor Skill set

Note: At least (1) validation team member must not be directly involved in the delivery & assessment of this training product. (e.g. industry expert). Minimum of (2) persons to validate. Validation team leader cannot be the person who delivered or assessed the unit / module being validated. Final validation decision made cannot be made by a person directly involved in the delivery / assessment of the unit of competency being validated.

Team Member Name	Position	Organization	Signature & Date

Assessment/RPL Activity	Y/N or NA	Please ensure you **comment** on how the assessment meets the defined criteria.
Is the assessment related to a unit of competency considered a high risk unit for the qualification? Refer to the Assessment Validation Risk Matrix.	N	
Confirm industry been engaged in refining this assessment? (Please verify with Head Teacher if necessary). Industry can include industry enterprises (e.g. employers), industry skill councils, industry associations, industry regulators, group training organisations. Evidence to be kept of industry engagement.	Y	(yes) Educational Industry Open Universities

Section A - Principles of Assessment

(Validation of the assessment tools and instruments)

Validity

Part 3
RPL Validation Form

a. Assessment is mapped to the unit or units (if clustered) of competency from the Training Package including elements, performance criteria, performance evidence, evidence of knowledge and assessment conditions.	N	
b. Assessment reflects workplace standards and regulatory requirements.	N/A	
c. Assessment is consistent with the training and assessment strategy.	Y	
Fairness		
d. Assessment provides for special needs of learners and reasonable adjustment.	N	Currently no learners are present in this Unit, but can be developed to suit specific students
e. An Assessment appeals process and information regarding attempts at assessment is made available to learners. This information is provided to students at student orientation and in the Student Assessment Guide – Unit of Competency (template).	Y	Detailed in the Student Assessment guide
f. Assessment takes into account language, literacy and numeracy needs of learners to the standard that would be expected in demonstrating competence in the workplace.	Y	
Flexibility		
g. Assessment may be used to recognise competencies no matter how, where or when they have been acquired and draw on a range of methods appropriate to the context.	Y	According to the answers for the specific questions asked
Reliability		
h. The assessment is likely to provide similar results when used with different groups of learners?	Y	Most assuredly
i. Assessment instructions to the learners are clear, concise and accurate to ensure consistent, reliable and fair results for all candidates.	Y	Specified in the Assessment Test
j. Assessment instructions to the assessor are available for assessors to achieve consistent, reliable and fair results for all candidates.	N	
k. Assessment marking guide that has model responses and/or performance requirements is provided for assessors.	N/A	All objective tasks
l. The assessment criteria for competence have been clearly defined.	N/A	
General Requirements		
The assessment tool includes the appropriate Assessment Cover Sheet and Assessment Feedback Sheet.	Y	it certainly does
The assessments validated are stored securely within the teaching section and accessible to relevant staff.	Y	I store my own

Part 3
RPL Validation Form

Modifications required (as identified under comments)**:**	☐ Yes	☒ No

Comments (Where the Principles of Assessment criteria are not met, describe the corrective action/s to be made).

The criteria was met

Section B - Rules of Evidence

Validation of the assessment judgements made. Refer **Table (1)** below to determine the assessment judgement sample size. A sample of assessment judgements from a minimum of **two (2)** units of competency to be validated.

Validity The assessment evidence is adequate for the appropriate AQF level & the assessor is assured the learner demonstrated the required knowledge evidence and / or performance evidence.	Y	it is adequate to AQF
Authenticity The assessor is assured the evidence presented is the learners own work.	Y	of course, it has such space
Sufficiency The assessment provides for the collection of appropriate evidence to ensure the relevance, quality and quantity to enable the assessor to be assured of learner's competence.	Y	it certainly provides evidence
Currency The assessment collects evidence of the learner's current skills and knowledge to the standard expected in the workplace.	Y	it absolutely collects evidence of the learner's current skills
General Requirements		
Assessment judgements validated are stored securely within the teaching section and accessible to relevant staff.	Y	
Modifications required (as identified under comments)**:**	☐ Yes	☒ No

Comments (Where the Rules of Evidence criteria are not met from the review of the assessment judgements describe the corrective action/s to be made).

Part 3
RPL Validation Form

Date changes made to assessment:	July 2016
Date of next review: (Note: to be validated at least once within each 3 year cycle)	January 2017

TABLE 1
Use this table as a reference to determine the number of judgments (completed student assessments) to be validated as per Rules of Evidence. A sample of assessment judgements from a minimum of **two (2)** units of competency to be validated.

Assessment judgment = Total number of students x total number of assessment events per unit of competency.
(Example: 50 students x 2 assessment events (in one unit of competency) total 100 assessment judgments.
Sample size = number of assessment judgments to be validated for that one unit of competency 31.

Total number of assessment judgments (per unit of competency)	10	20	30	40	50	60	70	80	100	120	150	175	200
Sample size to be used	9	14	18	21	24	26	27	29	31	32	34	35	36

Sample sizes above based on
Margin of error - 15%
Confidence level - 95%
Source : www.raosoft.com/samplesize.html

Part 4
Student Assessment Guide (Unit of Competency) including RPL Assessment
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name			
Unit of Competency Number and Name			
Application	To copy from Unit Competency Guide		
Prerequisites			
Licensing, Legislative or Certification requirements	The skills and knowledge described in this unit **do not require/ require** a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships		
Assessment Methods	From competency units		

Assessment Methods

Assessment criteria

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** *(**KS01-ED15A**)*, by meeting the requirements in the Learning Specification/s.

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: **Theory Test**. You will be given a test to be completed in class containing (10) questions on theoretical aspects of the unit on topics T1,T4,T5,T9 and T12 as detailed above .

Event 2: **Practical Test.** You will be given a multi part practical test to be completed in class which contains tasks on T3, T6 and T10.

Event 3: **Assignments/miniprojects 1-4**. Four (4) take home research and discussion Assignments on topics T2,T7,T8 andT11.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1					Satisfactory/Not yet satisfactory
2					Satisfactory/Not yet satisfactory
3					Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed.

Resources required for assessments

This unit is assessed using various resources/tools:

Learner Resource Manual: A short reference manual as well as various online sources will be posted to your course blog.

	Principal References: Online help available from application packages covered. You will also be provided with Access to other online resources containing information similar to that which you may encounter in a workplace. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper scientific calculator USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request. Your Head Teacher will address the appeal in accordance with Assessment Guidelines for IQY TECHICAL COLLEGE.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provides learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .

Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the our assessment policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Part 5

Training and Assessment System for each unit and Student Assessment Guide

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEECS0003-Assemble,set-up and test computing devices		
Application	This unit covers assembly, setting up and testing personal computers as directed in computer service manuals. It encompasses safe working practices, checking computer components, assembling components to form a basic personal computer, installing and testing basic operating system, drivers and application software, following written and oral instruction and applying customer relations procedures. Note: This unit applies to all aspects of Electro technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEENEEE101A Apply Occupational Health Safety regulations, codes and practices in the workplace		
Licensing, Legislative or Certification requirements	The skills and knowledge described in this unit **do not require** a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships		

Assessment Methods	Evidence shall show that knowledge has been acquired of safe working practices, assembling, setting-up and testing personal computers. All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies. UEECS0003 **Computing device servicing** Evidence shall show an understanding of computing devices' hardware structure to an extent indicated by the following aspects: Note: Examples include motherboards, memory modules, video modules, connecting buses, storage devices and other components. T1 Sub-assemblies architecture and their function Note: Examples include motherboards, memory modules, video modules, connecting buses, storage devices and other components. T2 Assembling and dismantling techniques T3 Hardware faults and troubleshooting techniques Note: Confined to subsystem level eg. PCI –E Cards or similar, T4 Basic network hardware and components T5 Connection of network media T6 Set up of standard network configuration T7 Sub-assemblies faults and troubleshooting techniques T8 Repair techniques T9 Operating systems in use. T10 Operating System installation and configuration T11 Basic authentication and file and directory security T12 Occupational health and safety fundamentals as they relate to computing device assembly/disassembly.
Assessment Methods	
Assessment criteria	Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's: 1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an 2. ***Understanding of the required skills and knowledge*** *(**KS01-ED15A**)*, by meeting the requirements in the Learning Specification/s. You will be assessed against the following criteria to establish your competence in the unit: **Event 1:** **Theory Test**. You will be given a test to be completed in class containing (10) questions on theoretical aspects of the unit on topics T1,T4,T5,T9 and T12 as detailed above . **Event 2:** **Practical Test.** You will be given a multi part practical test to be completed in class which contains tasks on T3, T6 and T10. **Event 3:** **Assignments/miniprojects 1-4**. Four (4) take home research and discussion Assignments on topics T2,T7,T8 andT11.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome

Assessment methods & schedule	1	Theory Test (20%)		Two hours		Satisfactory/Not yet satisfactory
	2	Practical Test (40)		Two hours		Satisfactory/Not yet satisfactory
	3	Mini Projects/Assignments (40%)		Fifteen Weeks		Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. .
Resources required for assessments	This unit is assessed using various resources/tools: **Learner Resource Manual:** A short reference manual as well as various online sources will be posted to your course blog. **Principal References:** Online help available from application packages covered. You will also be provided with • Access to other online resources containing information similar to that which you may encounter in a workplace. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper • scientific calculator • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit.

	If you are deemed unsatisfactory in an assessment event you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEECS0033 -Provide programming solution for computer systems engineering problems – R1		
Application	This unit covers the use of computer application relevant to engineering support work functions. It encompasses applying user preferences, using application menus and tools, entering and retrieves information, working with groups and transferring and printing files. The unit is intended for competency development entry-level employment-based programs incorporated in approved contracts of training. It may be used to augment previously acquired competencies.		
Prerequisites	None		
Licensing, Legislative or Certification requirements	The skills and knowledge described in this unit **do not require** a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships		

Assessment Methods	UEECS0033 **Personal computers, engineering applications software basic** Evidence shall show an understanding of object orientated programming basics to an extent indicated by the following aspects: T1 Computer Systems Overview encompassing: Safety Applications of computers in industry Types of computer systems Hardware components Software and firmware Memory Peripherals Removable storage devices PC hardware inventory Networking T2 Operating System Overview encompassing: Software layer model Function and characteristics of an operating system File structure Formatting disks Boot process Configuration files T3 Windows Operating System encompassing Windows screen Windows Explorer File management Managing software, updates, backups and virus protection. T4 Word Processors encompassing Word files Formatting Engineering symbols Tables and lists Drawings Spelling, grammar, and 'search-and-replace' Printing T5 Spreadsheets encompassing Parts of a spreadsheet Excel file management Inserting data into spreadsheets Formatting spreadsheets Charts Engineering problem solving Printing T6 Databases encompassing: Features and purpose of database Searching existing database Creating a simple database Manipulating data in a database Advance sort functions Reports
Assessment Methods	

T7 Transferring Data Between Windows Applications encompassing:

Moving data between Word, Excel and Access

T8 Drawing and Computer Assisted Design (CAD) programs encompassing:

Computer drawing using applications such as Visio.
Incorporation of electrical/electronic symbols into computer drawings.

T9 E-mail and Internet Browsers encompassing:

Browsers
Search Engines
Web-based e-mail (e.g. Hotmail)
Application-based e-mail (e.g. Outlook).

Assessment criteria

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** *(**KS01-ED15A**)*, by meeting the requirements in the Learning Specification/s.

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: **Theory Test**.You will be given a test to be completed in class containing (15) questions on theoretical aspects of a typical computer systems including number Systems, Memory, I/O, Storage and CPU, BIOS , System BUS, Ports etc.

Event 2: **Practical Test.** You will be given a multi part practical test to be completed in class containing questions on Excel and Visio.

Event 3: **Assignments 1-4**.Four (4) Mini Assignments to complete at home and class.

You will be required to successfully apply requested modifications to two mini project to demonstrate your competence in practical aspects of this unit.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Test (20%)				Satisfactory/Not yet satisfactory
2	Practical Test (60)				Satisfactory/Not yet satisfactory
3	Assignments (20%)				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed.

A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

	Please see Recognition for previous learning and experience - for further information.
Resources required for assessments	This unit is assessed using various resources/tools: **Learner Resource Manual:** A short reference manual as well as various online sources will be posted to your course blog. **Principal References:** Online help available from application packages covered. You will also be provided with • Access to other online resources containing information similar to that which you may encounter in a workplace. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper scientific calculator USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per policy.Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking.

	• where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the assessment policy. This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty	C.E.T.	**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECS0017 - Develop industrial Control Programs for Microcomputer Equipped Devices		
Application	This unit covers development of software programs to be able to control external devices using microcomputers as apply to engineering product development work. It encompasses working safely, following design brief, applying knowledge of microcomputer architecture, constructing prototype devices, programming 'C' programming language, testing program operation and documenting development work. Note: This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	**Competencies**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEENEEE101A - Apply Occupational Health and Safety regulations, codes and practices in the workplace **Required competencies:** (the following can be done in parallel with main unit) UEENEEH115A Develop software solutions for microcontroller based systems UEENEEH166A Troubleshoot microcontroller based hardware systems UEENEEE151A Provide programming solution for computer systems engineering Problems OR Superseaded relevant units **Literary and Numeracy:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing, Legislative or Certification requirements	None		
Assessment Methods	You will be assessed to prove your competence in the required skills and knowledge below: **KS01-ED150A Develop industrial control programs for microcomputer equipped devices** Evidence shall show an understanding of microprocessor assembly language and high-level language programming as it is applied to engineering applications to an extent indicated by the following aspects: **T1 Embedded C programming concepts:**		

Assessment Methods	The C environment Program Structure and elements of C (tokens) The C reserved key words Understand techniques of writing source code that is readable. • Types of variables, scope of variables, local and global variables Types of constants, symbolic, literal, literal string. Using #define Apply enumerations to variable declarations The printf() function • Non printable characters and escape sequences. **T2 Structured programming :** Storage Classes Using type casting. Operators and expressions. Assignment and arithmetic operators. Bitwise Boolean operations Logical and relational operators. Increment decrement and compound assignments **T3 Modular Programming, decision making and control flow**: • Operator precedence. • Using Control statements. • If statements (open branch) • If/Else statements (closed branch) • Conditional expressions. • Switch/Case **T4 Modular Programming, looping:** • While loop • Do/While loop • For loop • Break, Continue and Go to **T5 Using Functions** • Concepts of a program block • Prototyping and function organization. • Parameters, arguments and return values. • Using functions that return values. • Nested loops • Recursion. **T6 Using Pointers:** • Types of pointers. • Declaring a pointer • Passing pointer variables and their scope • Indirection, uses of the dereferencing operator (*). • The address operator (&). • Multiples indirections • Develop testing procedures to analyse the developed C code. • Rectify programming problems and bugs to ensure that the required specification of the code is met. **T7 Using arrays:** • Types of arrays. • Declaring an array. • Sorting with numeric arrays • Array boundaries. • Multidimensional arrays. **T8 Pointers to functions:** Using pointers to return several values in functions. Creating your own header files.
Assessment criteria	Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

Assessment methods & schedule

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** *(**KS01-ED150A**)*, by meeting the requirements in the Learning Specification/s.

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: A First Written Theory Exam on C-Language. Students will be given a test to be completed in class containing twenty (20) programming questions, either multiple choice or short answer.

Event 2: A Final Written Theory Exam on C-Language. Students will be given a test to be completed in class containing twenty (20) programming questions, either multiple choice or short answer.

Event 3: Eight (8) Mini Programing Assignments to be completed in class and at home

You will be required to successfully complete all mini programming assessments in this unit to demonstrate your competence in this unit.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Written Test, 25%				Satisfactory/Not yet satisfactory
2	Written Test, 25%				Satisfactory/Not yet satisfactory
3	8 Written Tasks, 50%				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed.

A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual: Students don't need to purchase any Learner Resource Manual:

Principal References: It is advised that students have access to the following reference books as the main references:

1. *Programing in C*
   Author: Stephen G Kochan
   Publisher: Sams Publishing 3r Ed
2. Any book you may have on C or C++ language

You will also be provided with

	Access to a simulated C programming environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper scientific calculator USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".

Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECS0027 Provide programming solution for computer systems engineering problems – R1		
Application	This unit covers development of software application, using OOP approach to programming. It encompasses working safely, following design brief, applying knowledge of declarative and SQL architecture, constructing simple forms, relations, forms, macros, queries basic VBA programming, testing program operation and documenting development work. Note: This unit applies to any recognised development program that leads to the acquisition of a formal award at AQF level 5 or higher This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) has/have been onfirmed. UEENEEE101A Apply Occupational Health Safety regulations, codes and practices in the Workplace OR superseaded relevant unit UEECD0007		
Licensing, Legislative or Certification requirements	None		
Assessment Methods	UEECS0027 **High level programming for engineering applications** Evidence shall show an understanding of control programming fundamentals and high-level language programming as it is applied to engineering applications to an extent indicated by the following aspects: T1 Control applications of software T2 Software terminology T3 Programming languages currently used by industry T4 Program development Note: Examples may include flowcharts, pseudocode, algorithms		

T5 Programming concepts encompassing:

Programming/data structure
documentation
Designing and populating tables
Making queries using either design or SQL method
Accessing and importing external data
Structured data types, Forms and macros
Reading from keyboard and writing to screen
Arithmetic, relational and logical operations
making decisions

Note:
Examples may include macros; forms, queries; Intrinsic functions,;
Writing functions; Linking in external data to the system

T6 Complex data types and structures encompassing:

Assessment Methods

Assessment criteria

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** *(**KS01-ED15A**)*, by meeting the requirements in the Learning Specification/s.

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Practical Test 1. Students will be given a test to be completed in class containing (5) questions on **query and Table design**.

Event 2: Practical Test 2. Students will be given a test to be completed in class containing (4) questions on **macro and Form Design**.

Event 3: Assignments 1-4.Four (4) Mini Assignments to complete at home and class.

Students will be required to successfully apply requested modifications to the last mini project to demonstrate their competence in this unit.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical 1 (20%)				Satisfactory/Not yet satisfactory
2	Practical 2 (40)				Satisfactory/Not yet satisfactory
3	Assignments (40%)				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

	If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual:** Students don't need to purchase any Learner Resource Manual: **Principal References:** It is advised that students have access to the following reference books as the main references: 1. *Modern Database Management* Author: Fred R. McFadden et al . Publisher: Benjamin/Cummins, Inc. 2. *Other Online help/tutorial sources as advised* You will also be provided with • Access to other online resources containing information similar to that which you may encounter in a workplace. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper scientific calculator USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year.

	If you engage in cheating such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

STUDENT ASSESSMENT GUIDE – UNIT OF COMPETENCY

<table>
<tr><td>Qualification</td><td>Engineering Technology – Electrical</td></tr>
<tr><td>Unit of competency</td><td>UEECD0004 Apply material science to solving electrotechnology engineering problems</td></tr>
<tr><td>Unit Descriptor</td><td>This unit covers the application of materials for a specific purpose in electrotechnology. It encompasses working safely, knowledge of materials science including classifications, characteristics and any impact a material may have on health and the environment, the processes of corrosion and degradation, how particular materials are used, solving electrotechnology problems involving of materials for a particular application and documenting justification for such solutions.</td></tr>
<tr><td>Prerequisites</td><td>UEENEEE101A/UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace</td></tr>
<tr><td>Assessment criteria</td><td>UEECD0004Materials science in electrotechnology
Evidence shall show that knowledge has been acquired of material science in electrotechnology.
Summary of topics.
Classification, nature and physical properties of materials used in electrotechnology
Dielectric strength and dielectric breakdown, examples to include applications using solids, liquids, gases and vacuum
Conductors and semiconductors
Chemical effects on materials
Material processing and manufacturing
Environment and health issues</td></tr>
<tr><td>Assessment methods</td><td>You will be required to complete all assessments for this unit to demonstrate your competence in this unit:
<table>
<tr><th>Assessment no.</th><th>Assessment method</th><th>Assessment grading</th></tr>
<tr><td>1</td><td>Research Project 1</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td>2</td><td>Research Project 2</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment schedule</td><td>You will be assessed for this unit as per the following schedule:
<table>
<tr><th>Assessment no.</th><th>Assessment date</th><th>Assessment venue</th></tr>
<tr><td>1</td><td></td><td>Industrial Control Lab</td></tr>
<tr><td>2</td><td></td><td>Industrial Control Lab</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Reporting assessment outcomes</td><td>Your Transcript of Academic Record lists all of your results in your study to date.

“This is an ungraded unit; therefore your result will be recorded and reported to you as Competent (AC) or Not Yet Competent (NC)”.</td></tr>
</table>

	If you have achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you have completed. You will also receive a **Statement of Attainment** for the unit/units you have successfully completed. **Recognition and credit transfers**:you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.
Resources required for assessments	This unit is assessed using specific resources/tools: You will be provided • access to a simulated environment • access to workplace documents, information and resources (such as compliance obligations, enterprise plans, work responsibilities) You are required to bring in the following for the assessments: N/A
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessmentactivities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment conditions	You must submit assessment work and attended scheduled assessments on the required dates. ○ **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. ○ **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. ○ **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. ○ **If you engage in cheating**such as copying, colluding with another person, using unauthorised notes, or allowing another personto copy your work, you will be liable for disciplinary action as per Student Discipline Policy .Whatever the form of assessment, it is essential that the work you are assessed on is your own. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: ○ where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% ○ when the assessment is more than seven days late, the result recorded is recorded as “not yet competent” ○ for non-attendance at an assessment on a negotiated date, the result is recorded as “not yet competent”.

Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy and guidelines.This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECD0005 -Electrotechnology Engineering Physics		
Application	This unit covers the law of physics and how they apply to solving electrotechnology related problems. It encompasses working safely, knowledge of measurements of physical phenomena, linear and angular motion, harmonic motion, wave theory, optics, acoustics and heat capacity and transfer, use of measurement techniques, solving physics related problems and documenting justification for such solutions.		
Prerequisites	**Competencies**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEENEEE101A/UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace **Literary and Numeracy:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing, Legislative or Certification requirements	None		
Required Skills & Knowledge	All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies. You will be assessed to prove your competence in the required skills and knowledge below: **UEECD0005** - **Electrotechnology Engineering Physics** Evidence shall show an understanding of electrotechnology engineering maths to an extent indicated by the following aspects: T1 Measurement encompassing • SI units in measurement of physical phenomena • Uncertainty and tolerance T2 Linear motion T3 Angular motion T4 Simple harmonic motion and vibration T5 Wave theory • Interference • Diffraction T6 Electromagnetic waves and propagation T7 Optics • Mirrors and lenses • Optical fibre		

Required Skills & Knowledge

T8 Acoustics and ultrasonics
T9 Heat capacity and heat transfer
T1 Measurement encompassing
- SI units in measurement of physical phenomena
- Uncertainty and tolerance

T2 Linear motion
T3 Angular motion
T4 Simple harmonic motion and vibration
T5 Wave theory
- Interference
- Diffraction

T6 Electromagnetic waves and propagation
T7 Optics
- Mirrors and lenses
- Optical fibre

T8 Acoustics and ultrasonics
T9 Heat capacity and heat transfer
- Fluid power

Assessment criteria

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** *(**KS01-EE082A**)*, by meeting the requirements in the Learning Specification/s.

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Theory Test 1. Short answers and calculations based on topics T1 to T6.

Event 2: Theory Test 2. Short answers and calculations based on topics T7 to T9.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Test 1				S/NS
2	Theory Test 2				S/NS

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed.

A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

You are required to bring in the following for the assessments:
Calculator, Pen.

Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECD0007Apply Occupational Health and Safety regulations, codes and practices in the workplace		
Application	This unit specifies the mandatory requirements of occupational health and safety and how they apply to the various electrotechnology work functions. It encompasses responsibilities for health and safety, risk management processes at all operative levels and adherence to safety practices as part of the normal way of doing work.		
Prerequisites	None"		
Licensing,	**1.2) License to practice** **During Training**: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships. **In the workplace**: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c. Other conditions may apply under State and Territory legislative and regulatory requirements.		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: T1 The basic legal requirements covering occupational health and safety in the workplace encompassing: underlying principles of OH&S general aims and objectives of the relevant state or territory legislation relating to OH&S. employer and employee responsibilities, rights and obligations. major functions of safety committees and representatives. powers given to Occupational Health and Safety Inspectors • housekeeping and potential hazards in relation to improper housekeeping selecting appropriate personal protective equipment (PPE) given hazardous situations T2 The work environment encompassing: typical hazards associated with a range of work environments procedures used to control the risks associated with these hazards principles of risk assessment / management and state the purpose of each. hierarchy of OH&S hazard control measures. required documentation for risk assessment. commonly used workplace safety signs. workplace emergencies that pose a threat to health and safety and suitable procedure for an emergency workplace evacuation. appropriate fire extinguisher for a given type of fire.		

Required Knowledge & Skills	requirements for the location, mounting and maintenance of portable fire extinguishers. basic process of fighting a fire. Importance of safe premises, buildings and security in an industrial setting and the consequences of non- compliance. standard work procedure. T3 Manual Handling encompassing: typical manual handling injuries and the effect they can have on lifestyle situations that may cause manual handling injuries correct procedures for lifting and carrying to prevent manual handling injuries T4 Chemicals in the workplace encompassing: hazardous substances and dangerous goods. classification of chemicals as hazardous substances and/or dangerous goods requirements for labelling of chemicals in the workplace safe storage procedures for chemicals purpose and interpretation of material safety data sheet (MSDS) T5 Working at heights encompassing: dangers associated with working on ladders and scaffolds identification of work area as a height risk and use appropriate safety equipment to prevent a fall selecting an appropriate ladder for a given situation and perform a safety check before use precautions that should be taken when ascending and working off a ladder precautions that should be taken when working on and around a scaffold and elevated platforms. T6 Confined spaces encompassing: hazards associated with working in a confined space identifying workplace situations that could be classified as a confined space control measures for working in a designated confined space T7 Physical and psychological hazards encompassing: short and long term effects of excessive noise and techniques to avoid damage to hearing due to excessive noise effects of vibration on the human body and work practices to protect against vibration effects of thermal stress on the human body and work practices to protect against thermal stress effects of ultraviolet (UV) radiation on the human body and work practices to protect against UV radiation. dangers associated with laser operated equipment and tools and suitable protective measures to overcome the danger. occupational overuse syndrome, how it occurs and means to overcome it factors that cause stress in the workplace, symptoms of a person suffering from stress and personal stress management techniques detrimental effects and dangers of drug and alcohol use in the workplace T8 Working safely with electricity encompassing: effects of electric shock on the human body common causes of electrical accidents precautions that can minimise the chance of electric shock (earthing, extra low voltage, fuses, circuit breakers and residual current devices – RCDs) protection offered by a residual current device (RCD) need for ensuring the (safe) isolation of an electrical supply appropriate method of removing an electric shock victim from a live electrical situation T9 Life support - CPR in the workplace encompassing: First Aid. responsibilities of the First Aider. priorities of first aid management for any accident or injury. procedures required at an accident scene. legal and ethical issues, which may impact on the management of care. 'Duty of Care'. examination of a casualty for injuries.

	effect of cardio pulmonary arrest on the body. Managing simulated conditions of: airway obstruction; respiratory arrest and cardio pulmonary arrest, single and two-person cardio pulmonary resuscitation (CPR). signs and symptoms of an altered level of consciousness management of simulation of a casualty with an altered level of consciousness. signs and symptoms of shock. • management of simulation of a casualty in shock
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: • A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: • Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement • Apply sustainable energy principles and practices as specified in the performance criteria and range statement • Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. Demonstrate an appropriate level of skills enabling employment Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures. Demonstrated consistent performance across a representative range of contexts from the prescribed items below: Applying OHS practices in the workplace as described in 8) and including: a. Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively. b. Understanding and following risk control safe work methods. c. Applying work procedures and instructions as they apply to risk control measures. d. Dealing with accidents and emergencies within the scope of responsibility. e. Participation in consultation processes, identifying hazards and implementing and monitoring control measures. Dealing with unplanned events
Assessment methods & schedule	Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff: • Observation of skills in practical exercises and • Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews You will be required to complete all assessments for this unit to demonstrate your competence in this unit. Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's: 1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an 2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

	Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
	1	Practical Test				Satisfactory/Not yet satisfactory
	2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

Electrical Trade Practice
Australian Electrical Wiring
Occupational Health & Safety Course book (IQY TECHICAL COLLEGE Module Resources Manual)

You will also be provided with

- Access to a simulated environment containing information similar to that which you may encounter in a workplace.
- Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS
- hooking Wire single core AWG 22 (Hartland Cables P/N HC0069)
- USB memory Stick

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

You will have three weeks from the date you receive your results in which to make an appeal and request a review.

You will receive a response within **ten working days** after receipt of the request.

Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECD0019 Fabricate, assemble and dismantle utilities industry components		
Application	This unit covers basic fitting and fabrication techniques as they apply in the various utilities industry work functions. It encompasses the safe use of hand, fixed and portable power tools; cutting, shaping joining and fixing using metallic and non-metallic materials; dismantling and assembling equipment; basic mechanical measurement and marking-out and reading drawings/diagrams		
Prerequisites	None"		
Licensing,	**During Training**: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships. **In the workplace**: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c. Other conditions may apply under State and Territory legislative and regulatory requirements.		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: T1 Mechanical drawing interpretation and sketching encompassing: drawing standards and conventions used in drawings of in AS1100 basic abbreviations and symbols used in drawing of mechanical interpretation of mechanical drawings commonly used (orthogonal projection, third angle - detail and assembly laying out a drawing of mechanical components using engineering freehand drawings of mechanical components showing manufacture/fabrication T2 Workshop planning and materials encompassing: methods used to work safely in an industrial work environment. typical non-electrical hazards in the workplace control measures for dealing with hazards identified. Conducting a risk assessment on a given work environment, risks identified type of metallic and non-metallic materials used in the application of the common materials planning process T3 Measuring and marking out encompassing: reasons for measuring and marking out tools used for marking out measuring and marking out a project accurately following sustainable energy work practices related to reducing waste T4 Holding and cutting encompassing: common tools for holding (bench vices, multi-grips, vice		

Required Knowledge & Skills	common tools for cutting metallic and non-metallic material pliers, files) procedure for using a range of tools for cutting, shaping, metallic materials safety procedures when using holding and cutting tools T5 Drills and drilling encompassing: • types of drills used in the electrotechnology industry sharpening twist drills drilling metallic and non-metallic components safe use of a bench drill T6 Tapping and threading encompassing: type and size of commonly used threads used in electrotechnology taps and tap wrenches tapping metallic and non-metallic components stock and die tools threading metallic and non-metallic components T7 General Hand Tools encompassing: hammers used in electrotechnology work screwdrivers used in electrotechnology work spanners and sockets used in electrotechnology work pliers used in electrotechnology work assembling components applicable to electrotechnology tools. T8 Joining techniques encompassing: types of machine screws and nuts forms of welding (Oxy-acetylene, electric arc welding). forms of brazing and hard soldering process of soft soldering joining components using machine screws joining components using welding, brazing or soldering T9 Portable electric power tools encompassing: portable electric power tools (grinders, drills, jigsaws, saws) applications of portable electric power tools used in the using portable power tools. fabricating components using power tools (drills, grinders) T10 Sheet metal work encompassing: types of sheet metal materials used in the electrotechnology names and applications of the types of fabrication materials. tools used with sheet metals in electrotechnology work punches, notching tools, folding machines) techniques used in fabricating sheet metal (cutting, bending, cutting mitres). marking out, cutting, bending, drilling and/or cutting and/cutting mitred joints using sheet metal. sustainable energy work practices to reducing waste when fabricating components using sheet metal and fabrication T11 Low tolerance measurement encompassing: tolerance techniques in using vernier callipers techniques in using micrometers. using vernier callipers to measure engineering components using micrometers to measuring engineering components T12 Dismantling and assembly techniques encompassing: tools used in dismantling and assembling electrotechnology screwdrivers, bearing pullers, etc). procedures for ensuring the safe treatment of dismantled dismantling electrical, electronic, instrumentation or refrigeration/equipment using correct procedures. • assembling electrical, electronic, instrumentation or refrigeration/equipment using correct procedures.
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

0 Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement

1 Apply sustainable energy principles and practices as specified in the performance criteria and range statement

2 Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

3 Demonstrate an appropriate level of skills enabling employment

4 Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

0 Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory

	2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience - for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: *Electrical Trade Practice* *Australian Electrical Wiring* *IQY TECHICAL COLLEGE Module Resources Fitting &* *Machining Handbook of Fitting & Machining* *Electrical Workshop Practice* You will also be provided with • Access to a simulated environment containing information similar to that which you may encounter in a workplace. • Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates.

	If you miss an assessment you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEECD0044 Solve problems in multiple path circuits UEECD0046 Solve problems in single path circuits		
Application	This competency standard unit covers competency development entry-level employment based programs incorporated in approved contracts of training. Note: This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies refer to the latest endorsed IT Training Package.		
Prerequisites	**Essential**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEENEEE101A UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	1.2) Licence to practice During Training: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships. In the workplace: the application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50V ac. or 120V dc.		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: Direct current circuits Evidence shall show an understanding of electrical fundamentals and direct current multiple path circuits to an extent indicated by the following aspects: **T1** Basic electrical concepts encompassing: electrotechnology industry static and current electricity production of electricity by renewable and non renewable energy sources transportation of electricity from the source to the load via the transmission and distribution systems utilisation of electricity by the various loads basic calculations involving quantity of electricity, velocity and speed with relationship to the generation and transportation of electricity. **T2** Basic electrical circuit encompassing: symbols used to represent an electrical energy source, a load, a switch and a circuit protection device in a circuit diagram		

Required Knowledge & Skills	purpose of each component in the circuit effects of an open-circuit, a closed-circuit and a short- circuit multiple and sub-multiple units **T3** Ohm's Law encompassing: basic d.c. single path circuit. voltage and currents levels in a basic d.c. single path circuit. effects of an open-circuit, a closed-circuit and a short-circuit on a basic d.c. single path relationship between voltage and current from measured values in a simple circuit determining voltage, current and resistance in a circuit given any two of these quantities graphical relationships of voltage, current and resistance relationship between voltage, current and resistance **T4** Electrical power encompassing: relationship between force, power, work and energy power dissipated in circuit from voltage, current and resistance values power ratings of devices measurement electrical power in a d.c. circuit effects of power rating of various resistors **T5** Effects of electrical current encompassing: physiological effects of current and the fundamental principles (listed in AS/NZS 3000) for protection against the this effect basic principles by which electric current can result in the production of heat; the production of magnetic fields; a chemical reaction typical uses of the effects of current mechanisms by which metals corrode fundamental principles (listed in AS/NZS3000) for protection against the damaging effects of current **T6** EMF sources energy sources and conversion electrical energy encompassing: basic principles of producing a emf from the interaction of a moving conductor in a magnetic field. basic principles of producing an emf from the heating of one junction of a thermocouple. basic principles of producing a emf by the application of sun light falling on the surface of photovoltaic cells basic principles of generating a emf when a mechanical force is applied to a crystal (piezo electric effect) principles of producing a electrical current from primary, secondary and fuel cells input, output, efficiency or losses of electrical systems and machines effect of losses in electrical wiring and machines principle of conservation of energy **T7** Resistors encompassing: features of fixed and variable resistor types and typical applications identification of fixed and variable resistors various types of fixed resistors used in the Electro technology Industry. e.g. wire-wound, carbon film, tapped resistors. various types of variable resistors used in the Electro technology Industry e.g. adjustable resistors: potentiometer and rheostat; light dependent resistor (LDR); voltage dependent resistor (VDR) and temperature dependent resistor (NTC, PTC). characteristics of temperature, voltage and light dependent resistors and typical applications of each power ratings of a resistor. power loss (heat) occurring in a conductor. resistance of a colour coded resistor from colour code tables and confirm the value by measurement. measurement of resistance of a range of variable' resistors under varying conditions of light, voltage, temperature conditions. specifying a resistor for a particular application. **T8** Series circuits encompassing: circuit diagram of a single-source d.c. 'series' circuit. Identification of the major components of a 'series' circuit: power supply; loads; connecting leads and switch applications where 'series' circuits are used in the Electro technology industry.

characteristics of a 'series' circuit - connection of loads, current path, voltage drops, power dissipation and affects of an open circuit in a 'series' circuit.
the voltage, current, resistances or power dissipated from measured or given values of any two of these quantities
relationship between voltage drops and resistance in a simple voltage divider network. setting up and connecting a single-source series dc circuit
measurement of resistance, voltage and current values in a single source series circuit effect of an open-circuit on a series connected circuit **T9** Parallel circuits encompassing:
schematic diagram of a single-source d.c. 'parallel' circuit.
major components of a 'parallel' circuit (power supply, loads, connecting leads and switch)
applications where 'parallel' circuits are used in the Electrotechnology industry.
characteristics of a 'parallel' circuit. (load connection, current paths, voltage drops, power dissipation, affects of an open circuit in a 'parallel' circuit).
relationship between currents entering a junction and currents leaving a junction
relationship between branch currents and resistances in a two branch current divider network.
calculation of the total resistance of a 'parallel' circuit.
calculation of the total current of a 'parallel' circuit.
Calculation of the total voltage and the individual voltage drops of a 'parallel' circuit. setting up and connecting a single-source d.c. parallel circuit
resistance, voltage and current measurements in a single-source parallel circuit
voltage, current, resistance or power dissipated from measured values of any of these quantities
output current and voltage levels of connecting cells in parallel.
T10 Series/parallel circuits encompassing:
schematic diagram of a single-source d.c. 'series/parallel' circuit.
major components of a 'series/parallel' circuit (power supply, loads, connecting leads and switch)
applications where 'series/parallel' circuits are used in the Electrotechnology industry. characteristics of a 'series/parallel' circuit. (load connection, current paths, voltage drops, power dissipation, affects of an open circuit in a 'series/parallel' circuit). relationship between voltages, currents and resistances in a bridge network. calculation of the total resistance of a 'series/parallel' circuit. calculation of the total current of a 'series/parallel' circuit.
calculation of the total voltage and the individual voltage drops of a 'series/parallel' circuit.
setting up and connecting a single-source d.c. series/ parallel circuit
resistance, voltage and current measurements in a single-source d.c. series / parallel circuit
the voltage, current, resistances or power dissipated from measured values of any two of these quantities
T11 Factors affecting resistance encompassing:
four factors that affect the resistance of a conductor (type of material, length, cross-sectional area and temperature)
affect the change in the type of material (resistivity) has on the resistance of a conductor.
affect the change in 'length' has on the resistance of a conductor.
affect the change in 'cross-sectional area' has on the resistance of a conductor.
effects of temperature change on the resistance of various conducting materials
effects of resistance on the current-carrying capacity and voltage drop in cables.
calculation of the resistance of a conductor from factors such as conductor length, cross-sectional area, resistivity and changes in temperature
using digital and analogue ohmmeter to measure the change in resistance of different types of conductive materials (copper, aluminium, nichrome, tungsten) when those materials undergo a change in type of material length, cross-sectional area and temperature.
T12 Effects of meters in a circuit encompassing:
selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application.
measuring resistance using direct, volt-ammeter and bridge methods.

instruments used in the field to measure voltage, current, resistance and insulation resistance and the typical circumstances in which they are used.
hazards involved in using electrical instruments and the safety control measures that should be taken.
operating characteristics of analogue and digital meters.
correct techniques to read the scale of an analogue meters and how to reduce the 'parallax' error.
types of voltmeters used in the Electrotechnology industry – bench type, clamp meter, Multimeter, etc.
purpose and characteristics (internal resistance, range, loading effect and accuracy) of a voltmeter.
types of voltage indicator testers. e.g. LED, neon, solenoid, volt-stick, series tester, etc. and explain the purpose of each voltage indicator tester.
operation of various voltage indicator testers.
advantages and disadvantages of each voltage indicator tester.
various types of ammeters used in the Electrotechnology industry – bench, clamp meter, multimeter, etc.
purpose of an ammeter and the correct connection (series) of an ammeter into a circuit.
reasons why the internal resistance of an ammeter must be extremely low and the dangers and consequences of connecting an ammeter in parallel and/or wrong polarity.
selecting an appropriate meter in terms of units to be measured, range, loading effect and accuracy for a given application
connecting an analogue/digital voltmeter into a circuit ensuring the polarities are correct and take various voltage readings.
loading effect of various voltmeters when measuring voltage across various loads.
using voltage indicator testers to detect the presence of various voltage levels.
connecting analogue/digital ammeter into a circuit ensuring the polarities are correct and take various current readings.
T13 Resistance measurement encompassing:
Identification of instruments used in the field to measure resistance (including insulation resistance) and the typical circumstances in which they are used. the purpose of an Insulation Resistance (IR) Tester.
the parts and functions of various analogue and digital IR Tester (selector range switch, zero ohms adjustment, battery check function, scale and connecting leads). reasons why the supply must be isolated prior to using the IR tester.
where and why the continuity test would be used in an electrical installation. where and why the insulation resistance test would be used in an electrical installation.
the voltage ranges of an IR tester and where each range may be used. e.g. 250 V d.c, 500 V d.c and 1000 V d.c
AS/NZS3000 Wiring Rules requirements – continuity test and insulation resistance (IR) test.
purpose of regular IR tester calibration.
the correct methods of storing the IR tester after use carry out a calibration check on a IR Tester
measurement of low values of resistance using an IR tester continuity functions.
measurement of high values of resistance using an IR tester insulation resistance function.
volt-ammeter (short shunt and long shunt) methods of measuring resistance.
calculation of resistance values using voltmeter and ammeter reading (long and short shunt connections)
measurement of resistance using volt-ammeter methods
T14 Capacitors and Capacitance encompassing:
basic construction of standard capacitor, highlighting the: plates, dielectric and connecting leads
different types of dielectric material and each dielectric's relative permittivity.
identification of various types of capacitors commonly used in the Electrotechnology industry (fixed value capacitors -stacked plate, rolled, electrolytic, ceramic, mica and Variable value capacitors – tuning and trimmer)
circuit symbol of various types of capacitors: standard; variable, trimmer and polarised

terms: Capacitance (C), Electric charge (Q) and Energy (W)
unit of: Capacitance (Farad), Electric charge (Coulomb) and Energy (Joule)
factors affecting capacitance (the effective area of the plates, the distance between the plates and the type of dielectric) and explain how these factors are present in all circuits to some extent.
how a capacitor is charged in a d.c. circuit.
behaviour of a series d.c. circuit containing resistance and capacitance components.
- charge and discharge curves
the term 'Time Constant' and its relationship to the charging and discharging of a capacitor.
calculation of quantities from given information: Capacitance (Q = VC); Energy (W =½CV2); Voltage (V = Q/C)
calculation one time constant as well as the time taken to fully charge and discharge a given capacitor. (τ = RC)
connection of a series d.c. circuit containing capacitance and resistor to determine the time constant of the circuit
T15 Capacitors in Series and Parallel encompassing:
hazards involved in working with capacitance effects and the safety control measures that should be taken.
safe handling and the correct methods of discharging various size capacitors
dangers of a charged capacitor and the consequences of discharging a capacitor through a person
factors which determine the capacitance of a capacitor and explain how these factors are present in all circuits to some extent.
effects of capacitors connected in parallel by calculating their equivalent capacitance.
effects on the total capacitance of capacitors connected in series by calculating their equivalent capacitance.
Connecting capacitors in series and/or parallel configurations to achieve various capacitance values.
common faults in capacitors.
testing of capacitors to determine serviceability.
application of capacitors in the Electrotechnology industry.

Assessment criteria

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Theory Test 1, closed book, checks the required skill adequacy of the student to demonstrate his/her competency in topics 1-7. Test consists of short answers, multiple choice questions, diagrams and calculations. Students are allowed to use scientific calculator only.

Event 2: Theory Exam 2, closed book, tests the required student's knowledge on topics 8-15. Test consists of short answers, multiple choice questions, diagrams and calculations. Students are allowed to use scientific calculator only.

Event 3: Practical Test, checks the required skill adequacy of the student to demonstrate his/her competency in assembling, measuring and verifying measurements of current, voltage and resistance is DC circuits using analogue and digital meters.

You will be required to successfully complete all 3 events to demonstrate your competence in unit E104A

Assessment schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Exam 1				Satisfactory/Not yet satisfactory
2	Theory Exam 2				Satisfactory/Not yet satisfactory
3	Practical Test				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: 1. Fundamentals of Electric Circuits (in library) Author: David A. Bell 2. Electrical Principles Author: Jim Jenneson You will also be provided with • Class notes **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS or similar
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. Yu will receive a response within **ten working days** after receipt of the request.
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	the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. IQY TECHICAL COLLEGE provides learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECD0020 Fix and secure electrotechnology equipment		
Application	This unit covers fixing, securing and mounting techniques as apply in the various electrotechnology work functions. It encompasses the safe use of hand and portable power tools, safe lifting techniques, safe use of ladders and elevated platforms and the selection and safe application of fixing devices and supporting accessories/equipment.		
Prerequisites	UEENEEE101A UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace		
Licensing,	**1.2) License to practice** **During Training**: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships. **In the workplace**: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c. Other conditions may apply under State and Territory legislative and regulatory requirements.		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **KS01-EE105A Fixing and support devices/techniques** Evidence shall show an understanding of accessories and support and fixing device and methods and their use to an extent indicated by the following aspects: T1. Device for securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories to hollow walls encompassing: types and safe application of devices for hollow wall fixing and support methods/techniques used to fix/support to wood, hollow wall, masonry blocks, plasterboard, panelling types and safe application of fixing devices used in the electrotechnology industry for wood and hollow wall structures (wood screws, coach bolts, self-tappers, self T2. Device for securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories to solid walls encompassing: types and safe application of devices used for solid wall fixing and support methods/techniques used in to fix to masonry and concrete structures fixing devices used in the electrotechnology industry for solid wall structures (wall-plugs, expanding concrete fixing devices, gas powered fixing tools, powder actuated fixing tools, loxins, dynabolts, chemical devices) regulatory requirements for use of powder fixing tools. hand and power tools used in fixing and supporting accessories using various fixing methods to fix/support to solid walls		

Required Knowledge & Skills

T3. Device for securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories to metal fixing encompassing:

accessories that may be fixed to metal (saddle clips, conduits, brackets, switches)

techniques for fixing to metal

fixing devices: coach bolts, self-tappers, metal thread bolts, hollow wall anchors, rivets

fixing tools - spanners, screwdrivers, power screw drivers, pop riveters, files, reamers

OH&S issues related to drilling, cutting, eye protection, metal filings, swarf, noise

Using power drills, drill bits, change drill speeds.

Install a fixing device and accessory capable of supporting up to 20 kg on the metal plate.

T4. Securing and mounting electrical/electronic/instrumentation/refrigeration/ air-conditioning/telecommunications accessories for supporting, fixing and protecting wiring/cabling/piping and functional accessories using fixing adhesives and tapes encompassing:

types and safe application of using adhesives and tapes as fixing devices (load limits of different commercial products)

accessories that may be fixed using adhesives and tapes

techniques for the application of adhesives and tapes

tools used to apply and cut adhesives and tapes

hazards and safety measures when working with adhesives and chemical fixing devices (fumes, cutting, eye protection, physical contact, hand protection,

•

Before the critical aspects of evidence are considered all prerequisites must be met.

Assessment criteria

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

Demonstrate an appropriate level of skills enabling employment

Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and

- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

Electrical Trade Practice
Australian Electrical Wiring
IQY TECHICAL COLLEGE Module Resources Fitting & Machining Handbook of Fitting & Machining
Electrical Workshop Practice

You will also be provided with

- Access to a simulated environment containing information similar to that which you may encounter in a workplace.
- Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS

	• hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electronics Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEECD0051– Use Drawings, diagrams, schedules, standards, codes and specifications		
Application	This unit covers the application of computational processes to solve engineering problems. It encompasses working safely, applying problem solving techniques, using a range of mathematical processes, providing solutions to electrical/electronic engineering problems and justifying such solutions. Note: Typical engineering problems are those encountered in meeting requirements in a design brief, meeting performance requirements and compliance standards, revising systems operating parameters and dealing with system malfunctions.		
Prerequisites	**Competencies**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEENEEE101A/UEECD0007 – Apply Occupational Health and Safety regulations, codes and practices in the workplace **Literary and Numeracy:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing, Legislative or Certification requirements	None		
Required Skills & Knowledge	All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies. You will be assessed to prove your competence in the required skills and knowledge below: **Drawings. Diagrams and Schedules** Evidence shall show an understanding of drawings, diagrams and schedules used in Electrotechnology work to an extent indicated by the following aspects: **T1 Architectural drawings encompassing:** • site plans, floor plans detailed drawings and standard drawings, • architectural floor plan to determine the power and lighting or communications / audio/ video layouts required in a domestic installation, • site plan to locate the service point, consumers mains, communication services, main switchboard, distribution boards and/or builders supplies, • standard drawing scales to determine the actual lengths represented by dimensions on an architectural drawing,		

Required Skills & Knowledge	reading and interpretation of floor plans to determine the location of the electrical/ communication/audio accessories and appliances, Australian standard symbols used on floor plans to show the location of the accessories and appliances as detailed in an electrical schedule, **T2 Electrical drawings encompassing:** types of electrical drawings: block, circuit, wiring and ladder diagrams purpose and application of block, circuit, wiring diagrams and ladder diagrams, Australian standard symbols used to represent components on electrical diagrams, conventions used in and the features of circuit diagrams, converting a circuit diagram to a wiring diagram, identification of cable type, origin and route from a cable schedule, developing a cable schedule for a given installation, **T3 Circuit diagrams encompassing:** purpose of circuit diagrams in the electro-technology industry, conventions used in and the features of circuit diagrams, sketching basic circuit diagrams, common symbols used in circuit diagram (Australian Drawing Standard AS/NZS 1102), developing switching charts to identify the terminals of various types of switches, connecting equipment using circuit diagrams, **T4 Wiring diagrams encompassing:** purpose of wiring diagrams in the electro-technology industry, conventions used in and the features of wiring diagrams, sketching basic wiring diagrams, common symbols used in wiring diagram (Australian Drawing Standard AS/NZS 1102), connecting equipment using wiring diagrams, **T5 Building construction drawings and diagrams encompassing:** building types: timber frame, brick veneer, double brick and metal frame, identification of different types of: footings, floors, external walls, roofs, interior walls, typical cable routes through buildings, structures and premises, sequence of each constructional stage for brick, brick veneer and timber cottages, identification of the stages at which the electrical/communications - first and second fixing occurs in the constructional sequence, areas of cooperation between electrical/communications and other building trades, **Introduction to regulations, compliance standards and codes** Evidence shall show an understanding of regulations, compliance standards and codes that apply to electrical work to an extent indicated by the following aspects: **T1 Regulation for undertaking electrical work encompassing:** scope of work covered by licensing in the electro-technology industry (Electrical licensing), legislative requirements for ensuring electrical or electronic equipment is safe i.e. compliance requirements of electrical installations, **T2 Standards philosophy and format encompassing:** performance verses prescriptive requirements, purpose of technical standards and their development, role of standards Australia/New Zealand, International Organisation for Standardisation (ISO) and the International Electro-technical Commission (IEC),

	• how standards are used in compulsory and accreditation compliance schemes, • arrangement and use of technical standards in relation to electrical and electronic work, • how to read and apply a standard, • Standards and codes that apply to all types of electrical installations • Standards include Standards mandated under regulation (e.g. Wiring Rules) or by an authority, deemed-to-comply standard and local service requirements (e.g. Service rules), • Codes include those applicable to electrical safe working practices and some aspects of the Building Code of Australia, **T3 Purpose, format and content of typical job specifications encompassing:** NATSPEC specification system - provide the most common templates on which job specification are written. **Critical Aspect of evidence** Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE'. Evidence shall also comprise: • A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: ▪ Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement ▪ Apply sustainable energy principles and practices as specified in the performance criteria and range statement ▪ Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. ▪ Demonstrate an appropriate level of skills enabling employment ▪ Conduct work observing the relevant Anti-Discrimination legislation, regulations, polices and workplace procedures. • Demonstrated consistent performance across a representative range of contexts from the prescribed items below: ▪ Use drawings, diagrams, schedules, standards, codes and specifications as described in 8) Range and including: a. Identifying drawings, diagrams, schedules and manuals relevant to the work to be undertaken. b. Interpreting drawings, diagrams, schedules and manuals correctly. c. Using correct conventions in freehand drawings. d. Giving correct information in freehand drawings. e. Obtaining compliance Standards and Codes applicable to particular disciplines f. Reviewing and understanding the format of compliance Standards and Codes that apply to particular disciplines g. Reviewing the format and content of typical job specifications. h. Dealing with unplanned events
Assessment criteria	Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's: 1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an 2. ***Understanding of the required skills and knowledge*** *(**KS01-ED150A**)*, by meeting the requirements in the Learning Specification/s.

Assessment methods & schedule

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: A Practical Test. Students will be given a test to be completed a drawing in class to locate electrical equipment using information from architectural drawings.

Event 2: A Practical Test. Students will be given a test to be completed a drawing in class to interpret and produce electrical drawings, connect circuits and predict operation.

Event 3: A Practical Test. Students will be given a test to be completed a drawing in class to interpret and produce circuit diagrams, connect circuits and predict operation.

Event 4: A Practical Test. Students will be given a test to be completed a drawing in class to interpret and produce wiring diagrams, connect circuits and predict operation.

Event 5: A Practical Test. Students will be given a test to be completed a drawing in class to identify cable routes in various buildings. Appropriately sequence electrical work.

Event 6: A Practical Test. Students will be given a test to be completed a drawing in class to identify and comply with regulatory requirements relevant to electrical work.

Event 7: A Practical Test. Students will be given a test to be completed a drawing in class to detail requirements for electrical work obtained from job specifications.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Drawing Task				Satisfactory/Not yet satisfactory
2	Drawing Task				Satisfactory/Not yet satisfactory
3	Drawing Task				Satisfactory/Not yet satisfactory
4	Drawing Task				Satisfactory/Not yet satisfactory
5	Drawing Task				Satisfactory/Not yet satisfactory
6	Drawing Task				Satisfactory/Not yet satisfactory
7	Drawing Task				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed.

A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual: **Principal Reference** The following reference book is one of the main references *Microsoft Visio 2013 Step by Step* Author: Scott A. Helmers Publisher: Microsoft Pres US (2013) ISBN: 978-0-73-566946-8 Dawey No.: **Other References** *Electrical Engineering Drawing* Author: Dr S K Bhattacharya Publisher: New Age International 5th Edition (2007) ISBN: 8-1224-0855-9 Dawey No.: **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • 0.5mm lead pencil, • Pkg of 12 lead refills 0.5mm HB hardness (e.g. Pentel Hi-Polymer leads) • 4 Colour pens (black, blue, red, green) • Left side wire-bound grid notebook • 30 cm metal ruler, • Full circle protractor, • Erasing rubber or mini erasers for lead pencil • Casio Fx-100 scientific calculator • USB memory stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate

	the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provides learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECD0025_Lay wiring_cabling and terminate accessories for extra-low v		
Application	This unit covers the laying of wiring/cabling, connection of accessories and continuity and insulation resistance testing of circuits intended to operate at extra-low voltage. Typically this includes circuits and accessories for ELV powered devices, security, controls, integrated systems, audio/video systems. It encompasses the principles of single source, single load power circuits, control circuits and communications circuits, safe working practices and following work processes that satisfy electrical principles for safety and functionality. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEENEEE101A/ UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE102A UEECD0019 Fabricate, dismantle, assemble of utilities industry components UEENEEE105A UEECD0020 Fix and secure electrotechnology equipment UEENEEE107A UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications		
Licensing,	The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships. 1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, and power operated tools, vehicles, road signage and traffic control, lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Extra low voltage wiring** Evidence shall show an understanding of extra low voltage wiring cable protection and support method and accessories to an extent indicated by the following aspects: T1 Cable protection and support method and accessories encompassing: Requirements to protect and support cables adequately - protection against mechanical damage, protection from adverse temperatures and corrosion and protection from magnetic field that may affect the performance of the cable. Cable support and protection devices, accessories and typical applications - metallic and non-metallic conduits, duct and trunking, cable ladder and tray, cable clips and ties and related accessories.		

Required Knowledge & Skills	Installation techniques - cable installation equipment and cable drawing and hauling techniques T2 Types of cables used in the electrotechnology industry and their application encompassing: Structural components of cables and their purpose - conductors and conductor material; insulation; sheathings and servings. Application of various cables types Cable variates - single cables, flexible cables, flexible cords, shielded cables, armoured cables, ribbon cables, other similar and like cables Typical characteristics and use of power circuit cables and control circuit cables T3 Installing cables in buildings, structures and premises encompassing: Building construction method and construction sequence. Typical cable routes through buildings, structures and premises. Building codes affecting the installation of cables in buildings, structures and premises - limitation on penetration structural elements and maintenance of fire protection interiority Cable segregation requirements T4 Basic cable and conductor terminations encompassing: Insulation removal and replacement Conductor handling and cable terminations encompassing: General aspects and soldering involving pins on electronic components and stranded conductors carrying current up to 25 amperes. Application of connecting devices for conductors and terminals Continuity through connections and insulation resistance testing Stress release on cables/conductors. T5 Technical standards, regulations and codes related to extra-low voltage work encompassing: Limitation imposed by regulations How to read and apply a standard Aspects of technical Standards that apply to extra-low voltage work T6 Environmental and heritage regulation effecting electrotechnology work encompassing: Purpose of environmental and heritage regulation Typical issues affecting electrotechnology services and systems Meeting requirements •
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement • Apply sustainable energy principles and practices as specified in the performance criteria and range statement • Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. • Demonstrate an appropriate level of skills enabling employment • Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures. • Demonstrated consistent performance across a representative range of contexts from the prescribed items below: • Applying OHS practices in the workplace as described in 8) and including:

a. Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.
b. Understanding and following risk control safe work methods.
c. Applying work procedures and instructions as they apply to risk control measures.
d. Dealing with accidents and emergencies within the scope of responsibility.
e. Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

Electrical Trade Practice (Latest Edition)
Australian Electrical Wiring (Latest Edition)

	IQY TECHICAL COLLEGE Module Resources Electrical Wiring (Latest Version) AS3000 Wiring Rule (Latest Edition) *AS3008 Cable Selection Rule (Latest Edition)* *Electrical Workshop Practice (Latest Edition)* You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request. Your Head Teacher will address the appeal in accordance with Assessment Guidelines for IQY TECHICAL COLLEGE.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. IQY TECHICAL COLLEGE provides learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".

Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty	C.E.T.	**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering - Electrical		
Unit of Competency Number and Name	UEECD0036- Providing engineering solutions for problems in complex multiple path circuits.		
Application	This unit covers determining correct operation of complex multiple path circuits and providing engineering solutions as they apply to various branches of electrotechnology work functions. It encompasses working safely, problem solving procedures, including using electrical measuring devices, applying appropriate circuit theorems and providing solutions derived from measurements and calculations and justification for such solutions. Note: This unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training.		
Prerequisites	**Essential Competencies**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEECD0039 Provide solutions to basic engineering computational problems **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	The skills and knowledge described in this unit require a license to practice in the workplace where plant and equipment operate at voltage above 50 V a.c. or 120 V d.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below:		

Required Knowledge & Skills

Evidence shall show that knowledge has been acquired of safe working practices and provide engineering solutions for solving problems in complex multiple path circuits. All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

Circuit analysis

Evidence shall show an understanding of circuit analysis to an extent indicated by the following aspects:

T1 Voltage/Current Sources and Kirchhoff's Law for d.c. Linear Circuits encompassing:

calculating the effect of the internal resistance on terminal voltage and current delivered for practical voltage sources and current sources
calculating current and voltage in any d.c. network of up to two loops and three sources.
Kirchhoff's Law using a circuit simulation program.
function and operation of an electronics circuit simulation program.
using electronics circuit simulation program.

T2 Superposition Principles for d.c. Linear Circuits encompassing:

d.c. networks (two loops, three sources)
using simulation programs
calculating current and voltage in any d.c. network of up to two loops and three sources.
Superposition theorem using a circuit simulation program.

T3 Mesh and Nodal Analysis for d.c. Linear Circuits encompassing:

writing mesh equations for d.c. networks containing up to three loops.
writing Nodal equations for d.c. networks containing up to three nodes.
using mesh analysis to find currents in d.c. networks of up to two loops.
using nodal analysis to find node voltage and branch currents in d.c. networks of up to two nodes
using a circuit simulation program to confirm the results of Mesh analysis or Nodal analysis of d.c. networks.

T4 Thévenin's principles for d.c. Linear Circuits encompassing:

calculating the effect of the internal resistance on terminal voltage and current delivered for practical voltage sources and current sources.
calculating the Thévenin equivalent voltage and resistance for d.c. networks and determining the load current, voltage and power.
converting the Thévenin equivalent circuit to a Norton equivalent circuit and vice versa.
verifying the equivalence of Thévenin equivalent circuits by measurement.

T5 Norton's principles for d.c. linear circuits encompassing:

calculating the effect of the internal resistance on terminal voltage and current delivered for practical voltage sources and current sources.
calculating the Norton equivalent current and resistance for d.c. networks and determining the load current, voltage and power.
converting the Thévenin equivalent circuit to a Norton equivalent circuit and vice versa.
verifying the equivalence of Norton equivalent circuits by measurement.

T6 Phasors encompassing:

time domain and frequency domain
frequency, angular frequency and units of measurement

defining rms and convert between time domain and rms phasor values for a sine wave.
converting between angular frequency and frequency.
using a calculator to convert between polar and rectangular forms of phasor.
representing a.c. voltages on a phasor diagram.

T7 Complex Impedance encompassing:

defining impedance, resistance and reactance.
defining admittance, conductance and susceptance.
converting between conductance to resistance.
converting between susceptance and reactance.
converting between impedance and admittance.
sketching impedance and admittance diagrams.
calculating two-component series equivalent circuits and two-component parallel equivalent circuits and convert between these forms.

T8 Series and parallel a.c. linear circuits encompassing:

Kirchhoff's Laws
series equivalent impedance
parallel equivalent impedance
voltage divider and current divider rules
calculating and measuring voltage and currents in a series a.c .circuit and draw the phasor diagram.
calculating and measuring currents in a parallel a.c. circuit and draw the phasor diagram.
calculating and measuring voltage and currents in a series/parallel a.c. circuit and draw the phasor diagram.

T9 Superposition principles and Kirchoff's Laws applied to a.c. linear circuits encompassing:

- calculating current and voltage in any a.c. network of up to two loops and two sources.
- using circuit simulation programs to demonstrate the superposition theorem.
- function and operation of an electronics circuit simulation program.
- entering given circuit specifications into an electronic circuit program.
- setting the circuit simulation program operation parameters including input and output values, ranges and graduation.
- producing hardcopies of the circuit and analyse results.

T10 Mesh and Nodal analysis for a.c. linear circuits encompassing:

- Mesh analysis
- Node voltages and nodal analysis
- matrix representation
- method of determinants
- writing mesh equations for a.c. networks containing up to three loops.
- writing nodal equations for a.c. networks containing up to three nodes.
- using mesh analysis to find currents in a.c. networks of up to two loops.
- using nodal analysis to find node voltage and branch currents in a.c. networks of up to two nodes.
- using a circuit simulation program to confirm the results of mesh analysis or nodal analysis of a.c. networks.

T11 Thévenin and Norton theorems applied to a.c. linear circuits encompassing:

calculating the effect of the internal resistance on terminal voltage and current delivered for practical voltage sources and current sources.

	calculating the Thévenin equivalent voltage and impedance for a.c. networks and determining the load current, voltage and power. calculating the Norton equivalent current and impedance for a.c. networks and determining the load current, voltage and power. converting the Thévenin equivalent circuit to a Norton equivalent circuit and vice versa. verifying the equivalence of Thévenin and Norton equivalent circuits by measurement. T12 Star-delta conversions encompassing: Star connections Star-delta transformation formula equations selection of appropriate conversion calculating the delta connected equivalent of a star connected balanced a.c. or d.c. load and vice versa. converting a complex non-series/parallel network to a series/parallel network by means of star-delta or delta-star conversions. verifying star-delta and delta-star network conversions by measurements. T13 Complex a.c. power and maximum power transfer theorem encompassing: true power, reactive power and apparent power maximum power transfer calculating real, reactive and apparent power for series/parallel a.c. circuits and state the appropriate units of measurement. calculating the power factor of a.c. series/parallel circuits. drawing power triangle for a given circuit. calculating the load value which would consume maximum power and calculate this power for d.c. networks. calculating the load value which would consume maximum power in an a.c. network when the load is a pure resistance and calculate the power. calculating the load value which would consume maximum power in an a.c. network when the load is an impedance of variable resistance and reactance and calculate the power. verifying load selection by measurement. T14 Transients encompassing: transients in R-C and R-L circuits growth and decay calculating voltage and currents in R-C series circuits using exponential equations. calculating voltage and currents in R-L series circuits using exponential equations
Assessment criteria	You will be assessed against the following criteria to establish your competence in the unit: **Event 1 (Theory test 1)** You will be assessed based on the theory test which mainly consist of problem solving however there may be some multiple choice questions. Theory test will cover solving DC circuits (T1 to T5) using all the circuit analysis techniques and network theorems. It will also contain test of mathematical ability required. Test will be of 50% marks. **Event 2 (Theory test 2)** You will be assessed based on the theory test 2 which mainly consist of problem solving and covers all the methods of analysis, network theorems studied under DC circuits but in this the circuits will be AC (T6 to T14).

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Test 1				Satisfactory/Not yet satisfactory
2	Theory Exam 2				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

1) Handouts given by the teacher
2) Class notes
3) Fundamentals of Electrical circuits by D A Bell (In library)

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

You will have three weeks from the date you receive your results in which to make an appeal and request a review.

You will receive a response within **ten working days** after receipt of the request.

Assessment guidelines

You must submit assessment work and attended scheduled assessments on the required dates.

- **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.
- **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit.
- **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information.

	If you engage in cheating such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEECD0016 D Document and apply measures to control OHS risks associated with electrotechnology work		
Application	This unit covers identifying occupational health and safety hazard and risks and documenting control measures. It encompasses identifying workplace hazards, assigning levels of risk, developing control measures to eliminate and/or mitigate risks, reviewing risk control measures and maintaining documentation of hazards, risk control measures and their application in accordance with compliance procedures. .		
Prerequisites	UEENEEE101A /UEECD0007Apply Occupational Health and Safety regulations, codes and practices in the workplace		
Licensing,	**During Training**: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships. **In the workplace**: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c. Other conditions may apply under State and Territory legislative and regulatory requirements.		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Risks and control measures for dealing with workplace hazards** Evidence shall show an understanding of risks and control measures for dealing with workplace hazards to an extent indicated by the following aspects: T1 Risk management and assessment of risk encompassing: Principle and purpose of risk management, and Processes for conducting a risk assessment Hazard identification by job analysis and work-site inspections Recording hazards and assessing the risk. T2 Hazards and risks and control measures in working on construction sites encompassing: Hazards include manual and mechanical handling; working at heights; working in confined spaces; noise; dusts, gases, chemicals. T3 Hazards associated with extra-low voltage, low-voltage and high-currents encompassing: Arrangement of power distribution and circuits in electrical installations Parts of an electrical system and equipment that operate at low-voltage and extra-low voltage, Parts of an electrical system and equipment where high-currents are likely. T4 Hazards and risks and control measures associated with high-voltage encompassing: Parts of an electrical system and equipment that operate at high-voltage,		

Required Knowledge & Skills	The terms ‘touch voltage’, ‘step voltage’, ‘induced voltage’ and ‘creepage’ as they relate to the hazards of high-voltage Control measures used for dealing with the hazards of high-voltage. T5 Hazards and risks and control measures in working with low voltage equipment encompassing: Risks in modifying electrical installations, fault finding, maintenance and repair. Control measures before, while and after working on electrical installations, circuits or equipment. Isolation and tagging-off procedures. Risks and restrictions in working live. Control measures for working live. T6 Hazards and risks and control measures associated with harmful, devices, materials, gases, dusts and airborne contaminant encompassing: Harmful devices: gas touches, welding equipment, laser equipped devises and the like. Harmful materials: gases (refrigerants) and some industrial cleaning agents, fibres of optical cable, thermal insulation Harmful airborne contaminants: fibres of thermal insulation, fibres of optical cable, fibrous cement materials, asbestos and other fibres in insulation materials. T7 Determine the degree of the risk encompassing: The three recognised levels of risk are: High (potential to kill or permanent disability); Medium (potential to cause an injury or illness of a permanent nature); Low (potential to cause a cause minor injury requiring first aid but no permanent disability) T8 Use control measures to eliminate or control the risk encompassing: Hierarchy of control measures are: eliminate the risk by discontinuing the activity. control the risk by redesigning the equipment adopt administrative procedures use of personal protective equipment. Control measures are formally documented in Job Safety Analysis (JSAs) or Safe Work Methods (SWMs). • T9 Engaging in monitoring and reviewing processes to ensure control measures remain valid.

Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met.
	
	Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:
	
	• A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
	  • Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
	  • Apply sustainable energy principles and practices as specified in the performance criteria and range statement
	  • Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
	  • Demonstrate an appropriate level of skills enabling employment
	  • Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Applying OHS practices in the workplace as described in 8) and including:
  a. Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.
  b. Understanding and following risk control safe work methods.
  c. Applying work procedures and instructions as they apply to risk control measures.
  d. Dealing with accidents and emergencies within the scope of responsibility.
  e. Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

	It is advised that students have access to the following reference books as the main references: *Electrical Trade Practice (Latest Edition)* *Australian Electrical Wiring (Latest Edition) IQY* *TECHICAL COLLEGE Module Resources* *Electrical Wiring AS3000 Wiring Rule (Latest Edition)* *Electrical Workshop Practice (Latest Edition)* You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent"

	• for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". You can view information related to assessment in *Every Student's Guide to*
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEL0024 Test and connect alternating current (a.c.) rotating machines UEEEL0025 Test and connect transformers		
Application	This unit covers ascertaining correct operation of single and three phase machines and solving machine problems as they apply to servicing, fault finding, installation and compliance work functions. It encompasses safe working practices, machine connections circuit arrangements, issues related to machine operation, characteristics and protection and solutions to machine problems derived from calculated and measured parameters. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. OR Their superseded units in UEE20 Training Package As per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of electrotechnology components UEECD0044+0046 Solve problems in d.c circuits UEECD0020 Fix and secure electrotechnology component UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications UEEEL0021 Solve problems in electromagnetic devices and related circuits UEEEL0019 Solve problems in AC Circuits UEEEL0020 UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0020 Fabricate, dismantle, assemble of electrotechnology components UEECD0044+46 Solve problems in d.c circuits UEECD0020 Fix and secure electrotechnology component UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications UEEEL0021+19 Solve problems in electromagnetic devices and related circuits UEEEL0020 Solve problems in A.c circuits UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of electrotechnology components UEECD0044+46 Solve problems in d.c circuits		
	The skills and knowledge described in this unit require a license to practice in the workplace		

Licensing,	for work involving direct access to plant and equipment connected to installation wiring at voltage above 50 V a.c. or 120 V d.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to

	regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships. Note: Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Single and three-phase transformers** Evidence shall show an understanding of single and three phase transformers to an extent indicated by the following aspects: T1 Transformer construction encompassing: types of lamination style and core construction used in single-phase, three phase, double wound, auto transformers and instrument transformers. identification of different winding styles/types used in transformers. methods used to insulate low and high voltage transformers. construction of transformer tanks for distribution transformers. transformer auxiliary equipment. (Bushings, surge-diverters, tap-changers, hot oil & winding indicators, breather, Buchholz relay and conservator). function of transformer auxiliary equipment. types of information stated on transformer nameplates. application of transformers. performing basic insulation resistance, continuity and winding identification tests. T2 Transformer operation encompassing: principles of mutual induction of a transformer. factors that determine the induced voltage in a transformer winding. determining the value of a transformers secondary voltage and current given one winding's electrical details and turns ratio. identification of voltage and current components of a phasor diagram for a transformer on no-load. principles of power transferred from the primary to secondary when a load is connected using a phasor diagram neglecting impedance drops. selecting transformers for specific application/s. safety features specified in AS/NZS3000 with respect to transformers and isolating transformers. T3 Transformer losses, efficiency and cooling encompassing: power losses which occur in a transformer. tests which allow the power losses of a transformer to be determine. determination of transformer losses and efficiency using test results. relationship between transformer cooling and rating. methods used for natural and forced cooling of transformers. properties of transformer oil. tests conducted on transformer oil.
Required Knowledge & Skills	T4 Transformer voltage regulation and percent impedance encompassing: voltage regulation as applicable to a transformer. reasons for voltage variation in the output of a transformer. determine the voltage regulation of a transformer from voltage and percentage impedance values. percentage impedance as applied to transformers. determine the percent impedance by using test results. determine percent impedance of a transformer by calculation. T5 Parallel operation of transformers and transformer auxiliary equipment encompassing: determine polarity markings for an unidentified single phase double wound transformer. need for parallel operation of transformers. conditions/restrictions required before two transformers can be connected in parallel.

connecting transformers in parallel to supply a single load (loading on transformers operating in parallel).
the consequences/effect of an incorrect connection.

T6 Auto-transformers and instrument transformers encompassing:

identification of auto-transformers, voltage transformers and current transformers from their winding diagrams.
determining voltage and current in the windings of an auto-transformer by calculation.
advantages and disadvantages of an auto-transformer.
AS/NZS3000 requirements with respect to transformers.
construction of voltage transformers.
ratings of voltage transformers.
construction of current transformers.
ratings of current transformers.
precautionary measures taken to connect and disconnect instrument transformers.
connection diagrams for instrument transformers.
applications for auto-transformers and instrument transformers.

K Alternating current rotating machines

Evidence shall show an understanding of alternating current rotating machines to an extent indicated by the following aspects:

T1 Operating Principles of three phase induction motors encompassing:

determining circuit operating characteristics by using the right hand (grip) rule for conductors and solenoids and Fleming's left and right hand rules.
characteristics of the magnetic field produced by a single, two and three-phase windings.
speed of rotation of a rotating magnetic field.
relationship between the rotor speed, slip and rotor frequency.
basic principle of operation of an induction motor.
reversing the direction of rotation of a three phase induction motor

T2 Three phase induction motor construction encompassing:

basic component parts of a three-phase induction motor.
types of rotors used in three-phase induction motors.
connecting three-phase induction motor in both star and
delta. dismantling three-phase induction motors.
testing insulation resistance of a three-phase induction motor prior to connection to the supply.
testing winding resistance (ohmic value and continuity) of a three-phase induction motor prior to connection to the supply

T3 Three phase induction motor characteristics encompassing:

relationship between torque, speed, and power and interpretation of speed/torque curves of induction motors.
squirrel cage motors operating characteristics conditions necessary for an induction motor to produce maximum torque.
operating characteristics of an induction motor from name plate information and by measurement.
induction motors efficiency and minimum energy performance standards (MEPS).
full load efficiency and power factor of induction motors.

T4 Single phase motors – split phase encompassing:

common types of single phase motor.
principles of operation of a split phase induction motor.
construction and basic characteristics of a split phase induction motor.
applications of split phase induction motors.
connecting, running and reversing a split phase induction motor.

T5 Single phase motors – capacitor and shaded pole types encompassing:

identification of single phase induction motors including capacitor start, capacitor

start/capacitor run, permanent split capacitor (PSC) and shaded pole
principles of operation of each motor type listed above.
operating characteristics and typical applications of each motor type listed above.
connection and running each type of motor listed.
reversing the direction of rotation of each of the capacitor type motors.

T6 Single phase motors – universal encompassing:

principles of operation of a series universal motor.
identification and functions of each of the basic parts of a series universal motor.

- operating characteristics and typical uses for a series universal motor.
- connecting, running and reversing a series universal motor.

T7 Motor protection encompassing:

- reasons why motor protection is required.
- requirements of the AS/NZS3000 Wiring rules with regards to motor protection.
- types of motor overload protection.
- operating principles of microtherm devices, thermal and magnetic motor protection devices.
- electrical features of motor protection HRC fuses.
- effects of under voltage and over voltage on motors and motor circuits.
- effects of repetitive starting and/or reversing on motors.
- special requirements for motor protection, in high humidity or moist environments, high temperature areas and corrosive atmospheres.
- operating principles of phase failure protection.
- selecting suitable protective devices for a given motor and starter combination.

T8 Three phase synchronous machines- operation principles and construction encompassing:

- power transfer diagram of an a.c. synchronous machine.
- need for the generation of a sinusoidal waveform.
- principles of operation of a synchronous alternator.
- principles of operation of a synchronous motor.
- principles of operation of an asynchronous generator (induction generator).
- identification of main parts of a synchronous alternator/motor.
- methods used to provide the excitation of a synchronous alternator/motor.
- block diagram of an alternator voltage regulator.
- advantages gained by the parallel operation of alternators.
- starting methods of synchronous motors.

T9 Alternators and generators encompassing:

- effects on the generated voltage of variations in excitation.
- effects on generated voltage of variations in load.
- identification of characteristic curves of an alternator.

types of prime movers used with single and three phase portable/standby alternators.

- manual operation of single and three phase portable/standby alternators.
- ratings of single and three phase portable/standby alternators.
- applications of single and three phase portable/standby alternators.
- construction details of single and three phase portable/standby alternators.
- common faults found in portable/standby alternators.

Assessment criteria

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement

- Apply sustainable energy principles and practices as specified in the performance criteria and range statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

Demonstrate an appropriate level of skills enabling employment

Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

c. Applying work procedures and instructions as they apply to risk control measures.
d. Dealing with accidents and emergencies within the scope of responsibility.
e. Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual
Students don't need to purchase any Learner Resource Manual :

Principal References
It is advised that students have access to the following reference books as the main references:

Electrical Trade Practice (Latest Edition)

	IQY TECHICAL COLLEGE Module Resources Electrical Machines (Latest Version) Electrical Machines, Drives & Power Systems, Synchronous Machines & Drives by AUSTIN HUGHES AND BILL DRURY You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • . • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".

Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEL0008 Evaluate and modify low voltage heating equipment and controls UEEEL0009 Evaluate and modify low voltage lighting circuits, equipment and controls EEEL0010 Evaluate and modify low voltage socket outlets circuits		
Application	This unit covers ascertaining correct operation of single and three phase low voltage electrical apparatus and circuits and solving circuit problems as they apply to servicing, fault finding, installation and compliance work functions. It encompasses safe working practices, apparatus circuit arrangements, issues related to operation, characteristics and protection and solutions to apparatus/circuit problems derived from calculated and measured parameters. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of electrotechnology components UEECD0044+46A Solve problems in d.c circuits UEECD0020 Fix and secure electrotechnology equipment UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications UUEEEL0021A Solve problems in electromagnetic devices and related circuits UEEEL0020 Solve problems in low voltage a.c. circuit UEEEL0023 Terminate cables, cords and accessories for low voltage circuits Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of utilities industry components UEECD0020 Fix and secure electrotechnology equipment UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications		
Licensing,	**During Training**: Competency development activities are subject to regulations directly related to licencing, occupational health and safety and where applicable contracts of training such as apprenticeships. **In the workplace**: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c. Other conditions may apply under State and Territory legislative and regulatory requirements.		
	You will be assessed to prove your competence in the required skills and knowledge below:		

Required Knowledge & Skills	**Electrical apparatus and circuits** Evidence shall show an understanding of electrical apparatus and circuits to an extent indicated by the following aspects: T1 Lighting circuits – looping at the light/switch encompassing: the "loop at the light" method of wiring lighting circuits. the "loop at the switch" method of wiring lighting circuits wiring diagrams for the lighting circuit of an installation that incorporates one-way, two-way and two-way and intermediate switching of light points using the loop at the light/switch methods of TPS wiring. TPS cabling requirement for the loop at the light/switch circuit. installation methods of accessories and wiring for a lighting circuit incorporating one-way, two-way and two-way and intermediate switching of lighting points using the loop at the light/switch method of TPS wiring. correct operation of the install circuits including testing for correct compliance with Australian Standards. T2 Circuits for socket outlets encompassing: the purpose of socket outlets. requirements concerning the polarity of switched socket outlets. correct cable size to supply 10 A, 15 A and 20 A socket outlets (single and three phase), for given installation conditions. number of socket outlets connected to a 16 A and 20 A circuit breaker. installation methods of a single phase socket outlet circuits. correct operation of the installed circuits including testing (dead testing only) for correct compliance with Australian Standards.
Required Knowledge & Skills	T3 Final sub-circuits and segregation encompassing: purpose of mixed circuits. circuit loading for a mixed circuit. purpose of segregation of circuits and the AS/NZS3000 requirements. Installation methods a single phase mixed circuits. correct operation of the installed circuits including testing for correct compliance with Australian Standards. T4 Electrical heating control devices encompassing: methods of manual heat control. methods of automatic heat control. types and application for common thermostats. operation of common thermostats. sensitivity and differential of thermostats. testing of a thermostat (including differential and correct operation) applications of simmerstats (infinite controls). operation of a simmerstat. electronic heat control (phase control and zero voltage switching). T5 Fixed electrical heating appliances encompassing: Terms: heat energy, temperature, specific heat capacity, thermal conductivity and thermal stability. determining the heat energy in joules and kWh in a simple heating process. methods of heat transfer. Determining the heat energy input and output of a heating process. connections to a two phase stove. operation of reverse cycle air conditioning. T6 Electrical water heater operation encompassing: types of water heaters (instantaneous and storage) and their methods of control. intrinsic safety (pressure relief and thermal cut-out). testing of over temperature cut-out point of a thermostat. switchboard requirements to supply a controlled load water heater. internal circuit of a twin element water heater, and supply connections. tariffs employed by local supply authorities. solar heating system and its integration into an installation. T7 Alternative supplies encompassing: reasons for the installation of alternative supplies. types of alternative supply systems. characteristics and operation of UPSs. Australian Standards and local requirements for safety services supply systems.

	T8 Installation of batteries encompassing: common types of primary cells and secondary batteries and typical applications. terminal voltage of common primary cells and secondary cells. correct storage, handling and disposal techniques for cells and batteries. charge/discharge cycle for a secondary cell. effect of internal resistance on a secondary cell. state of charge of a secondary cell. installation of batteries as per AS/NZS3011 commissioning procedures for various secondary batteries. safe working procedures when working with secondary cells and batteries. T9 Fire protection – residential fire and smoke alarms encompassing: types of fire and smoke alarms. regulations and standards requirements regarding residential fire and smoke alarms. locations for residential fire and smoke alarms. wiring methods for residential fire and smoke alarms. operation of typical residential fire and smoke alarms T10 Emergency and evacuation lighting and lighting control encompassing: factors and requirements of emergency and evacuation lighting concerning illumination levels, luminaire positioning and operating period. characteristics of maintained, non maintained and sustained emergency lighting systems. arrangement of batteries in point and central bank emergency lighting supply systems. lighting control methods T11 Lighting concepts and incandescent lighting encompassing: basic concepts of lighting. terminology, principles and standards relevant to lighting (energy efficiency as per BCA new lamp types and permitted replacements and their efficacy).. basic types of luminaries. operation of an incandescent lamp. types of incandescent lamps. expected lamp life, colour rendering and efficacy for typical incandescent lamps. lighting layout in terms of visual comfort and relevant Australian standards T12 Fluorescent low intensity discharge lighting encompassing: types of low intensity discharge lamps. expected lamp life, colour rendering and efficacy for typical types of low intensity discharge lamps. operation of low intensity discharge luminaires including their control equipment. Australian Standard and local requirements for low intensity discharge lighting. methods for satisfying Australian Standards and local supply authority requirements regarding low intensity discharge lighting. T13 High intensity discharge lighting encompassing: types of high intensity discharge lamps. expected lamp life, colour rendering and efficacy for typical types of high intensity discharge lamps. operation of high intensity discharge luminaires including their control equipment. Australian Standard and local requirements for high intensity discharge lighting. methods for satisfying Australian Standards and local supply authority requirements regarding high intensity discharge lighting. LED lighting and its applications. Neon, Argon and Xenon lighting and their applications. comparison of incandescent, low intensity discharge, high intensity discharge, LED and other types of lighting .
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

0 Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement

1 Apply sustainable energy principles and practices as specified in the performance criteria and range statement

2 Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

3 Demonstrate an appropriate level of skills enabling employment

4 Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

0 Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

Observation of skills in practical exercises and

Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A

	Statement of Attainment for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience - for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: *Electrical Trade Practice (Latest Edition)* *Australian Electrical Wiring (Latest Edition)* *IQY TECHICAL COLLEGE Module Resources Electrical Wiring (Latest Version) AS3000 Wiring Rule (Latest Edition)* *AS3008 Cable Selection Rule (Latest Edition)* *Electrical Workshop Practice (Latest Edition)* You will also be provided with • Access to a simulated environment containing information similar to that which you may encounter in a workplace. • Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information.

	If you engage in cheating such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - IQY TECHICAL COLLEGE Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	UEE62220 - Advanced Diploma of Electrical Engineering UEE62122 - Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEEEL0003 Arrange circuits, control and protection for general electrical installations		
Application	This unit covers the arrangement and termination of circuits, control and protection devices and systems for electrical installations operating at voltages up to 1,000 V a.c. or 1,500 V d.c. It encompass knowledge and application of schemes for protection of persons and property, correct functioning, ensuring compatibility with the supply, arranging installation into circuits and selecting and arranging switchgear/controlgear and protective devices to meet compliance requirements and documenting arrangement decisions . . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseaded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEECD0007A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of electrotechnology components UEECD0044+46 Solve problems in d.c circuits UEECD0020 Fix and secure electrotechnolgy equipment UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications UEEEL0021 Solve problems in electromagnetic devices and related circuits UEEEL0020 Solve problems in low voltage a.c. circuit UEEEL0023 Terminate cables, cords and accessories for low voltage circuits		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Electrical installations — arrangement, control and protection** Evidence shall show an understanding of circuit arrangements, control and protection of electrical installations that comply with the Wiring Rules and Service Rules to an extent indicated by the following aspects: T1 Safety principles to which electrical systems in building and premises shall comply. Safety principles are given in Part1 (Section 1) of the Wiring Rules AS/NZS 3000 with deemed-to-comply requirements given in Sections 2 to 8. Compliant methods for providing protection - include those for providing protection against direct and indirect contact; thermal effects; unwanted voltages; overcurrent; fault currents; overload; overvoltage; injury from mechanical movement. Requirements for installation design and selection of equipment - includes compliant protection arrangements; correct functioning; compatibility with supply; estimation of maximum demands; voltage drop considerations; arrangement of circuits and the like T2 Circuit and control arrangements encompassing:		

Required Knowledge & Skills	reason for dividing electrical installations into circuits factors that shall be considered in determining the number and type of circuits required for an installation. daily and seasonal demand for lighting power, heating and other loads in a given installation. number and types of circuits required for a particular installation. diagrams/schedules of circuits for given installations. application and arrangements of SELV and PELV circuits application and arrangement of an isolated supply T3 Hazards and risks in an electrical installation encompassing: effects on the human body of various levels of a.c. and d.c. current and duration of current flow for various current paths. risk of ignition of flammable materials due the thermal effects of current or electric arcs in normal service of an electrical installation. risk of injury from mechanical movement of electrically actuated equipment. Protection against direct contact (basic protection) acceptable methods use of extra-low voltage T4 Protection against indirect contact encompassing: indirect contact with live parts of an electrical installation may occur. methods and devices that comply with the Wiring Rules for providing protection against indirect contact. components of the 'automatic disconnection of supply' method of protection against indirect contact. the terms ‘touch voltage’ and ‘touch current’. the current path when a short circuit fault to exposed conductive parts of an appliance occurs. protection against indirect contact is by the use of Class II equipment and by electrical separation. additional protection by use of Residual Current Devices (RCDs) protection against indirect contact by use of extra-low voltage and electrical separation. Protection requirements for damp situations. Earthing encompassing: the terms: earthed, earthed situation, earth electrode, equipotential bonding, multiple earthed neutral (MEN) system, protective earth-neutral (PEN) conductor, main earthing conductor, protective earthing (PE) conductor, functional earthing, MEN link. selection of minimum size-earthing conductor for a range of active conductor sizes and materials. parts of an earthing system and the purpose of each. typical arrangement for a MEN earthing system. arrangements of protective earthing conductors that comply with the Wiring Rules. requirements for equipotential bonding in a range of installation situations. Installation of a MEN earthing system for a single phase installation T6 Protection against overload and short circuit current encompassing: overload current or fault currents in an electrical installation. equivalent circuit of an earth fault-loop level of fault current possible at a given point in an installation from the fault-loop impedance and data from the electricity distributor. methods and devices that comply with the Wiring Rules AS/NZS 3000 for providing protection against the damaging effects of overload and fault current requirements for co-ordination between protective devices and conductors
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

0 Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement

1 Apply sustainable energy principles and practices as specified in the performance criteria and range statement

2 Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

3 Demonstrate an appropriate level of skills enabling employment

4 Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

0 Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

Observation of skills in practical exercises and

Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: *Electrical Trade Practice (Latest Edition)* *Australian Electrical Wiring (Latest Edition)* *IQY TECHICAL COLLEGE Module Resources Electrical Wiring (Latest Version) AS3000 Wiring Rule (Latest Edition)* *AS3008 Cable Selection Rule (Latest Edition)* *Electrical Workshop Practice (Latest Edition)* You will also be provided with • Access to a simulated environment containing information similar to that which you may encounter in a workplace. • Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.

	If you miss an exam, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEL0003 Arrange circuits, control and protection for general electrical installations		
Application	This unit covers the arrangement and termination of circuits, control and protection devices and systems for electrical installations operating at voltages up to 1,000 V a.c. or 1,500 V d.c. It encompass knowledge and application of schemes for protection of persons and property, correct functioning, ensuring compatibility with the supply, arranging installation into circuits and selecting and arranging switchgear/controlgear and protective devices to meet compliance requirements and documenting arrangement decisions . . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseaded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEECD0007A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of electrotechnology components UEECD0044+46 Solve problems in d.c circuits UEECD0020 Fix and secure electrotechnolgy equipment UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications UEEEL0021 Solve problems in electromagnetic devices and related circuits UEEEL0020 Solve problems in low voltage a.c. circuit UEEEL0023 Terminate cables, cords and accessories for low voltage circuits		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Electrical installations — arrangement, control and protection** Evidence shall show an understanding of circuit arrangements, control and protection of electrical installations that comply with the Wiring Rules and Service Rules to an extent indicated by the following aspects: T1 Safety principles to which electrical systems in building and premises shall comply. Safety principles are given in Part1 (Section 1) of the Wiring Rules AS/NZS 3000 with deemed-to-comply requirements given in Sections 2 to 8. Compliant methods for providing protection - include those for providing protection against direct and indirect contact; thermal effects; unwanted voltages; overcurrent; fault currents; overload; overvoltage; injury from mechanical movement. Requirements for installation design and selection of equipment - includes compliant protection arrangements; correct functioning; compatibility with supply; estimation of maximum demands; voltage drop considerations; arrangement of circuits and the like T2 Circuit and control arrangements encompassing:		

Required Knowledge & Skills	reason for dividing electrical installations into circuits factors that shall be considered in determining the number and type of circuits required for an installation. daily and seasonal demand for lighting power, heating and other loads in a given installation. number and types of circuits required for a particular installation. diagrams/schedules of circuits for given installations. application and arrangements of SELV and PELV circuits application and arrangement of an isolated supply T3 Hazards and risks in an electrical installation encompassing: effects on the human body of various levels of a.c. and d.c. current and duration of current flow for various current paths. risk of ignition of flammable materials due the thermal effects of current or electric arcs in normal service of an electrical installation. risk of injury from mechanical movement of electrically actuated equipment. Protection against direct contact (basic protection) acceptable methods use of extra-low voltage T4 Protection against indirect contact encompassing: indirect contact with live parts of an electrical installation may occur. methods and devices that comply with the Wiring Rules for providing protection against indirect contact. components of the 'automatic disconnection of supply' method of protection against indirect contact. the terms ‘touch voltage’ and ‘touch current’. the current path when a short circuit fault to exposed conductive parts of an appliance occurs. protection against indirect contact is by the use of Class II equipment and by electrical separation. additional protection by use of Residual Current Devices (RCDs) protection against indirect contact by use of extra-low voltage and electrical separation. Protection requirements for damp situations. Earthing encompassing: the terms: earthed, earthed situation, earth electrode, equipotential bonding, multiple earthed neutral (MEN) system, protective earth-neutral (PEN) conductor, main earthing conductor, protective earthing (PE) conductor, functional earthing, MEN link. selection of minimum size-earthing conductor for a range of active conductor sizes and materials. parts of an earthing system and the purpose of each. typical arrangement for a MEN earthing system. arrangements of protective earthing conductors that comply with the Wiring Rules. requirements for equipotential bonding in a range of installation situations. Installation of a MEN earthing system for a single phase installation T6 Protection against overload and short circuit current encompassing: overload current or fault currents in an electrical installation. equivalent circuit of an earth fault-loop level of fault current possible at a given point in an installation from the fault-loop impedance and data from the electricity distributor. methods and devices that comply with the Wiring Rules AS/NZS 3000 for providing protection against the damaging effects of overload and fault current requirements for co-ordination between protective devices and conductors
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

0 Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement

1 Apply sustainable energy principles and practices as specified in the performance criteria and range statement

2 Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

3 Demonstrate an appropriate level of skills enabling employment

4 Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

0 Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

Observation of skills in practical exercises and

Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: *Electrical Trade Practice (Latest Edition)* *Australian Electrical Wiring (Latest Edition)* *IQY TECHICAL COLLEGE Module Resources Electrical Wiring (Latest Version) AS3000 Wiring Rule (Latest Edition)* *AS3008 Cable Selection Rule (Latest Edition)* *Electrical Workshop Practice (Latest Edition)* You will also be provided with • Access to a simulated environment containing information similar to that which you may encounter in a workplace. • Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.

	If you miss an exam, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEEEL0019 Solve problems in direct current (d.c.) machines UEEEL0021 Solve problems in magnetic and electromagnetic devices		
Application	Not Applicable		
Prerequisites	**Essential**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD004446 Solve problems in d.c circuits **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **KS01-EG101A** Electromagnetic devices and circuits Evidence shall show an understanding of electromagnetic devices and circuits to an extent indicated by the following aspects: **T1** Magnetism encompassing: Magnetic field pattern of bar and horse-shoe magnets. Magnets attraction and repulsion when brought in contact with each other. Common magnetic and non-magnetic materials and groupings (diamagnetic, paramagnetic and ferromagnetic materials). Principle of magnetic screening (shielding) and its applications. practical applications of magnets Construction, operation and applications of reed switches. **T2** Electromagnetism encompassing: Conventions representing direction of current flow in a conductor. Magnetic field pattern around a single conductor and two adjacent conductors carrying current. Using the "right hand rule" to determine the direction of magnetic field around a current carrying conductor. Direction of force between adjacent current carrying conductors. Effect of current, length and distance apart on the force between conductors (including forces on bus bars during fault conditions). Magnetic field around an electromagnet. Using the "right hand rule" to determine the direction of magnetic field around a current carrying coil. magnetomotive force (m.m.f.) and its relationship to the number of turns in a coil and the current flowing in the coil. Practical applications of electromagnets. **T3** Magnetic circuits encompassing:		

Required Knowledge & Skills	Magnetic characteristic curve for various materials and identify the various regions. Identify the various conditions of a magnetic material from its Hysteresis loop. Factors which determine losses in magnetic material. Methods used to reduce electrical losses in a magnetic circuit. Magnetic flux (definition, unit and symbol). Reluctance as the opposition to the establishment of magnetic flux. Permeability (definition, symbol and unit). Difference for magnetic and non-magnetic materials in regards to reluctance and permeability. Calculation of m.m.f., flux or reluctance given any two values. Flux density (definition, symbol, unit and calculation). Magnetising force (definition, symbol, unit and calculation). Common magnetic circuit types. Effect of an air gap in a magnetic circuit. Terms "magnetic leakage" and "magnetic fringing". **T4** Electromagnetic induction encompassing: Principle of electromagnetic induction (Faraday's law of electromagnetic induction). Applying "Fleming's right hand rule" to a current a carrying conductor under the influence of a magnetic field. Calculation of induced e.m.f. in a conductor given the conductor length, flux density and velocity of the conductor. Calculation of induced e.m.f. in a coil given the number of turns in a coil and the rate of change of flux. Calculation of force on a conductor given the flux density of the magnetic field, length of the conductor and the current being carried by the conductor. Lenz's law applications of electromagnetic induction **T5** Inductance encompassing: Construction of an inductor, including a bifilar winding inductor. Australian Standard circuit diagram symbol for the four types of inductor. Effect of physical parameters on the inductance of an inductor. Common types of inductor cores. Applications of the different types of inductors. Definition of terms self induction, inductance and mutual inductance. Calculation of value of self induced e.m.f. in a coil. Mutual induction occurs between two coils. Graphical relationship between load voltage, current and self induced e.m.f. in a single d.c. circuit having inductance. Practical applications for the effects of self and mutual induction. Undesirable effects of self and mutual induction. Definition of term "time constant" and draw the characteristic curve as applied to a series circuit containing an inductor and a resistor. (LR circuit)Calculation of value of the time constant for an LR circuit given the values of the components. Time constants required for the current in an LR circuit to reach its final value. Determining of instantaneous values of voltage and current in an LR circuit using a universal time constant chart. **T6** Measurement Instruments encompassing: Moving coil, moving iron, dynamometer meter movements and clamp testers. Practical applications for moving coil, moving iron and dynamometer meter movements. Calculation of resistance of shunts and multipliers to extend the range of ammeters and voltmeters. Factors to be considered in selecting meters for a particular application. Safety category of meters and their associated applications. Steps and procedures for the safe use, care and storage of electrical instruments. **T7** Magnetic devices encompassing: Construction, operation and applications of relays. Construction, operation and applications of contactors. Magnetic methods used to extinguish the arc between opening contacts. Construction, operation and applications of Hall Effect devices. Operation and applications of magnetostriction equipment. Construction, operation and application of magnetic sensing devices. **T8** Machine principles encompassing:

	Basic operating principle of a generator. Applying Fleming's right hand rule for generators. Basic operating principle of a motor. Applying Fleming's left hand rule for motors. Calculation of force and torque developed by a motor. **T9** Rotating machine construction, testing and maintenance encompassing: Components of a d.c. machine. Difference between a generator and a motor in terms of energy conversion. Nameplate of a machine. Using electrical equipment to make electrical measurements and comparison of readings with nameplate ratings. Identification of faults in a machine from electrical measurements. care and maintenance processes for rotating machines Safety risks associated with using rotating machinery. **T10** Generators encompassing: Basic operation of a d.c generator. calculation of generated and terminal voltage of a d.c. shunt generator Prime movers, energy sources and energy flow used to generate electricity. Types of d.c. generators and their applications. Methods of excitation used for d.c generators. Equivalent circuit for a d.c. generator. Importance of residual magnetism for a self excited generator. Open circuit characteristics of d.c. generators. Load characteristics of a d.c generator. reversing the polarity of a d.c. generator Connect and test a d.c generator on no-load and load Identify safety risks associated with using generators. **T11** Motors encompassing: Operation of a motor and its energy flow. effect of back e.m.f. in d.c. motors Torque as the product of the force on the conductors and the radius of the armature/rotor. Types of d.c. motors and their applications. Circuit diagrams for the types of d.c. motors. Equivalent circuit for the types of d.c. motors. Calculation of power output of a motor. Characteristics of the different types of d.c. motors. connection and testing a d.c. shunt motor on no-load and load Reversing the direction of rotation of a d.c. motor. Safety risks associated with using motors (include risks of series d.c. motors). **T12** Machine efficiency encompassing: Losses that occur in a d.c machine. Methods used to determine the losses in a d.c. machine. Calculation of losses and efficiency of a d.c machine. Efficiency characteristic of a d.c. machine and the conditions for maximum efficiency. Application of Minimum Energy Performance standards (MEPS). Methods used to maintain high efficiency.
Assessment criteria	You will be assessed against the following criteria to establish your competence in the unit: **Event 1:** Theory Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in Magnetic circuits, concepts, definitions and calculations. **Event 2:** Theory Exam 2, tests the required student's knowledge on DC machines construction, functions and applications, performance curves and calculations. **Event 3:** Practical Test, checks the required skill adequacy of the student to demonstrate his/her competency in measuring different magnetic circuits and/ or testing DC machines You will be required to successfully complete all 3 events to demonstrate your competence in unit G101A.

Assessment schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Exam 1				Satisfactory/Not yet satisfactory
2	Theory Exam 2				Satisfactory/Not yet satisfactory
3	Practical Test				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

1. Fundamentals of Electric Circuits
   Author: David A. Bell
2. Electrical Principles
   Author: Jim Jenneson

You will also be provided with

- Access to a simulated environment containing information similar to that which you may encounter in a workplace.
- Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS
- hooking Wire single core AWG 22 (Hartland Cables P/N HC0069)
- USB memory Stick

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

You will have three weeks from the date you receive your results in which to make an appeal and request a review.

Yu will receive a response within **ten working days** after receipt of the request.

Assessment guidelines

You must submit assessment work and attended scheduled assessments on the required dates.

	If you miss an assessment you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEEEL0020 – Solve problems in low voltage a.c. circuits		
Application	Not Applicable		
Prerequisites	**Essential** Granting competency in this unit shall be made only after competency in the following unit(s) has/ have been confirmed. UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0044+46 Solve problems in d.c. circuits UEEEL0021 Solve problems in electromagnetic devices and related circuits Literary and Numeracy Skills: Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	Alternating current power circuits Evidence shall show an understanding of alternating currents power circuits to an extent indicated by the following aspects: **T1** Alternating Current Quantities encompassing: sine, cosine and tangent ratios of a right angle triangle Pythagoras Theorem to a right angle triangle. use of the CRO to measure d.c. and a.c. voltage levels sinusoidal voltage generated by a single turn coil rotated in a uniform magnetic fields terms 'period', 'maximum value', 'peak-to-peak value', 'instantaneous value', 'average value', 'root-mean-square (r.m.s.) value', in relation to a sinusoidal waveform. Calculation of the instantaneous value of induced voltage of a generated sinusoidal waveform. Measurement of instantaneous, peak, peak-to-peak values and the period of a sinusoidal waveform. Calculation of root-mean-square (r.m.s.) value and frequency of a sinusoidal waveform from values of peak voltage and period. **T2** Phasors Diagrams encompassing: purpose of phasor diagrams 'in-phase', 'out-of-phase', 'phase angle'' lead' and 'lag'. phase angle between two or more alternating quantities from a given sinusoidal waveform diagram. Convention for representing voltage, current and the reference quantity in a phasor diagram.		

Required Knowledge & Skills	Drawing phasor diagrams to show the relationship between two or more a.c. values of voltage and/or current. Determination of phase relationship between two or more sinusoidal waveforms from a given diagram and measurements. **T3** Single Element a.c. circuits encompassing: setting up and connect a single-source resistive a.c. circuit and take voltage and current measurements to determine the resistance Determining the voltage, current resistances from measure of given values of any tow of these qualities. relationship between voltage drops and current in resistive a.c. circuit applications of resistive a.c. circuits Defining 'inductive reactance'. Calculation of inductive reactance for a given inductor and the relationship between inductive reactance and frequency. Applying Ohm's Law to determine voltage, current of inductive reactance in a purely inductive a.c. circuit given any two to these quantities. Applications of inductive a.c circuits. Calculation of capacitive reactance Applying Ohm's Law to determine voltage, current or capacitive reactance in a purely capacitive a.c circuit given any two of the quantities. applications of capacitive a.c circuits **T4** RC and RL Series a.c. circuits encompassing: Impedance and impedance triangle. Determining the impedance, current and voltages for a series RC circuit given the resistance, capacitance and supply voltage. drawing and labelling the impedance triangle for a series RC circuit drawing phasor diagrams for a series RC circuit AS/NZS 3000 requirements for the installation of capacitors. Examples of capacitive components in power circuits and systems and the effect on the phase relationship between voltage and current. Determining the impedance, current and voltages for a series RL circuit given the resistance, inductance and supply voltage. drawing and labelling the impedance triangle for a series RL circuit drawing the equivalent circuit of a practical inductor Draw phasor diagrams for a series RL circuit. examples of inductive components in power circuits and systems and describe their effect on the phase relationship between voltage and current **T5** RLC Series a.c. circuits encompassing: Measuring component voltages in a series RLC circuit and using a phasor diagram to determine the supply voltage and phase angle between circuit voltage and circuit current. Determining the impedance, current and voltages for a series RLC circuit given resistance, inductance, capacitance and supply voltage. Drawing and labelling the impedance triangle for a series RLC circuit. Calculation of total impedance for a series RLC circuit. Calculation of voltage drop for cables using the values for reactance and a.c. resistance from AS/NZS 3008. Comparison of current limiting characteristics of inductors and resistors. practical examples of RLC series circuits **T6** Parallel a.c. Circuits encompassing: Determining the branch currents of a parallel circuit that contain RL, RC or LC in two branches. Using a phasor diagram to determine the total circuit current and phase angle in parallel RL, RC or LC circuits. Determining the total circuit impedance of parallel RL, RC or LC circuits. Measuring the branch currents in a parallel RLC circuit and use a phasor diagram to determine the total current and phase angle between circuit voltage and circuit current. Determining the branch impedances, branch currents and phase angles voltages for a parallel RLC circuit given resistance, inductance, capacitance and supply voltage. Calculation of impedance for a parallel RLC circuit. Practical examples of parallel circuits. **T7** Power in an a.c. circuit encompassing:

Difference between true power, apparent power and reactive power and the units in which these quantities are measured.
drawing the power triangle to show the relationships between true power, apparent power and reactive power
Defining the term "power factor" and phase angle.
Methods used to measure single phase power, energy and demand.
T8 Power Factor Improvement encompassing:
Effects of low power factor.
Requirements for power factor improvement.
Methods used to improve low power factor of an installation.
local supply authority and AS/NZS 3000 wiring rules requirements regarding the power factor of an installation and power factor improvement equipment.
Methods used to measure single phase power factor.
using manufacturers catalogues to select power factor equipment for a particular installation
T9 Harmonics and Resonance Effect in a.c. Systems encompassing:
Term "harmonic" in relation to the sinusoidal waveform of an a.c. power system.
Sources in a.c. systems that produce harmonics.
Problems that may arise in a.c. circuits as a result of harmonics and how these are overcome.
methods and test equipment used to test for harmonics
methods used to reduce harmonics in a.c. power system
Conditions in a series a.c. circuit that produce resonance.
dangers of series resonance circuits
Conditions in a parallel a.c. circuit that produce resonance.
dangers of parallel resonance circuits
AS/NZS3000 and the local supply authority requirements concerning harmonics and resonance effect in a.c. power systems.
T10 Three Phase Systems encompassing:
Features of a multiphase system.
Comparison of voltages generated by single and multiphase alternators.
Reasons for the adoption of three phases for power systems.
How three phases is generated in a single alternator.
Calculation of r.m.s. value of voltage generated in each phase given the maximum value.
Relationship between the phase voltages generated in a three phase alternator and the conventions for identifying each.
Term "phase sequence" (also, referred to as "phase rotation").
determining the phase sequence of a three phase supply
T11 Three phase star-connections encompassing:
Connecting a three phase star-connection load.
Phase relationship between line and phase voltages and line and phase currents of a star-connected system.
Determining the r.m.s. value of line and phase voltage given any one of these quantities.
Determining the r.m.s. value of line and phase current given any one of these quantities.
Terms "balanced load" and "unbalanced load".
Effect of a reversed phase winding of a star connected alternator.
Example of balanced and unbalanced loads in typical power systems.
T12 Three phase four wire systems encompassing:
Purpose of the neutral conductor in a three phase four wire systems.
Determining the effects of an high impedance in the neutral conductor of a three phase four wire system supplying an unbalanced load where MEN earthing is employed.
Determining the value and phase relationship of neutral current in an unbalanced three phase four wire systems given line currents and power factors.
AS/NZS 3000 requirements regarding neutral conductors.
AS/NZS 3008.1.1 method for determining voltage drop in unbalanced three phase circuits
T13 Three phase delta-connections and Interconnected systems encompassing:
Connecting three phase delta loads.

Phase relationship between line and phase voltages and line and phase currents of a delta-connected system.
Determining the r.m.s. value of line and phase voltage given any one of these quantities.
Determining the r.m.s. value of line and phase current given any one of these quantities.
limitations and uses of open delta connections
effect of a reversed phase winding of a delta connected transformer
Example of loads in typical power systems.
Drawing the typical combinations of three phase interconnected systems using star-connections and a delta-connection.
Relationship between line and phase voltages and line and phase currents in the typical interconnected systems using star-connections and delta-connections.
T14 Energy and power requirements of a.c. systems encompassing:
Purposes for measuring power, energy, power factor and maximum demand of a.c. power systems and loads.
Difference between true power, apparent power and reactive power and the units in which these quantities are measured in a three phase system.
Drawing the power triangle to show the relationships between true power, apparent power and reactive power in a three phase system.
Methods used to measure three phase power , energy, power factor and demand.
Determining how the power factor of a three phase installation can be improved.
using manufacturers catalogues to select measurement equipment for a particular installation
T15 Fault Loop Impedance encompassing:
term fault loop impedance of a a.c. power system
determining fault loop impedance using resistance and reactance values from AS/NZS 3008.1.1
measuring fault loop impedance of typical circuits
procedures for testing fault loop impedance

Assessment criteria

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Theory Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in Single phase a.c. circuits, concepts, definitions and calculations.

Event 2: Theory Exam 2, tests the required student's knowledge on Poly-phase a.c. circuits, concepts, definitions and calculations.

Event 3: Practical Test, checks the required skill adequacy of the student to demonstrate his/her competency in measuring different a.c. quantities and/ or testing a.c. circuits.

You will be required to successfully complete all 3 events to demonstrate your competence in unit
UEEEL0020.

Assessment schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Exam 1				Satisfactory/Not yet satisfactory
2	Theory Exam 2				Satisfactory/Not yet satisfactory
3	Practical Test				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".
If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A

	Statement of Attainment for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: 1. Fundamentals of Electric Circuits Author: David A. Bell 2. Electric Circuit Analysis Author: S.A. Boctor You will also be provided with • Access to a simulated environment containing information similar to that which you may encounter in a workplace. • Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. Yu will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be

	considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEL0023 Terminate cables, cords and accessories for low voltage circuits		
Application	This unit covers the termination of cables and cords and their conductors at accessories and current-using devices designed to operate at voltages up to 1,000 V a.c. or 1,500 V d.c. It encompasses working safely and to standards, understanding wiring system and cable types and applications, selecting appropriate termination accessories, preparing and terminating cables and cords, terminating cables/cord conductors and ensuring completed termination complies with requirements. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of utilities industry components UEECD0020 Fix and secure electrotechnology equipment UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications		
Licensing,	**1.2) License to practice** **During Training**: Competency development activities are subject to regulations directly related to licensing, occupational health and safety and where applicable contracts of training such as apprenticeships. **In the workplace**: The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c. Other conditions may apply under State and Territory legislative and regulatory requirements.		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Wiring systems types, application and terminations** · Evidence shall show an understanding of wiring systems types, application and terminations to an extent indicated by the following aspects: T1 Cable types and terminations encompassing: cable variates (single cables, flexible cables, flexible cords, shielded cables, armoured cables, ribbon cables, other similar and like cables) structural components of cables and their purpose (conductor material, stranding, insulation type, voltage rating, screening, sheathing, armour and serving)		

Required Knowledge & Skills	Australian and International colour standards for cords and cables construction of common cables identification of cords and cables by conductor size, type and rating application of various cords and cables types identification of hardware used in terminating cords and cables preparation and termination of cords and cables termination of cords and cables using crimp lugs, tunnel connectors, soldering and solderless lugs requirements to protect and support cables adequately (protection against mechanical damage, protection from adverse temperatures and corrosion and protection from magnetic field that may affect the performance of the cable). T2 Cords, cables and plugs encompassing: selection of flexible cords for given applications preparation of cord ends for connection fitting standard three pin plug tops to a flexible cords fitting standard three pin extension sockets to a flexible cords connecting variety of plugs to different flexible cord types requirements of AS/NZS 3000 for flexible cords, cables and plugs using test equipment to test and locate various faults in flexible cords and cables. T3 Flat TPS wiring systems encompassing: Australian Standards requirements for the termination and protection of flat TPS cable Installation of flat TPS cable in trunking and duct for the supply of socket outlets using flat TPS cable for lighting looms testing circuits to ensure they are safe and operate as intended T4 Circular TPS wiring systems encompassing: Australian Standards requirements for the installation of circular TPS cable installation of circular TPS cables on cable ladder/tray installation of circular TPS cable testing circuits to ensure they are safe and operate as intended T5 Thermoplastic insulated cables in non-metallic enclosures encompassing: Australian Standards requirements for the installation of non-metallic enclosures cutting and setting rigid non-metallic ducting, trunking and conduit and accessories installation of circuits using TPI cables in non-metallic enclosures testing circuits to ensure they are safe and operate as intended T6 Thermoplastic insulated cables in metallic enclosures encompassing: Australian Standards requirements for the installation of metallic enclosures fitting metallic conduit to metallic trunking and accessories cutting, threading and setting metallic conduit installation of circuits using thermoplastic insulated cables in metallic conduit, ducting and trunking testing circuits to ensure they are safe and operate as intended T7 Fire protection cabling and systems encompassing: Australian Standards requirements for the installation of fire protection cable and mineral insulated metal sheathed cables requirements when passing a wiring system through a fire rated wall or floor recognising different fire protection cable types including Pyrolex, Radox and MIMS termination of fire protection cable. installation of circuits using fire protection cable. testing circuits to ensure they are safe and operate as intended T8 Steel wire armoured (SWA) cables encompassing: Australian Standards requirements for the installation of SWA cables identifying accessories used with SWA cables installation of circuits using SWA cables testing circuits to ensure they are safe and operate as intended T9 Trailing cables and catenary systems encompassing: Australian Standards requirements for the installation of trailing cables and catenary wiring identifying equipment used with trailing cable and catenary systems installation of catenary wiring systems installation of trailing cable systems supplying pendant sockets testing the installation to ensure it is safe and operates as intended •

Assessment criteria

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

Demonstrate an appropriate level of skills enabling employment

Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

	Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
	1	Practical Test				Satisfactory/Not yet satisfactory
	2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience - for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: *Electrical Trade Practice (Latest Edition)* *Australian Electrical Wiring (Latest Edition)* *IQY TECHICAL COLLEGE Module Resources Electrical Wiring (Latest Version) AS3000 Wiring Rule (Latest Edition)* *AS3008 Cable Selection Rule (Latest Edition)* *Electrical Workshop Practice (Latest Edition)* You will also be provided with • Access to a simulated environment containing information similar to that which you may encounter in a workplace. • Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.

	If you miss an exam, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEL0018 Select wiring systems and cables for low voltage general electrical installations		
Application	This unit covers selecting wiring systems and cables for electrical installations operating at voltages up to 1,000V a.c. or 1,500 V d.c. It encompass knowledge and application of wiring systems and cable types, selecting wiring system compatible with the installation conditions, selecting cables that comply with required current-carrying capacity and voltage drop and earth fault-loop impedance limitations, coordination between protective devices and conductors and documenting selection decisions . . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) OR Their superseded units in UEE20 Training package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace UEECD0019 Fabricate, dismantle, assemble of electrotechnology components UEECD0044+46 Solve problems in d.c circuits UEECD0020 Fix and secure electrotechnology equipment UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications UEEEL0024 Solve problems in single and three phase low voltage machines UEEEL0008+0009+0010 Solve problems in lighting,heating,socket outlet circuits UEEEL0003 Arrange circuits, control and protection for general electrical installations UEEEL0021A Solve problems in electromagnetic devices and related circuits UEEEL0020A Solve problems in low voltage a.c. circuit UEEEL0023Terminate cables, cords and accessories for low voltage circuits		
Licensing,	**1.2) License to practice** The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50 V a.c. or 120 V d.c. Practice in workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships. Note: 1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. 2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures		

Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Electrical installation — cable selection and co-ordination** Evidence shall show an understanding of selecting cables and ensuring co-ordination between protection device and conductors in electrical installations that comply with the Wiring Rules, Selection of cables standards and Service Rules to an extent indicated by the following aspects: T1 Performance requirements - design and safety encompassing: harmful effects against which the design of an electrical installation must provide protection. performance standards of a correctly functioning electrical installation. supply characteristics that shall be considered when designing an electrical installation. acceptable methods for determining the maximum demand in consumer's mains and sub-mains. AS/NZS 3000 requirements limiting voltage drop in an installation. reason for dividing electrical installations into circuits and the factors that shall determine their number and type. typical external factors that may damage an electrical installation and that shall be considered in the installation design. methods for protecting persons and livestock against direct and indirect contact with conductive parts and the typical application of each. acceptable methods of protection against the risks of ignition of flammable materials and injury by burns from the thermal effects of current, in normal service. likely sources of unwanted voltages and the methods for dealing with this potential hazard. acceptable methods for protecting persons and livestock against injury and property against damage from the effects of over current. requirement for protection against fault current. requirement for protection against the harmful effects of faults between live parts of circuits supplied at different voltages. need for protection against injury from mechanical movement and how this may be achieved. features of 'fire rated construction' and how the integrity of the fire rating can be maintained in relation to electrical installation. T2 Final subcircuit arrangements encompassing: factors that shall be considered in determining the number and type of circuits required for an installation. daily and seasonal demand for lighting, power, heating and other loads in a given installation. number and types of circuits required or a particular installation. current requirements for given final subcircuits. layout/schedule of circuits for given installations. T3 Factors affecting the suitability of wiring systems encompassing: wiring systems typically used with various construction methods and particular environments. installation conditions that may affect the current-carrying capacity of cables. external influences that may affect the current-carrying capacity and/or may cause damage to the wiring system. AS/NZS 3000 requirements for selecting wiring systems for a range of circuits, installation conditions and construction methods into which the wiring system is to be installed. Note: Wiring systems include cable enclosures, underground wiring, aerial wiring, catenary support, emergency systems, busbar trunking and earth sheath return. T4 Maximum demand on consumer’s mains/submains encompassing: acceptable methods for determining the maximum demand on an installation’s consumer’s mains and submains. maximum demand for the consumer's mains for given installations up to 400 A per phase. maximum demand for given submains. T5 Cable selection based on current carrying capacity requirements encompassing: installation conditions for a range of wiring systems and applications. external influences that require the use of a derating factor. AS/NZS 3000 requirements for coordination of cables and protection devices.

	AS/NZS 3008 used to select conductor size based on the maximum current requirement for a given installation condition including any applicable derating factors. T6 Cable selection based on voltage drop requirements encompassing: AS/NZS 3000 requirements for maximum voltage drop in an installation. relevant tables in AS/NZS 3008 for unit values of voltage drop. calculation of the expected voltage drop in a given circuit. selecting cables to satisfy voltage drop requirements in addition to current carrying capacity requirements. T7 Cable selection based on fault loop impedance requirements encompassing: AS/NZS 3000 requirements for maximum fault loop impedance in an installation. relevant tables in AS/NZS 3008 to determine cable impedances. calculation of the expected fault loop impedance for a given circuit arrangement. selecting cables to satisfy fault loop impedance requirements in addition to current carrying capacity requirements and voltage drop requirements. T8 Selecting protection devices encompassing: acceptable methods of protection against indirect contact. AS/NZS 3000 requirements for selecting methods and devices to protect against indirect contact for a range of installation types and conditions. coordination between conductors and protection devices to ensures the protection of cables from over heating due to over current. possible injuries to persons and livestock from hazards due to a short circuit. AS/NZS 3000 requirements for selecting devices to protect against overload current for a range of circuits and loads. AS/NZS 3000 requirements for selecting devices to protect against short-circuit current for a range of installation conditions. T9 Selecting devices for isolation and switching encompassing: requirements for the provision of the isolation of every circuit in an electrical installation. need for protection against mechanical movement of electrically activated equipment. AS/NZS 3000 requirements for selecting devices for isolation and switching for a range of installations and conditions. T10 Switchboards encompassing: AS/NZS 3000 and local supply authority requirements for switchboards. tariff structures for the supply of electricity. equipment installed at the main switchboards with capacities up to 400 A per phase. layout of a main switchboard for an installation supplied with single phase single tariff whole current metering. layout of a main switchboard for an installation supplied with single phase multiple tariff whole current metering. layout of a main switchboard for an installation supplied with multiphase single tariff whole current metering. layout of a main switchboard for an installation supplied with multiphase multiple tariff whole current metering. layout of a main switchboard for a multiple tenancy installation with whole current metering. layout of a main switchboard, including metering, for an installation supplied with three phase CT metering. local supply authority requirements for connection of an electrical installation to the electrical supply system
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

0 Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement

1 Apply sustainable energy principles and practices as specified in the performance criteria and range statement

2 Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

3 Demonstrate an appropriate level of skills enabling employment

4 Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

0 Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

Observation of skills in practical exercises and

Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: *Electrical Trade Practice (Latest Edition)* *Australian Electrical Wiring (Latest Edition)* *IQY TECHICAL COLLEGE Module Resources Electrical Wiring (Latest Version) AS3000 Wiring Rule (Latest Edition)* *AS3008 Cable Selection Rule (Latest Edition)* *Electrical Workshop Practice (Latest Edition)* You will also be provided with • Access to a simulated environment containing information similar to that which you may encounter in a workplace. • Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.

	If you miss an exam, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. . **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEL0041_Develop engineering solution for synchronous machine		
Application	This unit covers developing engineering solutions to resolve problems with synchronous machines and their controls. It encompasses working safely, apply extensive knowledge of synchronous machine operation, construction and their application, gathering and analysing data, applying problem solving techniques, developing and documenting solutions and alternatives. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEG149A Provide engineering solutions to problems in complex polyphase power circuits UEENEEE125A Provide engineering solutions for problems in complex multiple path circuit UEENEEE126A Provide solutions to basic engineering computational problems AND UEENEEE129A Solve electrotechnical engineering problems OR UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE104A Solve problems in d.c. circuits UEENEEG101A Solve problems in electromagnetic devices and related circuits OR UEENEEH114A Troubleshoot resonance circuits in an electronic apparatus UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace AND UEENEEE104A Solve problems in d.c. circuits OR UEENEEH169A Solve problems in basic electronic circuits		
Licensing,	The skills and knowledge described in this unit require a license to practice in the workplace for work involving direct access to plant and equipment connected to installation wiring at voltage above 50 V a.c. or 120 V d.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.		

	Note: Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Synchronous machine diagnostics** Evidence shall show an understanding of developing engineering solutions for synchronous machine problems to an extent indicated by the following aspects: T1 a.c. generators – construction, types and cooling encompassing: - construction of stator and rotor windings - rotor construction (cylindrical and salient pole) - advantages of rotating field construction - excitation methods - cooling methods - prime movers T2 a.c. generators – operating principles and characteristics encompassing: - a.c. generator equivalent circuits (synchronous reactance and resistance components) - tests – open circuit, short circuit, stator impedance - voltage regulation, island generator's terminal voltage load power factor - determination of excitation voltage and load angle T3 Synchronising a.c. generators encompassing: - conditions for synchronising (infinite bus) - methods for synchronising (lamp methods, synchroscope) - alternator load sharing, parallel operation T4 a.c. generators power, torque and efficiency encompassing: - power input, input torque, speed - power losses - output power, load power factor, rotor angle, pu power - efficiency - performance chart interpretation T5 Voltage regulation (AVR) encompassing: - need for AVR's - features of AVR's - effects of rotor inductance - connections of AVRs - operation of AVRs T6 a.c. generator operational stability encompassing: - power output, VAR effects, rotor angle, excitation - control of VAR (OLTC transformers) - voltage dependant nature of stability - critical clearance angle of a.c. generator - stability limits
Required Knowledge & Skills	T7 a.c. generator protection encompassing: - restricted, unrestricted primary, back up and duplicated protection - overcurrent, short circuit, differential, reverse power, load unbalance, rotor overload, loss-of-field, rotor earth fault, station earth fault, under frequency protection - external fault protection T8 Induction generator encompassing: - types operating principles, characteristics - excitation methods - losses and efficiency - synchronising and paralleling T9 Three phase synchronous motors encompassing: - construction – rotor, stator, windings - excitation methods - operating principles (equivalent circuits, synchronous impedance) - hunting and stability limits - power factor correction

	paralleling and synchronisation techniques starting methods braking methods
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: • A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: • Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement • Apply sustainable energy principles and practices as specified in the performance criteria and range statement • Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. Demonstrate an appropriate level of skills enabling employment Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures. Demonstrated consistent performance across a representative range of contexts from the prescribed items below: Applying OHS practices in the workplace as described in 8) and including: Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively. Understanding and following risk control safe work methods. Applying work procedures and instructions as they apply to risk control measures. Dealing with accidents and emergencies within the scope of responsibility. Participation in consultation processes, identifying hazards and implementing and monitoring control measures.
Assessment methods & schedule	Dealing with unplanned events Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff: Observation of skills in practical exercises and Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews You will be required to complete all assessments for this unit to demonstrate your competence in this unit. Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's: 1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an 2. ***Understanding of the required skills and knowledge ,***by meeting the requirements in the Learning Specification/s.

	Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
	1	Practical Test				Satisfactory/Not yet satisfactory
	2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

Electrical Trade Practice (Latest Edition)
Australian Electrical Wiring (Latest Edition)
IQY TECHICAL COLLEGE Module Resources Electrical Machines (Latest Version) Electrical Machines, Drives & Power Systems,
Synchronous Machines & Drives by AUSTIN HUGHES AND BILL DRURY

You will also be provided with

- Access to a simulated environment containing information similar to that which you may encounter in a workplace.
- Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS
- USB memory Stick

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

You will have three weeks from the date you receive your results in which to make an appeal and request a review.

You will receive a response within **ten working days** after receipt of the request.

Assessment guidelines	Your Head Teacher will address the appeal in accordance with Assessment Guidelines for IQY TECHICAL COLLEGE.
	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. IQY TECHICAL COLLEGE provides learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher		
Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty	C.E.T.	**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEL0043 Develop engineering solutions for induction machine		
Application	This unit covers developing engineering solutions to resolve problems with induction machines and their controls. It encompasses working safely; apply extensive knowledge of induction machine operation and construction and their application, gathering and analysing data, applying problem solving techniques, developing and documenting solutions and alternatives . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEG149A Provide engineering solutions to problems in complex polyphase power circuits UEENEEE125A Provide engineering solutions for problems in complex multiple path circuit UEENEEE126A Provide solutions to basic engineering computational problems AND UEENEEE129A Solve electrotechnical engineering problems OR UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE104A Solve problems in d.c. circuits UEENEEG101A Solve problems in electromagnetic devices and related circuits OR UEENEEH114A Troubleshoot resonance circuits in an electronic apparatus UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace AND UEENEEE104A Solve problems in d.c. circuits OR UEENEEH169A Solve problems in basic electronic circuits		
Licensing,	The skills and knowledge described in this unit require a license to practice in the workplace for work involving direct access to plant and equipment connected to installation wiring at voltage above 50 V a.c. or 120 V d.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.		

	Note: Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: excitation methods **Induction machines diagnostics** Evidence shall show an understanding of developing engineering solutions for induction motor problems to an extent indicated by the following aspects: T1 Operating principles of polyphase induction motors encompassing: rotating magnetic field torque slip MMF relationships Leakage fluxes T2 Construction of polyphase induction motors encompassing: squirrel cage motors slip-ring motors construction considerations in minimisation of tooth locking T3 Speed-torque relationships in induction motors encompassing: maximum torque torque – slip relationships squirrel cage rotor types power flow in the motors power distribution torque units slip ring rotors T4 Induction motor performance testing encompassing: no-load tests locked rotor tests development of motor equivalent circuit from test results analysis of motor performance using circle diagrams T5 Induction motor starters encompassing: starting requirements type of starters starting torque starting dynamics static friction mechanical loads starting duration T6 Reduced voltage starting encompassing: starting dynamics change over conditions starting duration acceleration curves
Required Knowledge & Skills	T7 Speed control of induction motors encompassing: constant torque, constant power concepts torque-flux-voltage relationships rotor resistance control stator impedance control variable frequency control T8 Braking of induction motors encompassing: electrical braking systems (plugging, d.c. dynamic, regenerative, capacitor-magnetic) mechanical braking systems (mechanical drum, demag, eddy current) T9 Motor protection encompassing: overload earth fault phase failure

T10 Motor selection criteria and RMS rating
T11 Induction motor maintenance/repair encompassing:
routine maintenance schedules
type of repairs (mechanical, electrical)

T12 Single phase induction motors encompassing:
operating principles (especially RMF)
construction types

speed-torque relationships
testing

Before the critical aspects of evidence are considered all prerequisites must be met.

Assessment criteria

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

  Demonstrate an appropriate level of skills enabling employment
  Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
Applying OHS practices in the workplace as described in 8) and including:
Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.
Understanding and following risk control safe work methods.
Applying work procedures and instructions as they apply to risk control measures.
Dealing with accidents and emergencies within the scope of responsibility.
Participation in consultation processes, identifying hazards and implementing and monitoring control measures.
Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

Electrical Trade Practice (Latest Edition)
Australian Electrical Wiring (Latest Edition)
IQY TECHICAL COLLEGE Module Resources Electrical Machines (Latest Version) Electrical Machines, Drives & Power Systems,
Induction Machines & Drives by AUSTIN HUGHES AND BILL DRURY
Electrical Machines Diagnosis by Jean-Claude Trigeassou

You will also be provided with

- Access to a simulated environment containing information similar to that which you may encounter in a workplace.
- Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS
- USB memory Stick

Assessment feedback,

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

review or appeals	If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • . • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering – Electrical Advanced Diploma of Engineering Technology - Electrical		
Unit of Competency Number and Name	UEEEL0062 A Provide engineering solutions to problems in complex polyphase power circuits		
Application	This unit covers determining correct operation of complex polyphase power circuits and providing solutions as they apply to electrical power engineering work functions. It encompasses working safely, problem solving procedures, including using electrical measuring devices, applying appropriate circuit theorems and providing solutions derived from measurements and calculations and justification for such solutions. Note: This unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training.		
Prerequisites	**Essential Competencies**: Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEE125A Provide engineering solutions for problems in complex multiple path circuits and UEENEEG102A Solve problems in low voltage a.c. circuits		
Licensing,	The skills and knowledge described in this unit require a license to practice in the workplace where plant and equipment operate at voltage above 50 V a.c. or 120 V d.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships		
	REQUIRED SKILLS AND KNOWLEDGE **7)** This describes the essential skills and knowledge and their level, required for this unit.		

Required Knowledge & Skills

Evidence shall show that knowledge has been acquired of safe working practices and providing solutions for problems in complex polyphase power circuits.
All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

Polyphase power circuit analysis

Evidence shall show an understanding of polyphase power circuit analysis to an extent indicated by the following aspects:

T1 Polyphase supply system encompassing:

advantage of three phase system compared to single phase systems
double subscript notation
phase sequence
120 degree operator
given circuit component parameters, solve practically based problems using:
equivalent circuits of transformers, lines and loads.
component values using rectangular and polar notation.
current divider and potential divider rules using complex impedances.
The "per unit" values of voltage, current, VA and impedance to a common VA base.

T2 Types of three phase system connections encompassing:

supply to balanced star, 3 and 4 wire loads
supply to delta connected loads
effects of phase reversal
representation of currents and voltages as complex phasors for 3 phase and 3 phase and neutral quantities.
calculation the values of and draw labeled phasor diagrams, not to scale, to represent complex values of current and voltage for balanced and unbalanced loads for star and delta systems.
calculation of values of P, Q and S for balanced and unbalanced systems.
draw and label single phase diagrams to represent 1 phase of a complex 3 phase system.
represent unbalanced voltages or currents as symmetrical components.
Phase to phase currents
Phase to neutral/earth currents.

T3 Balanced three phase loads encompassing:

calculations of balanced loads connected in star
calculations of balanced loads connected in delta
calculation of steady state values of fault current for various configurations.
evaluation of the symmetrical component impedances for the various distribution system components. Transformers (earthed neutral case). Generators (high impedance earth)
calculation of fault currents using the per unit approach.
calculation using the "worst case" values based on transformer impedance only (ie., a short circuit fault)
estimation of peak values using accepted multipliers.
effects of the d.c. component on the instantaneous magnitudes of fault currents in transformers and generators.

T4 Unbalanced three phase loads encompassing:

Star – 4 wire systems
Delta systems
Star – 3 wire systems
Star 4 wire with neutral impedance

T5 Power in three-phase circuits encompassing:

summation of phase powers and power in balanced loads measurement of power in balanced loads – 2 Wattmeter methods

T6 Reactive three phase power encompassing:

power triangle calculation
measurement of VAR
power factor correction

T7 Fault currents encompassing:

symmetrical components
positive, negative and zero sequence impedance
fault current breaking and let-through energy capacities of circuit breakers, fuses
importance of fault/arc impedance
calculation of fault currents - phase-to-earth faults
calculation of fault currents - phase-to-phase faults
analysis of asymmetrical faults currents.

T8 Harmonics in three phase systems encompassing:

presence of triple in harmonics in 3 phase systems
effects of 3 phase harmonics for different star and delta connections.
methods for reducing harmonics in three phase systems.

Assessment criteria

You will be assessed against the following criteria to establish your competence in the unit:

Event 1 (Theory test 1) You will be assessed based on the theory test which mainly consist of problem solving however there may be some multiple choice questions. Theory test will cover solving DC circuits using all the circuit analysis techniques and network theorems. It will also contain test of mathematical ability required. Test will be of 50% marks.

Event 2 (Theory test 2) You will be assessed based on the theory test 2 which mainly consist of problem solving and covers all the methods of analysis, network theorems studied under DC circuits but in this the circuits will be AC. Test will be worth 50%

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Test 1				Satisfactory/Not yet satisfactory
2	Theory Test 2				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments	**Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** 1) Handouts given by the teacher 2) Class notes 3) Fundamentals of Electrical circuits by D A Bell (In library)
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis.

	Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

STUDENT ASSESSMENT GUIDE – UNIT OF COMPETENCY

<table>
<tr><td>Qualification</td><td>(Engineering Technology – Electrical</td></tr>
<tr><td>Unit of competency</td><td>UEEEC0060 Repairs basic electronic apparatus faults by replacement of components</td></tr>
<tr><td>Unit Descriptor</td><td>This unit deals the replacement of electronic components, cabling and sub systems of electronic apparatus. It encompasses safe working practices, following written and oral instruction and procedures, basic testing and techniques, dismantling and assembling apparatus and disconnecting and reconnecting components.
.</td></tr>
<tr><td>Prerequisites</td><td>UEECD0007 Apply Occupational Health and Safety regulations, codes and practices in the workplace

UEECD0019 Fabricate, dismantle, assemble of utilities industry components</td></tr>
<tr><td>Assessment criteria</td><td>KS01-EH102A Component replacement to repair basic electronic apparatus faults
Key Areas of Assessment
• Electronic soldering equipment and techniques
• Printed circuit board soldering techniques
• Soldering electronic cables
• Electronic component basics
• Electronic cable overview and coaxial cable
• Performance copper cables
• Electronic apparatus components
Evaluation of progress towards competence shall be progressive, reflecting a holistic approach for purpose and the outcomes intended in this specification.
Completing Project work from Design and Layout to Testing a Verification, students will cover all components of the assessment criteria.
• Following manufacturer service instructions for access to components.
• Removing at least three different types of components specified in the work instructions.
• Replacing components to manufacturer requirements.
• Terminating correctly electronic cables using solderless termination techniques
• De-soldering and soldering to a high reliability standard and without damage to components.
• Reassembling the apparatus correctly.
• Testing apparatus operation.
• Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a holistic assessment with the above listed items.</td></tr>
<tr><td>Assessment methods</td><td>You will be required to complete all assessments for this unit to demonstrate your competence in this unit:

<table>
<tr><th>Assessment no.</th><th>Assessment method</th><th>Assessment grading</th></tr>
<tr><td>1</td><td>Workplace Simulations/projects (1-5)</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td>2</td><td>Soldering and Cabling Assignments</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Assessment schedule</td><td>You will be assessed for this unit as per the following schedule:

<table>
<tr><th>Assessment no.</th><th>Assessment date</th><th>Assessment venue</th></tr>
</table></td></tr>
</table>

	1	Week 1 - 18	Industrial Control Lab
	2	Week 1-18	Industrial Control Lab

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your result will be recorded and reported to you as **Competent** (AC) or **Not Yet Competent** (NC)". If you have achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you have completed. You will also receive a **Statement of Attainment** for the unit/units you have successfully completed. Your final reported results can be accessed from the DET Student Portal https://portal.det.nsw.edu.au **Recognition and credit transfers**:you can apply to have your previous study, work and/or life experiences recognised. .
Resources required for assessments	This unit is assessed using specific resources/tools: You will be provided • access to a simulated environment • access to workplace documents, information and resources (such as compliance obligations, enterprise plans, work responsibilities) You are required to bring in the following for the assessments: N/A
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessmentactivities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment conditions	You must submit assessment work and attended scheduled assessments on the required dates. ○ **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. ○ **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. ○ **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. ○ **If you engage in cheating**such as copying, colluding with another person, using unauthorised notes, or allowing another personto copy your work, you will be liable for disciplinary action as per Student Discipline Policy .Whatever the form of assessment, it is essential that the work you are assessed on is your own.

	We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" ○ for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy and guidelines.This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Contact Details		
	College **Ultimo**	**Section** **Electrical Engineering**

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEC0075 – Troubleshoot Single Phase Input D.C. Power Supplies		
Application	This unit covers determining correct operation of independent power supplies and power supply sections of electronic apparatus. It encompasses working safely, problem solving procedures, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in d.c. power supplies with single phases input. Note: This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	**Required Prerequisite Competencies**: Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEE101A - Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE104A - Solve problems in D.C. circuits UEENEEH102A - Repair Basic Electronic Apparatus by replacement of components UEENEEH114A - Troubleshoot resonance circuits in an electronic apparatus AND UEENEEH119A - Solve problems in multiple path extra low voltage (ELV) A.C. circuits AND UEENEEH169A - Solve problems in basic electronic circuits OR UEENEEG101A - Solve problems in electromagnetic devices AND UEENEEG102A - Solve problems in low voltage A.C. circuits **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Single phase input D.C. power supplies** Evidence shall show an understanding of single phase input D.C. power supplies, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects: **T1 OH&S:**		

Required Knowledge & Skills	• Apply safe working practices and relevant Standards, Codes and Regulations. **T2 Power supplies operating principles and applications:** • Power supply function • Block diagram identifying each sub-system • Expected waveforms in a power supply • Constant Voltage • Constant Current **T3 D.C. rectification circuits**: • Junction diode characteristics • Transformer turns ratio and losses • Half wave and full wave rectifiers (centre-tap and bridge) • Dual rail supply **T4 Filter Circuits**: • Capacitive and inductive filters (capacitor filter, LC filter, CR filter and filter faults • Ripple • Voltage doublers • Series and shunt Clipper and clamping circuits **T5 Zener diode regulators**: • Zener shunt regulator circuit • Simple, series and shunt transistor regulators • Load and line regulation definitions • Operating parameters and data sheets • Operation of different types of regulated power supplies **T6 Three terminal linear regulator circuits**: • Need for regulation • Three terminal regulator characteristics • Short circuit protection • Line and load regulation • Regulated power efficiency • Remote voltage sensing • Linear regulators using integrated circuits **T7 Electronic testing and measuring devices and techniques:** Test/measuring devices and their application - analogue and digital multimeters, voltage and digital testers, signal generators and oscilloscopes Connection of test/measuring devices into a circuit encompassing: safety procedures circuit arrangement of test/measuring devices Taking readings Storage, maintenance and care of test/measuring devices **T8 D.C. Power supply testing and fault finding:** • Rectifier diode faults • Zener diode faults • Three terminal regulator faults • Purpose and benefits of different types of regulated power supplies • Voltage current waveforms at different points within a power supply • Emerging technologies
Assessment criteria	You will be assessed against the following criteria to establish your competence in the unit: **Event 1:** Practical Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in working with Linear Power supplies. The student's task is to build a linear power supply and perform the required fault-finding and repairs to make the linear power supply operational. **Event 2:** Theory Exam 1, tests the required student's knowledge on linear power supplies as per the required knowledge contained in the topics delivered on the term. Exam 1 will be conducted during class time and it will contain thirty-five (35) multiple choice and five (5) calculation questions. To achieve competency in Exam 1, the student must answer correctly 50% of the test.

	You will be required to successfully assemble, fault-finding and achieve a fully working power supply and obtain 50% of the theory test to demonstrate your competence in unit H111A.
Assessment methods & schedule	Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff: • Observation of skills in practical exercises and • Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews You will be required to complete all assessments for this unit to demonstrate your competence in this unit. Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's: 1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an 2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: 1. *Understanding DC power supplies*. Author: David, Barry Publisher: Prentice Hall 2. *Exploring Electronic Devices* Author: Mark E. Hazen Publisher: Saunders College 3. *Electronic Devices* Author: Floyd, Thomas. Publisher: Merrill Publishing

	Introductory Electronic Devices & Circuits Author: Paynter, Robert Publisher: Prentice Hall You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".

Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEC0069 - Digital Subsystems		
Application	This unit covers determining correct operation of digital sub-systems. It encompasses working safely, problem solving procedures, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in digital components circuits.		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEH102A Repair basic electronic apparatus faults by replacement of components **Literary and Numeracy:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing, Legislative or Certification requirements	None		
Required Skills & Knowledge	All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies. You will be assessed to prove your competence in the required skills and knowledge below:		

Required Skills & Knowledge

Digital Subsystems

Evidence shall show an understanding of digital sub-system troubleshooting, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1. Analogue and digital signals

Comparison between analogue and digital signals
Observing digital and analogue waveforms

T2. Numbering systems

The binary number system
The hexadecimal number system
Binary addition and subtraction

T3. Numbering systems - conversions

Conversion between numbering systems
Binary Coded Decimal (BCD)
Gray code
The American Standard Code for Information Interchange (ASCII)
Unicode

T4. Combinational logic circuits

Precautions when handling electronic devices due to electrostatic discharge (ESD)
Truth tables
Basic operation and characteristics of logic gates
Logic probes
Verification of operation of logic circuits

T5. Digital displays

Seven segment LED displays
Drive requirements
Current limiting
Multiplexed displays
Seven segment Decoders
Liquid Crystal Displays (LCD)
Emerging display technologies
Verification of seven segment display circuit
Interfacing with logic circuits

T6. Digital subsystem building blocks

Encoders and Decoders
Multiplexers and Demultiplexers
Timing diagrams
Flip flops, Latches and registers
Ripple counters
MOD counters
Synchronous counters Multi-vibrators
Clocks
Verification and operation (eg. PLDs, ICs)

T7. Digital fault finding

General fault finding principles
Common digital faults
Digital test equipment
Digital test equipment (eg. Logic probes, Digital Oscilloscopes, digital trainers)

T8. Logic families and specifications

Input and output voltage characteristics
Comparison of logic families
Unit load

- Noise margin
- Interfacing different logic families
- Tri-state logic devices
- Overview and applications of A/D converter and D/A converter

Assessment criteria

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** by meeting the requirements in the Learning Specification/s.

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Theory Test 1. Short answers and calculations based on topics T1 to T6.

Event 2: Theory Test 2. Short answers and calculations based on topics T7 to T9.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Test 1				S/NS
2	Theory Test 2				S/NS

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed.

A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments

You are required to bring in the following for the assessments:
Calculator, Pen.

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

You will have three weeks from the date you receive your results in which to make an appeal and request a review.

You will receive a response within **ten working days** after receipt of the request.
Your Head Teacher will address the appeal in accordance with Assessment Guidelines for IQY TECHICAL COLLEGE.

Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEC0066 Troubleshoot Amplifiers in an Electronic Apparatus		
Application	This competency standard unit covers competency development entry-level employment based programs incorporated in approved contracts of training or other approved training programs. It may also be used to augment formally acquired competencies. Note: This unit is intended to apply to any recognised development program that leads to the acquisition of a formal reward at AQF level3 or higher. For general competencies refer to the latest endorsed IT Training Package.		
Prerequisites	**Essential**: Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. . UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE104A Solve problems in DC Circuits UEENEEH102A Repair Basic Electronic Apparatus Faults by Replacement of Components UEENEEH139A Troubleshoot Basic Amplifiers Circuits **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	1.2) Licence to practice The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50V ac. or 120V dc. However, other conditions may apply in some states/ territories subject to regulations related to electrical work Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.		

Required Knowledge & Skills	Amplifier fundamentals Evidence shall show an understanding of amplifier troubleshooting, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects: **T1. Single stage discrete amplifier d.c. characteristics** Risk and safety Field effect transistors (FET) and Bi-junction transistor (BJT) circuit symbols Quiescent (Q) point Biasing methods for BJT and FETs Circuit theory for BJT and FETs Verification of performance of BJT and FET amplifier circuits **T2. Single-stage discrete amplifier small signal characteristics** Small signal gain Gain measurements Overdrive conditions **T3. Capacitive coupling in single-stage discrete amplifiers** Coupling capacitor functions Coupling capacitor effect on low frequency response Emitter\source bypass capacitor effect on low frequency response Verification of circuit operation and frequency response (eg. Bode Plot). **T4. Multistage amplifier coupling methods** Coupling methods Total gain Bandwidth considerations Verification of circuit operation **T5. Differential amplifiers** Differential amplifier concept Typical circuit operation Differential and common-mode gain Common mode rejection Constant current and voltage sources Verification of circuit operation **T6. Negative feedback** Concept of negative feedback Effects of negative feedback Negative feedback configurations Amplifier gain and negative feedback
Required Knowledge & Skills	**T7. Introduction to classes of power amplifier operation** Power efficiency Classes and applications Crossover distortion Class AB operation Heat sinking **T8. Complimentary symmetry power amplifiers** Biasing and crossover distortion Power efficiency Quasi-complimentary and Darlington output configurations Complete amplifier operation D.C. operating condition calculations Verification of circuit operation

T9. Other solid state power amplifier design
Transformer coupled power amplifiers
I.C. power amplifiers
Class D power amplifiers

Assessment criteria

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Theory Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in topics 1-9. Test includes calculations, diagrams and short answers. Test is an open book.

Event 2: Practical Test, checks the required skill adequacy of the student to demonstrate his/her competency in assembling measuring and evaluating amplifier performance using analogue and digital meters and oscilloscope

You will be required to successfully complete both events to demonstrate your competence in unit H113A

Assessment schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Exam 1				Satisfactory/Not yet satisfactory
2	Practical Test				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual
Students don't need to purchase any Learner Resource Manual :

Principal References
It is advised that students have access to the following reference books as the main references:

1. Electronic devices
   Author: Thomas L. Floyd
2. Electronic Devices and Circuit Theory
   Author: Robert L. Boylestad, Louis Nashelsky

You will also be provided with
- Class notes

Other Resources
To complete this unit successfully you should bring the following equipment to class with you:
- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS or similar

Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. Yu will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • . • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEC0019 -Develop Software solutions for Microcontroller based Systems		
Application	This competency standard unit covers structured programming instructions for micro devices at a fundamental level. The unit encompasses working safely, applying knowledge device architecture and programming fundamentals, writing and testing specified instructions and documenting development activities. Note: This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	**Essential Competencies**: Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEE101A - Apply Occupational Health and Safety regulations, codes and practices in the workplace **Preferable competencies:** (the following may be done in parallel with main unit) UEENEEH102A.-.Repair Basic Electronic Apparatus by replacement of components UEENEEH112A - Troubleshoot Digital Subsystems UEENEED111A - Develop, implement and test object oriented code (using C++) **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Software Programming Fundamentals** Evidence shall show an understanding of software programming fundamentals, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects: **T1 Semiconductor Memory:** • memory cell, • antistatic precautions, • memory organization, • storage capacity and density, **T2 Overview of Address decoding:** **T3 Microprocessor/ Microcontroller architecture:** • internal architecture of a microprocessor,		

Required Knowledge & Skills	single chip microcontroller architecture, programming model of microprocessor/ microcontroller, **T4 Programming:** programming concepts, instruction set, machine code and assembly language high level and low level language, **T5 Addressing Modes:** types of addressing modes, applications for each addressing mode, programming using different addressing modes, **T6 Arithmetic and Logic Instructions:** types of arithmetic and logic instructions, applications for each type of arithmetic and logic instruction, programming using arithmetic and logic instructions, **T7 Branch Instructions and Flowcharts:** types of branching instructions, applications for each type of branching instruction, programming using branching instructions, **T8 Subroutines:** purpose and applications, stack memory, **T9 Timing Loops:** concept, timing calculations, nested timing loops, programming using timing loops, **T10 Input/ Output Ports:** input/output port devices and interfacing, programmable input/ output port ICs, The list of information included in this Learning Specification is included below: brief evolution of reprogrammable computer systems development, types of semiconductor memory and memory interface circuitry, a general computer architecture (block diagram), types of buses sizes and decoding of physical address and computations, system clock, bus cycles, microprocessor/ microcontroller architecture block diagram elements, CPU elements: ALU, Control Unit, Registers organization, microprocessor pin diagram and description of processor timing and signals, practical usage of the debugger, describe instruction timing execution and machine cycle timing, the microcontroller instruction set, instruction formats and mnemonics, the status register and flag manipulation, addressing modes (inherent, immediate, direct, extended, index), load, store, and data transfer instructions, arithmetic and logic instructions including shift and rotate instructions, relative branching, jumping instructions and program relocation, using compare and set instructions, looping instructions and using timing loops, bit test and bit scan instructions, multiplication and division instructions, instruction format in assembly programming, assembly directives and operators, stack memory operation, using subroutines and external subroutines, using push and pull instructions, describe types of input/ output ports, using serial asynchronous communications Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff: Observation of skills in practical exercises and

- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment criteria

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Practical Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in using the microprocessor hardware and software. The student's task is to write a program in assembly language based on the assembly instructions learned during the first term. Completing a successful program with the software task/s and getting the microprocessor to performed a fully working result will grant competency on this test

Event 2: Theory Exam 1, tests the required student's knowledge on the instructions and the microcontroller hardware contained in the topics delivered on the first term. Exam 1 will be conducted during class time and it will contain ten (10) questions either multiple choice or short answer. To achieve competency in Exam 1, the student must answer correctly 50% of the test.

Event 3: Practical Test 2, checks the required skill adequacy of the student to demonstrate his/her competency in using the microprocessor hardware and software used during the practical lectures. The student's task is to write a program in assembly language based on the assembly instructions learned during the second term. Completing a successful program with the software task/s and getting the microprocessor to performed a fully working result will grant competency on this test

Event 4: Theory Exam 2, tests the required student's knowledge on the instructions and the microcontroller hardware contained in the topics delivered on the first term. Exam 2 will be conducted during class time and it will contain seventeen (17) questions either multiple choice or short answer. To achieve competency in Exam 2, the student must answer correctly 50% of the test.

You will be required to successfully complete all 4 events to demonstrate your competence in unit H115A.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test 1				Satisfactory/Not yet satisfactory
2	Theory Exam 1				Satisfactory/Not yet satisfactory
3	Practical Test 2				Satisfactory/Not yet satisfactory
4	Theory Exam 2				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: 1. *Technicians Guide to 68HC11 Microcontroller*. Author: *Black, Daniel J.* Publisher: *Delmar Thomson Learning* 2. *Microcontroller Technology, The 68hc11 and 68HC12, 5th Ed.* Author: *Spasov, Peter* Publisher: *Prentice Hall* 3. *Microcontroller Engineering 3rd Ed.* Author: *Miller, Gene H.* Publisher: *Prentice Hall* 4. *MC68HC11, An Introduction 2nd Ed* Author: *Huang, Han Way* Publisher: *Delmar Cengage Learning* You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.

Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEC0028 – Fault find and repair Complex Power Supplies		
Application	This unit covers determining correct operation of independent power supplies and power supply sections of electronic apparatus. It encompasses working safely, problem solving procedures, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in d.c. power supplies with single phases input. Note: This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	**Required Prerequisite Competencies**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEENEEH111A – troubleshoot Single Phase Input D.C. Power Supplies **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **K Single phase input D.C. power supplies** Evidence shall show an understanding of single phase input D.C. power supplies, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects: **T1 OH&S:** • Apply safe working practices and relevant Standards, Codes and Regulations. **T2 Summary of Linear Power Supplies:** • Types of linear power supply systems function • Block diagram identifying each sub-system in a linear power supply • Operating inefficiencies of linear power supplies • Describe the difference of a SMPS versus a LPSU **T3 Complex Power Supplies:** • Explain the operation of an original complex car power supply • Explain the principle of operation of a SMPS • Name the different types and uses of common SMPS. • Analyse the 'special components' required in SMPS versus those of a LPSU **T4 The Buck Switch Mode Power Supply:**		

Required Knowledge & Skills	• Draw and explain the operation of Buck (step-down) SMPS • Describe the relationship of V_{IN}, V_{OUT}, tON, tOFF and tS in a Buck SMPS. • Explain the Buck SMPS with feedback **T5 The Boost and Buck-Boost Switch Mode Power Supplies:** • Draw and explain the operation of Boost (step-up) SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Boost SMPS • Draw and explain the operation of Buck-Boost SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Buck-Boost SMPS **T6 The Ćuk, the Sepic and the Zeta Switch Mode Power Supplies:** • Draw and explain the operation of Ćuk SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Ćuk SMPS • Draw and explain the operation of Sepic SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Sepic SMPS • Draw and explain the operation of Zeta SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Zeta SMPS **T7 The Push-Pull, Half-Bridge Full-Bridge Switch Mode Power Supplies:** • Draw and explain the operation of Push-Pull SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Push-Pull SMPS • Draw and explain the operation of Half-bridge SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Half-bridge SMPS • Draw and explain the operation of Full-Bridge SMPS • Describe the relationship of V_{IN}, V_{OUT}, t_{ON}, t_{OFF} and t_S in a Full-Bridge SMPS **T8 The Specialized Circuits used in Switch Mode Power Supplies:** • Discuss the use of soft-start circuits in SMPS. • Describe how current limiting is attained. • Explain the over-voltage protection provision. • Describe why a RFI filter is found in a SMPS. • Generating Pulse Width Modulation • Using 3 Terminal regulators in a SMPS • Using the LM723 as a Buck in SMPS • Advantages and disadvantages of IC SMPS
Assessment criteria	You will be assessed against the following criteria to establish your competence in the unit: **Event 1:** Practical Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in working with Complex Power supplies. The student's task is to build a Switch Mode power supply and perform the required fault-finding and repairs to make the Switch Mode power supply operational. **Event 2:** Theory Exam 1, tests the required student's knowledge on linear power supplies as per the required knowledge contained in the topics delivered on the term. Exam 1 will be conducted during class time and it will contain thirty-five (35) multiple choice and five (5) calculation questions. To achieve competency in Exam 1, the student must answer correctly 50% of the test. You will be required to successfully assemble, fault-finding and achieve a fully working power supply and obtain 50% of the theory test to demonstrate your competence in unit H138A.
Assessment methods & schedule	Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff: • Observation of skills in practical exercises and • Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

1. *Understanding DC power supplies*.
   Author: David, Barry
   Publisher: Prentice Hall, 1983
2. *High Frequency Switching Power Supplies: Theory and Design, 2nd Ed.*
   Author: George Chrissis
   Publisher: McGraw-Hill, 1989
3. *Switching Power Supply Design, 2nd Ed.*
   Author: Abraham I. Pressman
   Publisher: McGraw-Hill, 1998
4. *Demystifying Switching Power Supplies.*
   Author: Raymond A. Mack, Jr.
   Publisher: Elsevier Newnes, 2005

You will also be provided with

- Access to a simulated environment containing information similar to that which you may encounter in a workplace.
- Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser

	• scientific calculator Casio fx-100AU PLUS • hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEC0067 Troubleshoot Basic Amplifier Circuits		
Application	This competency standard unit covers competency development entry-level employment based programs incorporated in approved contracts of training or other approved training programs. It may also be used to augment formally acquired competencies. Note: This unit is intended to apply to any recognised development program that leads to the acquisition of a formal reward at AQF level3 or higher. For general competencies refer to the latest endorsed IT Training Package.		
Prerequisites	**Essential**: Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE104A Solve problems in DC Circuits UEENEEH102A Repair Basic Electronic Apparatus Faults by Replacement of Components UEENEEH114A Troubleshoot Resonance Circuits in an Electronic Apparatus Or UEENEEG102A Solve problems in Low Voltage AC Circuits **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	1.2) Licence to practice The application of the skills and knowledge described in this unit require a license to practice in the workplace where work is carried out on electrical equipment or installations which are designed to operate at voltages greater than 50V ac. or 120V dc. However, other conditions may apply in some states/ territories subject to regulations related to electrical work Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.		

Required Knowledge & Skills	**Basic amplifier circuit troubleshooting** Evidence shall show an understanding of basic amplifier circuit troubleshooting, applying safe working practices and relevant Standards Codes and Regulations to an extent indicated by the following aspects: **T1. Introduction to Amplifiers** ☐ Purpose of amplifiers ☐ Introduction to black box model of amplifier ☐ Decibels, engineering terms and formulae ☐ Measurement of gain and frequency response **T2. Amplifier Terminal Characteristics** ☐ ☐ Amplifier types and transfer characteristics Ideal amplifier transfer characteristics **T3. Practical amplifiers** ☐ Practical amplifier terminal characteristics Input and output resistance calculations based on voltage measurements **T4. Operational amplifiers - Introduction** ☐ Advantages of operational amplifiers ☐ Schematic symbol ☐ Open loop configuration ☐ Input and output resistance ☐ Gain bandwidth product ☐ Open loop amplifier operation ☐ Comparator circuit Circuit verification of operational amplifier configured as a comparator **T5. Operational amplifiers – Inverting Amplifier** ☐ The need for and effects of negative feedback ☐ Inverting operational amplifier circuit configuration ☐ Inverting operational amplifier gain calculations ☐ Summing inverting operational amplifier gain calculations Circuit verification of operational amplifier gain **T6. Operational amplifiers – Non-inverting amplifier** ☐ Non-inverting operational amplifier circuit configuration ☐ Non-inverting operational amplifier gain calculations ☐ Circuit verification of non inverting operational amplifier gain ☐ Voltage follower circuit configuration ☐ Voltage follower circuit gain Circuit verification of voltage follower
Required Knowledge & Skills	**T7. Operational amplifiers – Differential Amplifier** ☐ The differential amplifier ☐ Schematic circuit of differential amplifier using an operational amplifier ☐ Differential amplifier gain calculations ☐ Circuit verification of differential amplifier operation ☐ The Schmitt trigger Circuit verification of Schmitt trigger circuit
Assessment criteria	You will be assessed against the following criteria to establish your competence in the unit: **Event 1:** Theory Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in topics 1-7. Test is an open book and includes calculations, diagrams and short answers. **Event 2:** Practical Test, checks the required skill adequacy of the student to demonstrate his/her competency in assembling measuring and evaluating amplifier performance using analogue and digital meters and oscilloscope

Assessment schedule

You will be required to successfully complete both events to demonstrate your competence in unit H139A

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Theory Exam 1				Satisfactory/Not yet satisfactory
2	Practical Test				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

1. Electronic devices
   Author: Thomas L. Floyd
2. Electronic Devices and Circuit Theory
   Author: Robert L. Boylestad, Louis Nashelsky

You will also be provided with

- Class notes

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS or similar

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

You will have three weeks from the date you receive your results in which to make an appeal and request a review.

You will receive a response within **ten working days** after receipt of the request.

Assessment guidelines

You must submit assessment work and attended scheduled assessments on the required dates.

- **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.

	• **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEEC0072– Troubleshoot Microcontroller Based Hardware Systems		
Application	This competency standard unit covers structured programming instructions for micro devices at a fundamental level. The unit encompasses working safely, applying knowledge device architecture and programming fundamentals, writing and testing specified instructions and documenting development activities. Note: This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	**Essential**: Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEH115A - Develop software solutions for microcontroller based systems **Preferable:** (the following may be done in parallel with the main unit) UEENEEH102A.-.Repair Basic Electronic Apparatus by replacement of components UEENEEH112A - Troubleshoot Digital Subsystems **Literary and Numeracy Skills:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Troubleshoot Microcontroller Based Hardware Systems** Evidence shall show an understanding of microcontroller-based systems troubleshooting, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects: **T1 Microcontroller Systems Overview:** • Digital Systems Concepts Associated with Microcontroller based systems. • Microcontroller architecture • Microcontroller System block diagram • Microcontroller manufacturers **T2 Program Storage Types:** • Software • Memory Terminology Hardware • Secondary Memory and Usage **T3 The Microcontroller Data Storage Types:**		

Required Knowledge & Skills	OTPROM RAM EEPROM **T4 I/O Ports, Analog and Digital Control:** Analog Ports Introduction to analog to digital control Using analog to digital control **T5 Integrated Peripherals: Timers, Interrupts, etc** Introduction to types of timers/counters Introduction to real rime, software and hardware interrupts Using interrupts with Timers and counters **T6 Control Circuitry: System Clock, Reset, etc** System clock circuitry Reset circuit Communication circuitry, (e.g. serial port, etc.). **T7 Writing, testing and debugging code:** Microcontroller operational modes Using the programming environment to develop bootstrap code **T8 Electronic Fault-finding Techniques:** Fault identification techniques Test equipment, safe operating procedure, application and in circuit connection. **T9 Testing Methods:** Visual inspection Sectional testing Split-half tests Component isolation Dealing with intermittent faults The list of information included in this Learning Specification is included below: describe the microcontroller interrupt architecture (block diagram), explain data masking and bit manipulation, bit-level comparison and bit-level conditional branching, explain the process of interrupt servicing and masking and non-masking interrupt priority, differentiate the strengths and weaknesses of maskable and non-maskable interrupts, understand the impact of hardware reset on all hardware systems, explain the servicing of a power on reset, interrupt reset, clock failure reset, illegal op-code reset, describe the process of and servicing an interrupt request, explain the difference between local and global interrupts, using the stop instruction, using the clear, enable wait for interrupt instructions, describe the interrupt service routine and the stacking of registers, describe the return from interrupt and unstacking registers, explain the difference between software and hardware interrupts, accessing and using interrupt control registers, using interrupt vectors, pseudo vectors and jump tables, Nyquist and the sample rate reading the keypad with software, writing the monitor with software, using the microcontroller's interrupt resources, 0 parallel ports, 1 input and output ports 2 handshaking, 3 describe the software interrupt (intermediate skill practice test), 4 describe the real time interrupt (intermediate skill practice test), 5 describe the input pin interrupts (intermediate skill practice test), 6 describe the single and multiple output pin interrupts (intermediate skill practice test), 7 describe the serial communications interface interrupts (intermediate skill practice test), 8 describe the analogue capture function (intermediate skill practice test), 9 describe the programmable timer system interrupts, Using the Bootstrap and Extended operational modes of the microcontroller, Using a bootstrap debugger

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews
- Determine the operating parameters of an existing microcontroller circuit
- Alternating an existing microcontroller circuit to comply with specific operating parameters
- Developing the characteristics functions of a microcontroller to comply with specific function and operating parameters

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge)***, by meeting the requirements in the Learning Specification/s.

Assessment criteria

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: Practical Test 1, checks the required skill adequacy of the student to demonstrate his/her competency in using the microprocessor hardware functions, the hardware and software interrupts and the assembler software. The student's task is to write a program in assembly language based on the information learned during the first term. Completing a successful program with the requested software task and getting the microprocessor to performed a fully working result will grant competency on this test

Event 2: Theory Exam 1, tests the required student's knowledge on the microprocessor hardware functions, the hardware and software interrupts contained in the topics delivered on the first and second term. Exam 1 will be conducted during class time and it will contain twenty-two (22) questions either multiple choice or short answer. To achieve competency in Exam 1, the student must answer correctly half of the test.

Event 3: Practical Test 2, checks the required skill adequacy of the student to demonstrate his/her competency in using the microprocessor hardware functions, the hardware and software interrupts and the assembler software. The student's task is to write a program in assembly language based on the information learned during the second term. Completing a successful program with the requested software task and getting the microprocessor to performed a fully working result will grant competency on this test

You will be required to successfully complete all 3 events to demonstrate your competence in unit H166A.

Assessment schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test 1				Satisfactory/Not yet satisfactory
2	Theory Exam 1				Satisfactory/Not yet satisfactory
3	Practical Test 2				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A

	Statement of Attainment for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy. Please see Recognition for previous learning and experience - for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: 1. *Technicians Guide to 68HC11 Microcontroller*. Author: *Black, Daniel J.* Publisher: *Delmar Thomson Learning* 2. *Microcontroller Technology, The 68hc11 and 68HC12, 5th Ed.* Author: *Spasov, Peter* Publisher: *Prentice Hall* 3. *Microcontroller Engineering 3rd Ed.* Author: *Miller, Gene H.* Publisher: *Prentice Hall* 4. *MC68HC11, An Introduction 2nd Ed* Author: *Huang, Han Way* Publisher: *Delmar Cengage Learning* You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information.

	If you engage in cheating such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)
(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEENEEH188A - Design and Develop Electronics – Computer System Projects		
Application	This competency standard unit covers designing and developing electronics/computer systems projects. It encompasses working safely, designing, constructing, and recording, evaluating and reporting of an electronics/computer systems design project.		
Prerequisites	**Competencies**: Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed. UEECD0007- Apply Occupational Health and Safety regulations, codes and practices in the workplace **Literary and Numeracy:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing, Legislative or Certification requirements	None		
Required Skills and Knowledge	This describes the essential skills and knowledge and their level, required for this unit. Evidence shall show that knowledge of safe working practices and designing and developing electronics/computer systems projects has been acquired. All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies. **Engineering design process** Evidence shall show an understanding of engineering design process, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects. **T1 Electronic measuring instruments encompassing:** • Test/measuring devices and their application - examples are analogue and digital multi-meters, voltage and digital testers, signal generators and oscilloscopes **T2 Connection of test/measuring devices into a circuit encompassing:** • safety procedures • circuit arrangement of test/measuring devices **T3 Taking readings** **T4 Storage, maintenance and care of test/measuring devices** **T5 Engineering design processes** **T6 The functional and non-functional requirements of a customer encompassing:**		

Required Skills and Knowledge	scope of the project, non-functional requirements Note: Examples include economics (time, cost) including total life-cycle costs - design, implementation (construction), maintenance (operation), decommissioning (recycling); aesthetics (quality) **T7 Design objectives (specifications) to satisfy a given set of customer attributes,** Note: Establishing the specifications by defining the problem and producing a solution to satisfy the customer. **T8 Creation of a design plan through solution synthesis by selecting or creating a solution** **T9 Analysis** **T10 Optimization of the proposed solution** **T11 Validations of the resulting design against the customer's needs** **T12 Implementation of the selected design** **T13 Occupational health and safety fundamentals encompassing:** underlying principles of OH&S general aims and objectives of the relevant state or territory legislation relating to OH&S employer and employee responsibilities, rights and obligations major functions of safety committees and representatives powers given to Occupational Health and Safety Inspectors housekeeping and potential hazards in relation to improper housekeeping selecting appropriate personal protective equipment (PPE) given hazardous situations **T14 The work environment encompassing:** typical hazards associated with a range of work environments procedures used to control the risks associated with these hazards principles of risk assessment / management and state the purpose of each hierarchy of OH&S hazard control measures required documentation for risk assessment commonly used workplace safety signs workplace emergencies that pose a threat to health and safety and suitable procedure for an emergency workplace evacuation appropriate fire extinguisher for a given type of fire requirements for the location, mounting and maintenance of portable fire extinguishers basic process of fighting a fire safe premises, buildings and security are important in an industrial setting and the consequences of non- compliance with these standard work procedure is and why they are required in some circumstances **T15 Manual handling encompassing:** typical manual handling injuries and the effect they can have on lifestyle situations that may cause manual handling injuries correct procedures for lifting and carrying to prevent manual handling injuries Chemicals in the workplace encompassing: ○ hazardous substances and dangerous goods ○ Classification of chemicals as hazardous substances and/or dangerous goods. ○ requirements for labelling of chemicals in the workplace ○ safe storage procedures for chemicals ○ purpose of and interpretation of material safety data sheet (MSDS) **T16 Working at heights encompassing:**

Required Skills and Knowledge	dangers associated with working on ladders and scaffolds identification of work area as a height risk and use appropriate safety equipment to prevent a fall selecting an appropriate ladder for a given situation and perform a safety check before use precautions that should be taken when ascending and working off a ladder precautions that should be taken when working on and around a scaffold and elevated platforms **T17 Confined spaces encompassing:** hazards associated with working in a confined space identifying workplace situations that could be classified as a confined space control measures for working in a designated confined space **T18 Physical and psychological hazards encompassing:** short and long term effects of excessive noise and techniques to avoid damage to hearing due to excessive noise effects of vibration on the human body and work practices to protect against vibration effects of thermal stress on the human body and work practices to protect against thermal stress effects of ultraviolet (UV) radiation on the human body and work practices to protect against UV radiation dangers associated with laser operated equipment and tools and suitable protective measures to overcome the danger occupational overuse syndrome, state examples of how it occurs and describe means to overcome it factors that cause stress in the workplace, symptoms of a person suffering from stress and personal stress management techniques detrimental effects and dangers of drug and alcohol use in the workplace **T19 Working safely with electricity encompassing:** effects of electric shock on the human body common causes of electrical accidents precautions that can minimise the chance of electric shock (earthing, extra low voltage, fuses, circuit breakers and residual current devices – RCDs) protection offered by a residual current device (RCD) need for ensuring the (safe) isolation of an electrical supply appropriate method of removing an electric shock victim from a live electrical situation **T20 Life support - CPR in the workplace encompassing:** First Aid. responsibilities of the First Aider, priorities of first aid management for any accident or injury procedures required at an accident scene legal and ethical issues, which may impact on the management of care 'Duty of Care' examination of a casualty for injuries effect of cardio pulmonary arrest on the body Managing simulated conditions of: airway obstruction; respiratory arrest and cardio pulmonary arrest, single and two-person cardio pulmonary resuscitation (CPR) signs and symptoms of an altered level of consciousness management of simulation of a casualty with an altered level of consciousness signs and symptoms of shock management of simulation of a casualty in shock **T21 Risk management and assessment of risk encompassing:** Principle and purpose of risk management, and Processes for conducting a risk assessment T22 Hazards associated with low-voltage, extra-low voltage and high-currents encompassing:

Required Skills and Knowledge	• Parts of an electronic systems and equipment that operate at low-voltage and extra-low voltage, • Parts of an electronic systems and equipment where high-currents are likely. **T23 Risks and control measures associated with high-voltage encompassing:** • Parts of an electronic systems and equipment that operate at high-voltage, • The terms used - 'touch voltage', 'step voltage', 'induced voltage' and 'creepage' as they relate to the hazards of high-voltage, and • Control measures used for dealing with the hazards of high-voltage. **T24 Risks and control measures associated with low voltage encompassing:** • Risks associated with installation, fault finding, maintenance and repair. • Control measures before, while and after working on electronic systems or equipment • Isolation and tagging-off procedures. • Risks and restrictions in working live. • Control measures for working live. **T25 Risks and control measures associated with the high levels of radiation encompassing:** • RF hazards • Maximum exposure levels to RF • Maximum exposure to microwave radiation **T26 Optical fibre safety encompassing:** • Coherent optical sources and joining procedures • Laser safety class 3a devices or their replace **T27 Safety, selection, use, maintenance and care of test equipment encompassing:** • Safety characteristics of electrical testing devices, • Chemical cleaning solvents, glues and joining wastes used in electronics, • Safe use of electrical testing device, and • Checks and storage methods for maintaining the safety of testing devices.
Skill Practice Observations	1. Develop a project brief in consultation with the teacher and students using appropriate planning methods, documentation and language. (1.5% max) 2. Use equipment, tools and practices to develop an engineering design within the context of an electronics/ microprocessor systems project. (1.5% max) 3. Follow engineering design processes to develop a range of design solutions within the context of an electronics/ microprocessor systems project. (1.5% max) 4. Develop a quality design that utilizes standard quality assurance practices and satisfies specifications based on customer attributes. (1.5% max) 5. Create a design plan through solution synthesis by selection or creation of effective design solutions. (e.g. Flow Chart). (1.5% max) 6. Design communications strategies, tools, instruments and practices within the context of an electronics/ microprocessor systems project. (1.5% max) 7. Use project management tools to undertake risk management using standard practices and WHS practices and considerations. (1.5% max) 8. Perform engineering analysis of proposed design solutions to identify improvement strategies for electronics/ microprocessor systems projects. (1.5% max) 9. Employ effective practices relating to project plant, equipment and technologies. (1.5% max) 10. Utilize engineering knowledge to optimize the design solution across a range of design characteristics for electronics/microprocessor systems projects. (1.5% max) 11. Use performance measurement strategies to solve problems and identify corrective measures for electronics/ microprocessor systems projects. (1.5% max) 12. Provide validation of the resulting design against specifications and customer requirements. (1.5% max)

	13. Use interpersonal skills to resolve disputes and conflicts within the context of an electronics/ computer systems project. (1.5% max) 14. Manage implementation of the selected design within the context of an electronics/ computer systems project. (1.5% max)
Work Performances	1. Develop outlines of alternative designs. (2% max) 2. Develop designs within safety, functionality and budget limitations. (2% max) 3. Construct and test prototypes according to design briefs and regulatory requirements. (2% max) 4. Document and present designs effectively. (2% max) 5. Negotiate alterations to the design successfully. (2% max) 6. Obtain approval for the final design. (2% max) 7. Verify compliance of the design against the final brief. (2% max) 8. Deal with unplanned events by drawing on knowledge and skills. (2% max)
Assessment criteria	You will be assessed against the following criteria to establish your competence in the unit: **Event 1:** Write a Project Report that describes the design stages required by the student to write a report for the project assignment of subject UEENEEI156A. The standard format of the Report should be done in a Times New Roman font, size 12 with one inch margins and single line space and no spacing before or after the lines. You will be required to successfully complete all assessments in this unit to demonstrate your competence in this unit.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method.	Assessment date.	Assessment duration.	Assessment venue.	Assessment outcome.
1	Project Report				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience - for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the reference books in Moodle as the main references in particular: 1. *How to write a structured Project Report* Author: Computer Centre and Communication Facility Publisher: http://www.tifr.res.in/~cccf/index.php/services-2 2. *Writing Effective Project Reports* Author: Gordon B. Hazen Publisher: Department of Industrial Engineering and Management Sciences North-western University 3. *How to Write Project Reports*

	Author: Dave Pearce Publisher: University of York You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper scientific calculator USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .

Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

STUDENT ASSESSMENT GUIDE – UNIT OF COMPETENCY

<table>
<tr><td>Qualification</td><td>Engineering Technology – Electrical</td></tr>
<tr><td>Unit of competency</td><td>UEEIC0013 Develop, enter and verify discrete control programs for programmable controllers</td></tr>
<tr><td>Unit Descriptor</td><td>This unit covers development, installation and testing of programs for programmable controllers (PLC) for a system requiring discrete control functions. It encompasses working safely, applying knowledge of control systems, control system development methods, using ladder diagrams/statement list/function block diagram instruction sets, following written instructions and documenting program development and testing activities.</td></tr>
<tr><td>Prerequisites</td><td>UEECD0007 Apply Occupational Health Safety regulations, codes and practices in the workplace</td></tr>
<tr><td>Assessment criteria</td><td>Programmable controllers

Key Areas of Assessment
Software – enter/test /transfer/simulate
Hardware-wiring/safety/Emergency Stops/failsafe
Basic Programming- Examine on/off
Basic Programming Stop/Start
Develop a program from a description
Use Flags / Internals , create Assignment List/symbolic table
Basic Programming – Use Timers
Basic Programming – Use Counter and Comparators
Use Jumps / Blocks / Structured Programming
OH&S – Safety / PLC Safety</td></tr>
<tr><td>Assessment methods</td><td>You will be required to complete all assessments for this unit to demonstrate your competence in this unit:
<table>
<tr><th>Assessment no.</th><th>Assessment method</th><th>Assessment grading</th></tr>
<tr><td>1</td><td>Workplace Simulations (1-4)</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td>2</td><td>Practical Test</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td>3</td><td>Theory Test</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
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<tr><td>Assessment schedule</td><td>You will be assessed for this unit as per the following schedule:
<table>
<tr><th>Assessment no.</th><th>Assessment date</th><th>Assessment venue</th></tr>
<tr><td>1</td><td></td><td>PLC Lab</td></tr>
<tr><td>2</td><td></td><td>PLC Lab</td></tr>
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</table></td></tr>
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Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your result will be recorded and reported to you as **Competent** (AC) or **Not Yet Competent** (NC)". If you have achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you have completed. You will also receive a **Statement of Attainment** for the unit/units you have successfully completed. **Recognition and credit transfers**:you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy.
Resources required for assessments	This unit is assessed using specific resources/tools: You will be provided • access to a simulated environment • access to workplace documents, information and resources (such as compliance obligations, enterprise plans, work responsibilities) You are required to bring in the following for the assessments: N/A
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessmentactivities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment conditions	You must submit assessment work and attended scheduled assessments on the required dates. ○ **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. ○ **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. ○ **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year. ○ **If you engage in cheating**such as copying, colluding with another person, using unauthorised notes, or allowing another personto copy your work, you will be liable for disciplinary action as

	per Student Discipline Policy .Whatever the form of assessment, it is essential that the work you are assessed on is your own. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .
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Contact Details	

STUDENT ASSESSMENT GUIDE – UNIT OF COMPETENCY

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<tr><td>Qualification</td><td>Engineering Technology – Electrical</td></tr>
<tr><td>Unit of competency</td><td>UEEIC0015 Develop, enter and verify word and analogue control programs for programmable logic controllers.</td></tr>
<tr><td>Unit Descriptor</td><td>This unit covers development, installation and testing of programs for an industrial system requiring advance control functions. It encompasses working safely, using structure logic, acceptable design techniques, applying knowledge of high level instructions, and documenting development and programming activities</td></tr>
<tr><td>Prerequisites</td><td>Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf
has/have been confirmed.
UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEI150A Develop, enter and verify discrete control programs for programmable logic controllers</td></tr>
<tr><td>Assessment criteria</td><td>Software – enter/test /transfer/simulate
Use Jumps / Blocks / Structured Programming
Statement List programming
Data manipulation and storage /Data Blocks
Word manipulation – Masking /shifting
Using Functions and re-usable code
Math functions and data manipulation
Indirect Addressing
Analog Value Processing – Scaling , addressing
OH&S – Safety / PLC Safety</td></tr>
<tr><td>Assessment methods</td><td>You will be required to complete all assessments for this unit to demonstrate your competence in this unit:
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</table>

	3		PLC Lab
Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your result will be recorded and reported to you as **Competent** (AC) or **Not Yet Competent** (NC)". If you have achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you have completed. You will also receive a **Statement of Attainment** for the unit/units you have successfully completed. **Recognition and credit transfers**:you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.		
Resources required for assessments	This unit is assessed using specific resources/tools: You will be provided • access to a simulated environment • access to workplace documents, information and resources (such as compliance obligations, enterprise plans, work responsibilities) You are required to bring in the following for the assessments: N/A		
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessmentactivities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.		
Assessment conditions	You must submit assessment work and attended scheduled assessments on the required dates. o **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. o **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. o **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year.		

	If you engage in cheatingsuch as copying, colluding with another person, using unauthorised notes, or allowing another personto copy your work, you will be liable for disciplinary action as per Student Discipline Policy .Whatever the form of assessment, it is essential that the work you are assessed on is your own. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". If you are a student with a disability it is important for you to indicate this on your enrolment form
Assessment: reasonable adjustments	and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy and guidelines.This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.
Contact Details	

STUDENT ASSESSMENT GUIDE – UNIT OF COMPETENCY

Qualification	**Engineering Technology – Electrical**
Unit of competency	UEEIC0014 - **Develop, enter and verify programs in Supervisory Control and Data Acquisition systems**
Unit Descriptor	This unit covers development, installation and testing of programs for supervisory control and data acquisition. It encompasses working safely, process analysis, developing process condition database and Human-Machine Interface (HMI) using SCADA software package and documenting programming activities.
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. UEENEEE101A Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEI150A Develop, enter and verify discrete control programs for programmable logic controllers UEENEEI151A Develop, enter and verify word and analogue control programs for programmable logic controllers.
Assessment criteria	Software – enter/test setup comm's and run project Configure Tags – Variable and Trend Configure at least 5 objects on a graphics page Develop an HMI for a given project/machine Incorporate Alarms and Limits for a process variable Incorporate Trends for a given process Set up security and Users for a project Sample and display data as text and use a genie Rectify operating faults and anomalies OH&S – Safety / SCADA Safety
Assessment methods	You will be required to complete all assessments for this unit to demonstrate your competence in this unit:

Assessment no.	Assessment method	Assessment grading
1	Workplace Simulations (1-3)	[Satisfactory/Not Yet Satisfactory]
2	Theory Test	[Satisfactory/Not Yet Satisfactory]

Assessment schedule	You will be assessed for this unit as per the following schedule:

Assessment no.	Assessment date	Assessment venue
1		PLC Lab

	2		PLC Lab

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your result will be recorded and reported to you as **Competent** (AC) or **Not Yet Competent** (NC)". If you have achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you have completed. You will also receive a **Statement of Attainment** for the unit/units you have successfully completed. **Recognition and credit transfers**:you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.
Resources required for assessments	This unit is assessed using specific resources/tools: You will be provided • access to a simulated environment • access to workplace documents, information and resources (such as compliance obligations, enterprise plans, work responsibilities) You are required to bring in the following for the assessments: N/A
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessmentactivities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment conditions	You must submit assessment work and attended scheduled assessments on the required dates. o **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. o **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. o **For final examinations in Category A or B** (exams that are centrally set and timetabled) you have 10 working days. Your teacher will inform you about the revised examination date which may not be until the following year.

	○ **If you engage in cheating**such as copying, colluding with another person, using unauthorised notes, or allowing another personto copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: ○ where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% ○ when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" ○ for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy and guidelines.This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

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STUDENT ASSESSMENT GUIDE – UNIT OF COMPETENCY

<table>
<tr><td>Qualification</td><td>Engineering Technology – Electrical</td></tr>
<tr><td>Unit of competency</td><td>UEEIC0007 Design and use advanced programming tools PC networks and HMI Interfacing</td></tr>
<tr><td>Unit Descriptor</td><td>This unit covers the design of computer application for control processes. It encompasses apply knowledge of control devices, control systems, programmable logic controllers, supervisory control and data acquisition systems and control programming methods, developing alternative design schemes based on design brief, customer relations and documenting designs</td></tr>
<tr><td>Prerequisites</td><td>Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf
has/have been confirmed.
UEENEEE101A, UEENEEI150A, UEENEEI151A</td></tr>
<tr><td>Assessment criteria</td><td>Software – enter/test /transfer/simulate/System Diagnostics
Control Loops and signal conditioning of field devices/scaling
Methods used to achieve PID control using a PLC
Integral Functions for PID control/applications of PID control
Interrupts and special organisation functions
Requirements when networking/interfacing PLC’s
Setup , test and Verify PLC/SCADA communications (Industrial Networks)
Design a HMI for a workplace simulation.
Verify and test and documentation for PLC/HMI project
OH&S – Safety / PLC Safety</td></tr>
<tr><td>Assessment methods</td><td>You will be required to complete all assessments for this unit to demonstrate your competence in this unit:
<table>
<tr><th>Assessment no.</th><th>Assessment method</th><th>Assessment grading</th></tr>
<tr><td>1</td><td>Workplace Simulations (1-2)</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td>2</td><td>Major Project Workplace Simulation (PLC/HMI)</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
<tr><td>3</td><td>Theory Assignments (1-2)</td><td>[Satisfactory/Not Yet Satisfactory]</td></tr>
</table></td></tr>
<tr><td>Assessment schedule</td><td>You will be assessed for this unit as per the following schedule:
<table>
<tr><th>Assessment no.</th><th>Assessment date</th><th>Assessment venue</th></tr>
<tr><td>1</td><td></td><td>PLC Lab</td></tr>
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	per Student Discipline Policy .Whatever the form of assessment, it is essential that the work you are assessed on is your own. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". If you are a student with a disability it is important for you to indicate this on your enrolment form
Assessment: reasonable adjustments	and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy and guidelines.This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.
Contact Details	

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEEIC0010 - - Develop and test Code for Microcontroller Devices		
Application	This competency standard unit covers structured programming instructions for micro devices at a fundamental level. The unit encompasses working safely, applying knowledge device architecture and programming fundamentals, writing and testing specified instructions and documenting development activities. Note: This unit applies to all aspects of Electro-technology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.		
Prerequisites	**Competencies**: Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. . UEENEEE101A - Apply Occupational Health and Safety regulations, codes and practices in the workplace **Required competencies:** (the following can be done in parallel with main unit) UEENEEH112A - Troubleshoot Digital Subsystems UEENEED111A - Develop, implement and test object oriented code (using C++) **Literary and Numeracy:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing, Legislative or Certification requirements	None		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: **Develop and Test Code for Microcontroller Devices** Evidence shall show an understanding of microcontroller the high-level processor/wiring programming language and as it is applied to embedded engineering applications to an extent indicated by the following aspects: **T1 The Arduino environment: using the embedded microcontroller platform as a whole and the different boards available:** · The power rails. · The chips used · The pin outs		

Required Knowledge & Skills

T2 Install and configure the Arduino IDE and the virtual communication port drivers:

Explanation of the various IDE Windows.
Creation of a template sketch
An introduction to the Arduino programming language
setup()
loop()
variables, constants comments

T3 Create sketches using the parallel port:

Sketch for Blinking an LED
Sketch for Fading an LED
Sketch reading a switches
Sketches using the PWM bits

T4 Create sketches using the serial and analogue port:

Sketches using serial output
Sketches using serial input
Sketches using analogue input

T5 Create sketches to produce sound:

Sketch using a buzzer
Sketch using a microphone

T6 Create sketches for light applications:

Sketch using a phototransistor
Sketch using a photocell
Sketch using an infrared receiving sensor
Sketch using an infrared transmitting sensor
Sketch to respond to the amount of light to turn an LED higher or lower

T7 Create sketches to monitor temperature:

Sketch using a temperature sensor
Sketch using a humidity sensor

T8 Create sketches for applications involving magnetism:

Sketch using a hall effect sensor

T9 Create sketches for tilt detection:

Sketch using an accelerometer

T10 Create sketches that use display modules:

Sketch to display a 7 segment display
Sketch using a LCD display
Sketch using a serial LCD display

T11 Create sketches to control speed:

Sketch using a D.C motor
Sketch using a servo motor
Sketch using a stepper motor

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

Observation of skills in practical exercises and
Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews
Provide written justification for the solutions to problems
Deal with unplanned events by drawing on required skills and knowledge to provide appropriate solutions incorporated in a holistic assessment with the above listed items.

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.
Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:
Successful Performance of the Competency, by meeting the requirements in the Work Performance Specification, and an

Understanding of the required skills and knowledge by meeting the requirements in the Learning Specification/s.

Assessment criteria

You will be assessed against the following criteria to establish your competence in the unit:

Event 1: The Practical Assignment is a hardware project that requires you to build two PCBs. The 1st one is a Car-Jig which emulates the car functions. The 2nd one is a PCB that interfaces the Car-Jig to an Arduino board atMega 2560. The whole assignment is to design an anti-theft car alarm system, based on a state machine design, which includes the following states: armed, unarmed, mobilized, remote-pending, hijacked, pre-armed, arm-pending, alarmed, and silenced. The practical assignment must be fully working to be competent

Event 2: The Programing assignment is based on two programming tasks. The first programming task will test the functionality of the Arduino PCB with the other two PCBs you created. This first task must be fully completed to achieve competency. The second programming task will test the complete car alarm state machine states and must have 7 of the nine states mentioned in event 1 to achieve competency

Event 3: Written Theory Exam in the Arduino Programing Language. Students will be given test to be completed in class containing twenty (20) programming questions, either multiple choice or short answer.

You will be required to successfully complete all 3 events to demonstrate your competence in unit I156A.

Assessment methods & schedule

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Assignment				Satisfactory/Not yet satisfactory
2	Programming Assignment				Satisfactory/Not yet satisfactory
3	Written test				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual
Students don't need to purchase any Learner Resource Manual :

Principal References
It is advised that students have access to the following reference books as the main references:

	Physical Computing: Sensing and Controlling the Physical World with Computers. Author: *Tom Igoe and Dan O'Sullivan* Publisher: *Course Technology, 2004* *Getting Started with Arduino* Author: *Massimo Banzi* Publisher: *Make Books, 2008* *Arduino programming Notebook, 2nd Ed.* Author: *Brain W. Evans.* Publisher: *Creative Commons, 2008* You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper • scientific calculator • hooking Wire single core AWG 22 (Hartland Cables P/N HC0069) USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply:

	• where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
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Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UETTDRIS67A Solve problems in energy supply network equipment		
Application	This unit covers evaluating energy used in buildings and developing and documenting strategies/methods to effectively reduce energy use without compromising occupancy standards. It encompasses working safely, setting up and conducting evaluation measurements and evaluating energy use from measured parameters. . . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. Common Unit Group Unit Code — Unit Title UEENEEE101A — Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE102A — Fabricate, assemble and dismantle utilities industry components UEENEEE104A — Solve problems in d.c. Circuits UEENEEE105A — Fix and secure electrotechnology equipment UEENEEE107A — Use drawings, diagrams, schedules, standards, codes and specifications UEENEEG101A — Solve problems in electromagnetic devices and related circuits UEENEEG102A — Solve problems in low voltage a.c. Circuits UEENEEG006A — Solve problems in single and three phase low voltage machines UEENEEG106A — Terminate cables, cords and accessories for low voltage circuits		
Licensing,	1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. 2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.		
	You will be assessed to prove your competence in the required skills and knowledge below: . Electricity supply and reticulation		

Required Knowledge & Skills

Evidence shall show an understanding of electricity supply and reticulation systems to an extent indicated by the following aspects:

T1 Generation encompassing:

- primary energy sources
- power stations
- power station output
- acts and legislation relating to generation
- renewable energy sources and techniques

T2 Transmission encompassing:

- system requirements
- principal components of a power system
- voltage levels
- grid systems
- acts/legislation relating to transmission
- future trends

T3 Distribution encompassing:

- high voltage distribution systems
- medium/low voltage distribution systems
- radial feeders
- parallel feeders
- ring main feeders
- acts/legislation relating to distribution

T4 Substations encompassing:

- purpose
- location
- layout

T5 Overhead and underground systems encompassing:

- relative merits

Required Knowledge & Skills

applications

- planning
- installation

T6 Power distribution system electrical characteristics encompassing:

- transmission and distribution systems
- inductance, capacitance and resistance

T7 Voltage problems in a power distribution system encompassing:

- low voltage
- unbalanced voltages
- voltage rises

T8 Voltage regulation encompassing:

- autotransformers with OLTC
- transformers with OLTC
- static capacitors
- load control

T9 Control of OLTC encompassing:

- regulation relays
- control circuits
- line drop compensation

T10 Power distribution system faults encompassing:

- type/classification of fault
- typical causes/effects of faults
- three-phase symmetrical fault levels
- fault level limitation

T11 Voltage surges in a power distribution system encompassing:

- lightning surges
- switching surges
- typical surge levels
- surge impedance, typical values
- significance of the system surge impedance.

T12 Metering and metered quantities encompassing:

- purpose
- energy
- maximum demand
- accuracy classes for metering systems

T13 Energy and demand meters encompassing:

construction
- operation
- adjustments
- testing

T14 Metering circuits encompassing:
- direct metering
- instrument transformer metering

T15 Electronic metering systems and recording meters encompassing:
- types
- applications
- connections

T16 Load control encompassing:
- purpose
- methods

Assessment criteria

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
  - Demonstrate an appropriate level of skills enabling employment

- Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Applying OHS practices in the workplace as described in 8) and including:
  a. Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.
  b. Understanding and following risk control safe work methods.
  c. Applying work procedures and instructions as they apply to risk control measures.
  d. Dealing with accidents and emergencies within the scope of responsibility.
  e. Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
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Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: • Generation, Transmission and Utilization of Electrical Power By AT Starr • Basic Training Manual 16-12 Electrical Trades-Cable, conduits, busbar • Trades-Cable, conduits, busbar Some components of Learning outcome 3 • Electrical Distribution Engineering (2nd Ed) by Anthony j Pansini, The Fairmont Press Inc 1991 • Electrical Power Distribution & Transmission by Luceson Faulkenberry & walter Coffer , Prentice Hall, 1996 • Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972 • Site Surveying & Levelling By John Clancy + Internet downloaded article-Software package for line route survey • +Transmission line mechanical design • Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972 Australian Standards AS 1026, 1023, 1034, 1042,1078,1117,1158,1190,1202, 1220,1222,1243, 1284, 1359,1360,1469,1531,1675,1680,1746,1767,1768,1798,1824,1883,1930,1931, 2005,2006,2184,2209,2263,2264,2326,2374,2421,3000,3116,3274 You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: • pens, pencils, notepaper, soft rubber eraser • scientific calculator Casio fx-100AU PLUS • USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request. .
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.

	If you miss an exam, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UETTDRIS68A Solve problems in energy supply network protection equipment and systems		
Application	This unit covers determining correct operation of energy supply network protection equipment and systems and providing solutions as they apply to energy supply network protection. It encompasses working safely, reading circuit and reticulation diagrams, applying logical problem solving processes from measurements and completing the necessary documentation.		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. Common Unit Group Unit Code — Unit Title UEENEEE101A — Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE102A — Fabricate, assemble and dismantle utilities industry components UEENEEE104A — Solve problems in d.c. Circuits UEENEEE105A — Fix and secure electrotechnology equipment UEENEEE107A — Use drawings, diagrams, schedules, standards, codes and specifications UEENEEG101A — Solve problems in electromagnetic devices and related circuits UEENEEG102A — Solve problems in low voltage a.c. Circuits UEENEEG006A — Solve problems in single and three phase low voltage machines UEENEEG106A — Terminate cables, cords and accessories for low voltage circuits UETTDRIS67A Solve problems in energy supply network equipme		
Licensing,	1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. 2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.		
	You will be assessed to prove your competence in the required skills and knowledge below:		

Required Knowledge & Skills	. KS01-TIS68A Electrical power system protection Evidence shall show an understanding of protection methods and devices for electrical power systems to an extent indicated by the following aspects: T1 Protection fundamentals encompassing: purpose of protection features of a protection scheme T2 Instrument transformers for protection encompassing: Operating principles Applications of current transformers Applications of voltage transformers T3 Feeder protection encompassing: fuse protection overcurrent & earth fault sensitive earth fault unit schemes distance protection trip/close sequences for feeders recloser/sectionaliser systems T4 Transformer protection encompassing: overheating protection overcurrent protection restricted earth fault protection differential protection oil and gas devices T5 Busbar protection encompassing: types of fault requirements of busbar protection system protection frame-earth protection T6 Surge protection encompassing: voltage surges surge diverters arcing horns
Required Knowledge & Skills	
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in

accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

0 Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement

1 Apply sustainable energy principles and practices as specified in the performance criteria and range statement

2 Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

3 Demonstrate an appropriate level of skills enabling employment

4 Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

0 Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

Observation of skills in practical exercises and

Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes	Your Transcript of Academic Record lists all of your results in your study to date. "This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**". If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process. **Recognition and credit transfers:** you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy. Please see Recognition for previous learning and experience - for further information.
Resources required for assessments	This unit is assessed using specific resources/tools: **Learner Resource Manual** Students don't need to purchase any Learner Resource Manual : **Principal References** It is advised that students have access to the following reference books as the main references: • Generation, Transmission and Utilization of Electrical Power By AT Starr • Basic Training Manual 16-12 Electrical Trades-Cable, conduits, busbar • Trades-Cable, conduits, busbar Some components of Learning outcome 3 Electrical Distribution Engineering (2nd Ed) by Anthony j Pansini, The Fairmont Press Inc 1991 Electrical Power Distribution & Transmission by Luceson Faulkenberry & walter Coffer , Prentice Hall, 1996 Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972 Site Surveying & Levelling By John Clancy + Internet downloaded article-Software package for line route survey +Transmission line mechanical design • Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972 • Arts & Science of Protective Relaying By Stevenson • Power Protection Course Notes from various Technological Universities Australian Standards AS 1026, 1023, 1034, 1042,1078,1117,1158,1190,1202, 1220,1222,1243, 1284, 1359,1360,1469,1531,1675,1680,1746,1767,1768,1798,1824,1883,1930,1931, 2005,2006,2184,2209,2263,2264,2326,2374,2421,3000,3116,3274 You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS USB memory Stick

Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • . • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UETTDRIS69A Diagnose and rectify faults in energy supply apparatus		
Application	This unit covers diagnosing and rectifying faults in apparatus in energy supply and distribution systems. The unit encompasses safe working practices, interpreting diagrams and technical data, applying knowledge of energy supply apparatus to logical fault finding processes, implementing fault rectification, safety and functional testing and reporting work activities and outcomes . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. Common Unit Group Unit Code — Unit Title UEENEEE101A — Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE102A — Fabricate, assemble and dismantle utilities industry components UEENEEE104A — Solve problems in d.c. Circuits UEENEEE105A — Fix and secure electrotechnology equipment UEENEEE107A — Use drawings, diagrams, schedules, standards, codes and specifications UEENEEG101A — Solve problems in electromagnetic devices and related circuits UEENEEG102A — Solve problems in low voltage a.c. Circuits UEENEEG006A — Solve problems in single and three phase low voltage machines UEENEEG106A — Terminate cables, cords and accessories for low voltage circuits UETTDRIS67A Solve problems in energy supply network equipme UETTDRIS68A Solve problems in energy supply network protection equipment and systems		
Licensing,	1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.		

2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.

You will be assessed to prove your competence in the required skills and knowledge below:

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Required Knowledge & Skills

KS01-TIS69A Electrical power system operations

Evidence shall show an understanding of electrical power system operations to an extent indicated by the following aspects:

T1 Control of voltage encompassing:

Conditions leading to voltage collapse and system disintegration.

Effects on the system of high/low volts

Voltage control devices - voltage regulators applied to generators and synchronous phase modifiers, electromagnetic voltage regulators, series and parallel capacitors, OLTC transformers and static Var compensations (SVCs) such as saturated reactor compensations (SRs), thyristor controlled reactor compensators (TCRs), combined TCR/TSCs and the production of wave-form distorting harmonics and control devices.

T2 The importance of the location in the system of voltage control devices.

T3 The use of graphical methods to calculate the size of VAr regulating plant.

T4 Control of power encompassing:

Base load and spinning reserve

Regulating machines

Rapid start plant,

Phase shifting transformers and various forms of load shedding.

Principles and practices of automated control of individual machines

Stations and transmission/tie-line elements.

Synchronising power

T5 The relationship between power and frequency encompassing:

Limiting values

Machine stabilising - steam by-pass, rapid valving, slip stabilisers and over speed limiting.

Use of single pole generator CB's.

Use of machine AVR's as angular stabilisers.

Damped and un-damped system oscillations.

Relationship between fault clearance times and system stability.

Calculation of critical clearance angles based on equal area criteria.

Required Knowledge &

Skills

Assessment criteria

Before the critical aspects of evidence are considered all prerequisites must be met.

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.

Demonstrate an appropriate level of skills enabling employment

Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures.

Demonstrated consistent performance across a representative range of contexts from the prescribed items below:

Applying OHS practices in the workplace as described in 8) and including:

Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

Understanding and following risk control safe work methods.

Applying work procedures and instructions as they apply to risk control measures.

Dealing with accidents and emergencies within the scope of responsibility.

Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge (KS01-H115A)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome

	1	Practical Test				Satisfactory/Not yet satisfactory
	2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experienceE for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

Generation, Transmission and Utilization of Electrical Power By AT Starr

Basic Training Manual 16-12 Electrical Trades-Cable, conduits, busbar

- Trades-Cable, conduits, busbar Some components of Learning outcome 3

Electrical Distribution Engineering (2nd Ed) by Anthony j Pansini, The Fairmont Press Inc 1991

Electrical Power Distribution & Transmission by Luceson Faulkenberry & walter Coffer , Prentice Hall, 1996

Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972

Site Surveying & Levelling By John Clancy + Internet downloaded article-Software package for line route survey

- +Transmission line mechanical design

- Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972
- Arts & Science of Protective Relaying By Stevenson
- Power Protection Course Notes from various Technological Universities

Australian Standards

AS 1026, 1023, 1034, 1042,1078,1117,1158,1190,1202, 1220,1222,1243, 1284, 1359,1360,1469,1531,1675,1680,1746,1767,1768,1798,1824,1883,1930,1931,

2005,2006,2184,2209,2263,2264,2326,2374,2421,3000,3116,3274

You will also be provided with

Access to a simulated environment containing information similar to that which you may encounter in a workplace.

Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

	pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • . • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems		
Application	This unit covers diagnosing and rectifying faults in electrical energy transmission systems. The unit encompasses safe working practices, interpreting diagrams and technical data, applying knowledge of energy supply and transmission systems to logical fault finding processes, implementing fault rectification, safety and functional testing and reporting work activities and outcomes. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. Common Unit Group Unit Code — Unit Title UEENEEE101A — Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE102A — Fabricate, assemble and dismantle utilities industry components UEENEEE104A — Solve problems in d.c. Circuits UEENEEE105A — Fix and secure electrotechnology equipment UEENEEE107A — Use drawings, diagrams, schedules, standards, codes and specifications UEENEEG101A — Solve problems in electromagnetic devices and related circuits UEENEEG102A — Solve problems in low voltage a.c. Circuits UEENEEG006A — Solve problems in single and three phase low voltage machines UEENEEG106A — Terminate cables, cords and accessories for low voltage circuits UETTDRIS67A Solve problems in energy supply network equipme UETTDRIS68A Solve problems in energy supply network protection equipment and systems UETTDRIS69A Diagnose and rectify faults in energy supply apparatus		
Licensing,	1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control and		

	lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: . KS01-TIS71A Electrical power system transmission faults Evidence shall show an understanding of electrical power system transmission faults to an extent indicated by the following aspects: T1 Overview of the transmission system including lines, buses, transformers and cables. Line/bus layouts including single and double switching, breaker and a half systems and HV crossing methods. T2 The principles involved in high voltage a.c. transmission including tower types and configurations, choice of towers or poles (economic and environmental), insulator types and configuration, types of conductors, their configuration and standard nomenclature. Typical line spacing and ground clearances. Line ratings based on ambient temperature. Conductor terminating and clamping equipment including vibration damping principles and equipment. T3 The principles involved in d.c. transmission including the economics, harmonic generation, VAR requirements and protection difficulties. Types of connections and transformer requirements. Advantages and disadvantages of d.c. transmission. Typical overseas systems. Likely (future) use in this country. T4 The principles of operation, voltage and current range, breaking capacity and field of use of the following types of circuit breakers. bulk oil small oil volume air break air blast air puffer vacuum and SF6 (double pressure and puffer types). T5 The types of isolators in use. Examples include duo-roll, blade and scissor type. T6 Circuit breaker auxiliary systems including: high pressure air systems and air storage and handling processes d.c. systems including battery types, charging and protection systems and earth fault detection systems SF6 conditioning, storage and handling system T7 The characteristics of lines and cables including the calculation of R, X and B for different arrangements of conductor. Typical values for actual lines. Transposition. Models based on line length. Voltage and line regulation. The transmission of power (P) and VARs (Q). T8 Control of voltage. Conditions leading to voltage collapse and system disintegration. Effects on the system of high/low volts. Voltage control devices including: voltage regulators applied to generators and synchronous phase modifiers electromagnetic voltage regulators series and parallel capacitors OLTC transformers and static Var compensations (SVCs) T9 Range of devices covered by SVCs including: saturated reactor compensations (SRs) thyristor controlled reactor compensators (TCRs) combined TCR/TSCs and production of wave-form distorting harmonics and control devices T10 Importance of the location in the system of voltage control devices T11 Use of graphical methods to calculate the size of VAr regulating plant T12 Types of communication systems including telephone, power line carrier, dedicated cable, micro-wave links and fibre optics. Quantities and signals to be communicated. Advantages and disadvantages of the various systems. Equipment requirements
Required Knowledge & Skills	

	T13 Transient over-voltages in power systems. Switching and lightning overvoltages and their effect on different plant items. Transient over-voltage control and reduction using surge diverters, shield wires and CB are control. Insulation systems, insulation co-ordination, insulation grading in plant items, bushings and capacitor bushings T14 Factors leading to the generation of corona. Consequences of corona. Reduction of corona including conductor bundling, grading rings and conductor surface treatment
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement Apply sustainable energy principles and practices as specified in the performance criteria and range statement • Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. Demonstrate an appropriate level of skills enabling employment Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures. Demonstrated consistent performance across a representative range of contexts from the prescribed items below: Applying OHS practices in the workplace as described in 8) and including: Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively. Understanding and following risk control safe work methods. Applying work procedures and instructions as they apply to risk control measures. Dealing with accidents and emergencies within the scope of responsibility.

e. Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge)***, by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to IQY TECHICAL COLLEGE Recognition Policy.

Please see Recognition for previous learning and experience for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

- Generation, Transmission and Utilization of Electrical Power By AT Starr
- Basic Training Manual 16-12 Electrical Trades-Cable, conduits, busbar
- Trades-Cable, conduits, busbar Some components of Learning outcome 3

	Electrical Distribution Engineering (2nd Ed) by Anthony j Pansini, The Fairmont Press Inc 1991 Electrical Power Distribution & Transmission by Luceson Faulkenberry & walter Coffer , Prentice Hall, 1996 Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972 Site Surveying & Levelling By John Clancy + Internet downloaded article-Software package for line route survey +Transmission line mechanical design Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972 Arts & Science of Protective Relaying By Stevenson Power Protection Course Notes from various Technological Universities Australian Standards AS 1026, 1023, 1034, 1042,1078,1117,1158,1190,1202, 1220,1222,1243, 1284, 1359,1360,1469,1531,1675,1680,1746,1767,1768,1798,1824,1883,1930,1931, 2005,2006,2184,2209,2263,2264,2326,2374,2421,3000,3116,3274 You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. . **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable

	for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UETTDRIS73A Develop engineering solutions for energy supply power transformer problems		
Application	This unit covers diagnosing and rectifying faults in electrical energy transmission systems. The unit encompasses safe working practices, interpreting diagrams and technical data, applying knowledge of energy supply and transmission systems to logical fault finding processes, implementing fault rectification, safety and functional testing and reporting work activities and outcomes. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. Common Unit Group Unit Code — Unit Title UEENEEE101A — Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE102A — Fabricate, assemble and dismantle utilities industry components UEENEEE104A — Solve problems in d.c. Circuits UEENEEE105A — Fix and secure electrotechnology equipment UEENEEE107A — Use drawings, diagrams, schedules, standards, codes and specifications UEENEEG101A — Solve problems in electromagnetic devices and related circuits UEENEEG102A — Solve problems in low voltage a.c. Circuits UEENEEG006A — Solve problems in single and three phase low voltage machines UEENEEG106A — Terminate cables, cords and accessories for low voltage circuits UETTDRIS67A Solve problems in energy supply network equipme UETTDRIS68A Solve problems in energy supply network protection equipment and systems UETTDRIS69A Diagnose and rectify faults in energy supply apparatus UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems		
Licensing,	1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder		

operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.

Required Knowledge & Skills

You will be assessed to prove your competence in the required skills and knowledge below:

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KS01-TIS73A Power transformers diagnostics

Evidence shall show an understanding of power transformers to an extent indicated by the following aspects:

T1 Transformer construction and operating principles encompassing:

- various types of lamination style and core construction used in single phase, three phase, double wound and auto transformers.
- different winding styles/types used in transformers.
- how input current is limited on no load and how power is transferred from primary to secondary when a load is connected.
- using the transformation ratio to determine an unknown quantity of V, I, VA.
- significance of nameplate data items.
- operation of a transformer under load/no load conditions.
- the reason any particular type of transformer is used in a specific application.
- safety features specified in regulatory standards with respect to transformers.
- safety features specified in regulatory standards with respect to isolating transformers.
- basic insulation resistance, continuity and winding identification tests.

T2 Transformer parameters encompassing:

- the percentage impedance of a transformer by test.
- percentage impedance of a transformer by calculation.
- the equivalent circuit of a transformer.
- calculation of voltage regulation.
- losses that occur in a transformer.
- tests to determine losses.
- efficiency and state typical values.
- the all day efficiency of a transformer.

T3 Cooling methods encompassing:

- methods of natural and forced cooling.
- properties of transformer oil.
- tests performed on transformer oil.
- auxiliary equipment
- the purpose and operation of the types of auxiliary equipment used on transformers - bushings, explosion vents, surge diverters, tap changers, conservator, breathers and desiccants, gas relays, temperature indicators.

Required Knowledge & Skills

T4 Instrument transformers encompassing:

- construction of current transformers.
- uses and ratings of current transformers.
- construction of voltage transformers.
- uses and ratings of voltage transformers.
- safety techniques when using instrument transformers.

T5 Transformer connections encompassing:

- vector group of a transformer from a connection diagram.
- connections of a three-phase transformer to create a particular vector group.
- reasons for using the different vector groups.
- purpose of tertiary windings.
- consequences/effect of an incorrect connection

T6 Parallel operation encompassing:

- polarity markings for the windings of a transformer.

	conditions/restrictions for parallel operation of transformers. calculation of loading on transformers operating in parallel. connection of transformers in parallel to supply a common load. the consequences/effect of an incorrect connection. T7 Harmonics in transformers encompassing: how harmonics are generated in transformers. problems caused by harmonics in transformers. measurement of the harmonics in a transformer. methods/equipment used to overcome harmonics in transformers. T8 High voltage isolation encompassing: the term high voltage. procedures for isolating high voltage apparatus. regulations with respect to access permits. clearances to be observed with respect to high voltages up to 33 kV. the term 'step' and 'touch' potential.
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: • A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: • Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement • Apply sustainable energy principles and practices as specified in the performance criteria and range statement • Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. Demonstrate an appropriate level of skills enabling employment Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures. Demonstrated consistent performance across a representative range of contexts from the prescribed items below: Applying OHS practices in the workplace as described in 8) and including: Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively. Understanding and following risk control safe work methods. Applying work procedures and instructions as they apply to risk control measures. Dealing with accidents and emergencies within the scope of responsibility. Participation in consultation processes, identifying hazards and implementing and monitoring control measures. Dealing with unplanned events
Assessment methods &	Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

schedule

- Observation of skills in practical exercises and

- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

2. ***Understanding of the required skills and knowledge*** by meeting the requirements in the Learning Specification/s.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Practical Test				Satisfactory/Not yet satisfactory
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Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

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Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - E for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

- Electrical Machines, Drives & Power Transformers
- IQY TECHICAL COLLEGE Module Resources Power Transformer
- Generation, Transmission and Utilization of Electrical Power By AT Starr
- Basic Training Manual 16-12 Electrical Trades-Cable, conduits, busbar
- Trades-Cable, conduits, busbar Some components of Learning outcome 3
- Electrical Distribution Engineering (2nd Ed) by Anthony j Pansini, The Fairmont Press Inc 1991
- Electrical Power Distribution & Transmission by Luceson Faulkenberry & walter Coffer , Prentice Hall, 1996
- Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972

	Site Surveying & Levelling By John Clancy + Internet downloaded article-Software package for line route survey +Transmission line mechanical design Electrical Power Transmission System-By R Robert Eata & Edward Cohen , Prentice Hall, 1972 Arts & Science of Protective Relaying By Stevenson Power Protection Course Notes from various Technological Universities Australian Standards AS 1026, 1023, 1034, 1042,1078,1117,1158,1190,1202, 1220,1222,1243, 1284, 1359,1360,1469,1531,1675,1680,1746,1767,1768,1798,1824,1883,1930,1931, 2005,2006,2184,2209,2263,2264,2326,2374,2421,3000,3116,3274 You will also be provided with Access to a simulated environment containing information similar to that which you may encounter in a workplace. Access to computer systems for real time assessments sufficient to enable participation in the assessment process. **Other Resources** To complete this unit successfully you should bring the following equipment to class with you: pens, pencils, notepaper, soft rubber eraser scientific calculator Casio fx-100AU PLUS USB memory Stick
Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
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	considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UETTDRIS74A Develop engineering solutions for energy supply system protection problems		
Application	This unit covers diagnosing and rectifying faults in electrical energy transmission systems. The unit encompasses safe working practices, interpreting diagrams and technical data, applying knowledge of energy supply and transmission systems to logical fault finding processes, implementing fault rectification, safety and functional testing and reporting work activities and outcomes. . .		
Prerequisites	Granting competency in this unit shall be made only after competency in the following unit(s) or their superseded units in UEE20 Training Package as per mapping table http://www.highlightcomputer.com/UEE11-20Mapping.pdf has/have been confirmed. Common Unit Group Unit Code — Unit Title UEENEEE101A — Apply Occupational Health and Safety regulations, codes and practices in the workplace UEENEEE102A — Fabricate, assemble and dismantle utilities industry components UEENEEE104A — Solve problems in d.c. Circuits UEENEEE105A — Fix and secure electrotechnology equipment UEENEEE107A — Use drawings, diagrams, schedules, standards, codes and specifications UEENEEG101A — Solve problems in electromagnetic devices and related circuits UEENEEG102A — Solve problems in low voltage a.c. Circuits UEENEEG006A — Solve problems in single and three phase low voltage machines UEENEEG106A — Terminate cables, cords and accessories for low voltage circuits UETTDRIS67A Solve problems in energy supply network equipme UETTDRIS68A Solve problems in energy supply network protection equipment and systems UETTDRIS69A Diagnose and rectify faults in energy supply apparatus UETTDRIS71A Diagnose and rectify faults in electrical energy supply transmission systems		
Licensing,	1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder		

	operated fixing tools, power operated tools, vehicles, road signage and traffic control and lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: . KS01-TIS74A Electrical power system protection diagnostic Evidence shall show an understanding of diagnosing faults in electrical power system protection to an extent indicated by the following aspects: T1 Protection scheme requirements encompassing: Requirements of a protection scheme - relationship to primary system design, purpose of protection, safety of persons, protection of plant, system instability, system break up, loss of customers, loss of revenue, protection zones, restricted schemes, unrestricted schemes, duplicate protection, local backup protection, remote backup protection, selectivity, discrimination, stability, sensitivity, reliability Components of a protection scheme - current transformers, potential transformers, summation current transformers, interposing transformers, multi-tapped transformers, all-or-nothing relays, induction relays, balanced beam relays, directional relays, biased relays, solid state relays, microprocessor based relays, gas relays, thermal sensors, hardwired communication, powerline carriers systems, microwave systems, fibre optic systems, need for isolation, need for interfacing Protection applied to buses - overload, differential, earth leakage, structure leakage, combined schemes, protection overlap Protection applied to transformers - biased differential, gas, winding temperature, oil temperature Protection applied to single/radial lines - overcurrent, earth leakage, slow earth leakage, distance, auto reclose, sectionalising, over voltage Protection applied to interconnected lines - overcurrent, pilot wire, directional, directional overcurrent, current differential, phase comparison, current comparison, distance, impedance, admittance, offset T2 Discrete protection systems encompassing: Earth fault protection - master earth leakage schemes, sensitive earth fault relays and schemes, residual earth fault scheme, core balance earth fault scheme, frame/structure earth leakage scheme, time graded discrimination, backup protection Overcurrent protection - feeder overcurrent protection, instantaneous overcurrent schemes, inverse timed overcurrent schemes, types and location of components of an overcurrent scheme, CT summation, time graded discrimination, backup protection
Required Knowledge & Skills	Alarms and controls - auxiliary relays, voltage regulating relays, line drop compensation, gas relay types, gas relay scheme operation and setting, over temperature schemes T3 Interdependent protection systems encompassing: Overcurrent and earth leakage intertripping, interlocking and blocking - logic mapping, master control, electromechanical, electronic, shading coils Pilot wire, phase comparison - opposed voltage schemes, circulating current schemes, location of components of a scheme, pilot supervisory techniques, Load shedding, voltage control, parallel operation, load rejection CB failure protection Reclose systems - applications, single shot, multishot, blocking schemes, synchronisation checking T4 Complex protection systems encompassing: Distance - characteristics, electromechanical, electronic, impedance, mho, offset mho, switched schemes, non-switched schemes, blocking schemes, bus zone

	Differential, transformer differential, bus overcurrent - principles, feeder protection, transformer protection, bias systems, harmonic restraint, CT connections, bus protection, low impedance schemes, high impedance schemes, bus overcurrent schemes, generator protection, CT connections, special considerations, digital systems Types of revenue metering Applications of SCADA Complex protection systems for communications Harmonic control Point on wave switching
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement • Apply sustainable energy principles and practices as specified in the performance criteria and range statement Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. Demonstrate an appropriate level of skills enabling employment Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures. Demonstrated consistent performance across a representative range of contexts from the prescribed items below: Applying OHS practices in the workplace as described in 8) and including: Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively.

b. Understanding and following risk control safe work methods.
c. Applying work procedures and instructions as they apply to risk control measures.
d. Dealing with accidents and emergencies within the scope of responsibility.
e. Participation in consultation processes, identifying hazards and implementing and monitoring control measures.

Dealing with unplanned events

Assessment methods & schedule

Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff:

- Observation of skills in practical exercises and
- Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews

You will be required to complete all assessments for this unit to demonstrate your competence in this unit.

Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's:

1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an

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Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
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Resources required for assessments

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Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

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Assessment feedback, review or appeals	Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted. If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher. You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
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Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	Advanced Diploma of Engineering Technology - Electrical Advanced Diploma of Electrical Engineering Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEERE0013 Sustainability in the Energy Sector		
Application	This unit covers developing strategies to address environmental and sustainability issues in the energy sector. It encompasses working safely, apply extensive knowledge of sustainable energy systems and components and their operating parameters, gathering and analysing data, applying problem solving techniques, developing and documenting alternatives solutions.		
Prerequisites	None **Literary and Numeracy:** Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 "Literacy and Numeracy"		
Licensing, Legislative or Certification requirements	None		
Required Skills & Knowledge	All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies. You will be assessed to prove your competence in the required skills and knowledge below: **Sustainability in the Energy Sector** Evidence shall show an understanding of greenhouse reduction strategies to an extent indicated by the following aspects: T1 Principles of sustainability encompassing: • ways in which ecosystems moderate climate. • ways in which ecosystems purify and store water. • ways in which ecosystems recycle waste. T2 Problems in a sustainable world encompassing: • changes to Australian forest cover since white settlement, and the resulting loss of ecosystem and human benefits. • changes to Australia's soils since white settlement, and the resulting loss of ecosystem and human benefits. • changes to Australia's waterways since white settlement, and the resulting loss of ecosystem and human benefits. • place of environmental accounting in quantifying Australia's environmental losses. • limits to Australia's population carrying capacity. T3 Sustainability principles encompassing: • principles within sustainability including: environmental accounting and economies; full cost pricing; triple bottom line ethic; ecologically sustainable development; greenhouse		

Required Skills & Knowledge	gas abatement; energy efficiency; resource and water use efficiency; life cycle costing; renewable energy substitution, cleaner production; waste minimisation, reuse and recycling; ecological footprint. T4 Addressing the problem of global warming encompassing: • greenhouse gases and their sources and quantities that contribute to global warming • global warming impacts for Australia for 2030 and 2070 predicted by CSIRO modelling. • requirements to achieve stable atmospheric concentrations of greenhouse gases. • ecologically and economically sustainable methods for achieving these stable concentrations. T5 Greenhouse gas emissions profile encompassing: • goals and principles of the National Greenhouse Strategy • what a greenhouse gas inventory is, why it is required, and the sectors to which it applies • uses to which the National Greenhouse Gas Inventory can be applied. T6 Understanding and communicating climate change and its impacts encompassing: • the possible impact of climate change in Australia. • techniques for improving the understanding of climate change • techniques for communicating to and educating the general public on greenhouse gas induced climate change. T7 Partnerships for greenhouse action encompassing: • actions achievable by each level of government to implement the NGS. • methods by which the community activity can be engaged in the reduction of greenhouse gas emissions. • initiatives that can be undertaken by the private sector to reduce greenhouse gas emissions. • advantages of international partnerships. • emissions trading system. T8 Efficient and sustainable energy use and supply encompassing: • techniques for reducing the greenhouse intensity of energy supply. • types of renewable energy sources suitable for use in Australia. • methods and technique for improving end-use efficiency. T9 Efficient transport and sustainable urban planning encompassing: • how integrating land use and transport planning can assist the greenhouse problem. • how each of the following can be used to mitigate greenhouse gas; travel demand and traffic management strategies; encouraging greater use of public transport, walking and cycling; freight and logistics systems; improving vehicle fuel efficiency and fuel technologies T10 Greenhouse sinks and sustainable land management encompassing: • how enhancing greenhouse sinks and encouraging sustainable forestry and vegetation management can complement the AGS. • how greenhouse gas emissions are obtained from agricultural production and describe techniques to mitigate the emissions. T11 Models of greenhouse best practice in industrial processes and waste management encompassing: • types and methods of reducing greenhouse gas emissions from industry. • methods of reducing methane emissions from waste treatment and disposal. T12 Adaptation to climate change encompassing: • salient points in each of the key sectors that require analysis and the strategies required in the need for adaptation to climate change
Assessment criteria	Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's: 1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an 2. ***Understanding of the required skills and knowledge*** *(**KS01-EE082A**)*, by meeting the requirements in the Learning Specification/s. You will be assessed against the following criteria to establish your competence in the unit: **Event 1:** Assignment 1. A full report based on topics T1 to T7, T10 to T12..

Assessment methods & schedule

Event 2: Assignment 2. A full report based on topics T8 and T9.

Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
1	Assignment 1				S/NS
2	Assignment 2				S/NS

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as Competent **(AC)** or Not Yet Competent **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed.

A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience - for further information.

Resources required for assessments

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

You will have three weeks from the date you receive your results in which to make an appeal and request a review.

You will receive a response within **ten working days** after receipt of the request.

Assessment guidelines

You must submit assessment work and attended scheduled assessments on the required dates.

- **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first.
- **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit.
- **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information.
- **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate

	the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent". .
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher Contact Details		

Student Assessment Guide (Unit of Competency)

(Streamlined Training Package)

Faculty		**College**	
Teaching Section	Electrical Engineering		
Qualification Number and Name	- Advanced Diploma of Electrical Engineering - Advanced Diploma of Engineering Technology - Electrical - Advanced Diploma of Engineering Technology - Electronics		
Unit of Competency Number and Name	UEERE0012 Develop effective engineering strategies for energy reduction		
Application	This unit covers evaluating energy used in buildings and developing and documenting strategies/methods to effectively reduce energy use without compromising occupancy standards. It encompasses working safely, setting up and conducting evaluation measurements and evaluating energy use from measured parameters. . . .		
Prerequisites	Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed: UEENEEK132A Develop strategies to address environmental and sustainability issues in the energy sector		
Licensing,	Neither Legislative licensing nor Certification licensing requirements are needed		
Required Knowledge & Skills	You will be assessed to prove your competence in the required skills and knowledge below: . **Energy efficient building design** Evidence shall show an understanding of energy efficient building design to an extent indicated by the following aspects: T1 Climate and thermal comfort encompassing: characteristics of the different Australian climatic types. use of climatic data in published and electronic forms to extract the quantities relevant to energy efficient design. relationship between climate and comfort using bioclimatic or psychrometric charts. calculation of heating or cooling degree days or degree hours for various locations. calculation of thermal neutrality for a given location. T2 Solar geometry and radiation encompassing: definition of the terms: declination, hour angle, zenith angle, azimuth and altitude angles, the equation of time. conversion of solar time to local time and vice versa. position of the sun and the length of shadows with the aid of algorithms, tables, sun charts or computer software. daily irradiation incident on a wall, window or roof of a given tilt and orientation. relative summer and winter irradiation of windows facing the cardinal orientations. T3 Heat transfer encompassing: thermal processes of conduction, convection and radiation apply to the transfer of heat in buildings.		

Required Knowledge & Skills

- calculation of the summer and winter U-values of building elements using tables and software.
- calculation of the infiltration heat transfer in a building.

T4 Glazing Systems encompassing:

- different types of glazing systems and their characteristics.
- different types of shading devices and the window orientations for which they are most appropriate.
- solar heat gain for different glazing types and angles of incidence
- calculation of the average daily irradiation of a window partly shaded by eaves, using computer software.
- calculation of the average daily heat gain through a window partly shaded by eaves.

T5 Insulation encompassing:

- different types of insulation and where they are used.
- how different types of insulation are installed in roofs, walls and floors.
- determination of the minimum R-values of roof insulation for different locations using Australian Standard AS2627 or similar standards.

T6 Thermal mass encompassing:

- advantages and disadvantages of using substantial thermal mass in different climate types and for different heating and cooling regimes.
- where thermal mass can be located in a building.
- explain what is meant by the following terms: time lag, decrement factor, admittance, response factor.

T7 Comfort control strategies encompassing:

- interpretation of the usefulness of a design strategy with the aid of a psychrometric chart showing control potential zones for a particular location.
- selection of the most useful comfort control strategies for Australian climatic regions.

determination of the direction of the following: both true and magnetic, north winter and summer sunrise, winter and summer sunset.

- solar access in summer and winter to various possible house locations on a site and room locations within the house.
- how vegetation can be used to both funnel and deflect wind.
- using cross ventilation as a cooling strategy.

T9 Thermal performance of a building encompassing:

- heating requirements of a building using the heating degree day or hour method.
- dynamic performance predicted by a computer simulation program such as NatHERS or BERS.

Integration of active solar systems encompassing:

- active solar system types available which can provide hot water, space heating and cooling.
- the best location on the roof, and the optimum tilt and orientation of the collector panels.
- function of the main components of an air or water-based solar space heating system.

	schematic of the fluid circuit of an air or water- based space
Assessment criteria	Before the critical aspects of evidence are considered all prerequisites must be met. Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines - UEE07'. Evidence shall also comprise: • A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to: • Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement • Apply sustainable energy principles and practices as specified in the performance criteria and range statement • Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements. Demonstrate an appropriate level of skills enabling employment Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures. Demonstrated consistent performance across a representative range of contexts from the prescribed items below: Applying OHS practices in the workplace as described in 8) and including: Preparing to enter the workplace including, the use of work permits and clearances and isolation permissions.Planning estimation work effectively. Understanding and following risk control safe work methods. Applying work procedures and instructions as they apply to risk control measures. Dealing with accidents and emergencies within the scope of responsibility. Participation in consultation processes, identifying hazards and implementing and monitoring control measures. Dealing with unplanned events
Assessment methods & schedule	Assessment of this Learning Specification will be based on the evidence that you provide using 2 or more of the following, as prescribed by your local Institute/ College teaching staff: Observation of skills in practical exercises and Questioning of knowledge using pen and paper tests, essays, oral tests and/or interviews You will be required to complete all assessments for this unit to demonstrate your competence in this unit. Sufficient evidence must be collected, using local assessment methods/tools identified in the Assessment Table below to demonstrate both the student's: 1. ***Successful Performance of the Competency***, by meeting the requirements in the Work Performance Specification, and an 2. ***Understanding of the required skills and knowledge)***, by meeting the

requirements in the Learning Specification/s.

	Assessment event no.	Assessment Name/ Method	Assessment date	Assessment duration	Assessment venue	Assessment outcome
	1	Practical Test				Satisfactory/Not yet satisfactory
	2	Theory Exam				Satisfactory/Not yet satisfactory

Reporting assessment outcomes

Your Transcript of Academic Record lists all of your results in your study to date.

"This is an ungraded unit; therefore your academic result will be recorded and reported to you as ***Competent*** **(AC)** or ***Not Yet Competent*** **(NC)**".

If you achieved competency in this unit but are unable to finish the qualification, you will receive a Transcript of Academic Record showing only the units you completed. A **Statement of Attainment** for the unit/units you have successfully completed will also be provided. Please contact the Head Teacher to initiate this process.

Recognition and credit transfers: you can apply to have your previous study, work and/or life experiences recognised. Recognition of Prior Learning will be determined according to Recognition Policy.

Please see Recognition for previous learning and experience -for further information.

Resources required for assessments

This unit is assessed using specific resources/tools:

Learner Resource Manual

Students don't need to purchase any Learner Resource Manual :

Principal References

It is advised that students have access to the following reference books as the main references:

- *Sustainable Solar Housing*
- *Solar Thermal Installation*
- *Renewable Energy-Power for sustainable Future*
- *Solar Engineering of Thermal Process*
- *Renewable Energy-Energy Efficient Building Design Resource Book- TAFE-QLD*
- *Materials for Engineers & Technician*
- *AS4777/AS3000/AS3008*
- *Green Energy Council Publications*

You will also be provided with

- Access to a simulated environment containing information similar to that which you may encounter in a workplace.
- Access to computer systems for real time assessments sufficient to enable participation in the assessment process.

Other Resources

To complete this unit successfully you should bring the following equipment to class with you:

- pens, pencils, notepaper, soft rubber eraser
- scientific calculator Casio fx-100AU PLUS
- USB memory Stick

Assessment feedback, review or appeals

Your teacher will provide feedback no later than three (3) weeks after all assessment activities have been conducted.

If you would like to request a review of your results or if you have any concerns about your results, contact your teacher or head teacher.

	You will have three weeks from the date you receive your results in which to make an appeal and request a review. You will receive a response within **ten working days** after receipt of the request.
Assessment guidelines	You must submit assessment work and attended scheduled assessments on the required dates. • **If you miss an assessment** you must discuss the issue of the missed assessment with your teacher within seven days, or at your first class attendance after the assessment, whichever occurs first. • **If you miss an exam**, or arrive late by more than 30 minutes after the commencement of the exam, due to illness or circumstances beyond your control, you should contact the teacher of this unit. • **If you are deemed unsatisfactory in an assessment event** you will be eligible to receive one (1) additional reattempt to demonstrate competence. Speak to your teacher for further information. • **If you engage in cheating** such as copying, colluding with another person, using unauthorised notes, or allowing another person to copy your work, you will be liable for disciplinary action as per Student Discipline Policy - Whatever the form of assessment, it is essential that the work you are assessed on is your own. To validate the authenticity of your submitted work it may be checked used anti plagiarism software in addition it may be stored for future plagiarism checking. We provide learners with every reasonable opportunity to have their work assessed and where possible each case of learner absence from an assessment will be considered on an individual basis. However, where there are no extenuating circumstances, the following penalties apply: • where the results of the unit are recorded in marks, when the assessment is up to seven days late the result achieved by the learner is reduced by 15% • when the assessment is more than seven days late, the result recorded is recorded as "not yet competent" • for non-attendance at an assessment on a negotiated date, the result is recorded as "not yet competent".
Assessment: reasonable adjustments	If you are a student with a disability it is important for you to indicate this on your enrolment form and make contact with the Teacher / Consultant for Students with a Disability in your Institute for further information. If possible, this should happen before you enrol. They will provide you with appropriate information about the range of units available. Teachers and teacher consultants will arrange for students with a disability to be given reasonable adjustment in assessment on an individual needs basis. Teachers may make reasonable allowances for the learners, based on the evidence provided, in accordance with the Assessment Policy - This may relate to the timeframe for submitting/attempting the assessment task or to an alternative form of assessment evidence to be used for assessing the learner's level of achievement.

Teacher		
Contact Details		

UEECD0036 Provide engineering solutions for problems in complex multiple path circuits

Elements and performance criteria

Elements		**Performance criteria**		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Prepare tools, equipment and materials for problem solving**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	Safety check in practical
		1.2	WHS/OHS risk control work preparation measures and workplace procedures are followed	Safety check in practical
		1.3	Scope of circuit/s problems are obtained from documentation and/or work instructions to determine the work	Safety check in practical

Elements		Performance criteria		
		1.4	Advice is sought from the work supervisor to ensure the work is coordinated with others	Teacher Instruction
		1.5	Materials required for work are identified and accessed in accordance with workplace procedures	Practical set up
		1.6	Tools, equipment and testing devices required for work are obtained and checked for correct operation and safety	Practical set up
2	**Provide solutions for complex multiple path circuits**	**2.1**	WHS/OHS risk control work measures and workplace procedures are followed	Safety check in practical
		2.2	Inspect and test live work is conducted in accordance with WHS/OHS requirements and workplace procedures	Safety check in practical

Elements		Performance criteria		
		2.3	Circuits are checked and isolated as required in accordance with WHS/OHS requirements and workplace procedures	Safety check in practical
		2.4	Methods used to solve circuit problems are used from measured and calculated values as they apply to complex multiple path circuits	Problem solving
		2.5	Unplanned situations are dealt with in accordance with WHS/OHS and approval of a relevant person	Problem solving
		2.6	Problems are solved without damage to apparatus, circuits, the surrounding environment and/or services using sustainable energy practices	Problem solving

Elements		Performance criteria		
3	**Complete work and documentation**	**3.1**	WHS/OHS work completion risk control measures and workplace procedures are followed	Housekeeping
		3.2	Worksite is cleaned and made safe in accordance with workplace procedures	Housekeeping
		3.3	Justification for solutions used to solve circuit problems is documented	Problem solving
		3.4	Work completion is documented and relevant person/s notified in accordance with workplace procedures	Problem solving

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:

• analysing complex multiple path circuits • applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • completing work and documenting problem-solving activities • completing written justification of solutions • coordinating work with others • dealing with unplanned events in accordance with problem-solving techniques and workplace procedures • determining the operating parameters of existing circuits • inspecting and testing active systems • obtaining and following work instructions • obtaining and using tools, equipment and products • preparing to solve problems in complex multiple path circuits • providing effective solutions to circuit problems from measurements and calculations • providing solutions for problems in complex multiple path circuits	• UEECD0036 Provide engineering solutions for problems in complex multiple path circuits EXERCISES.pdf • Hayt Engineering Circuit Analysis 8th • G048.pdf • E026.pdf • UEECD0036 Class Lessons.pdf • UEECD0036-Provide engineering solutions for problems in complex multiple path circuits. VIDEO LESSONS

• using sustainable energy practices in accordance with workplace procedures • using testing devices.	

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

• complex alternating current (a.c.) power and maximum power transfer theorem	Q21
• complex impedance	Q25+Q26
• mesh and nodal analysis for a.c. linear circuits	Q16+Q17
• mesh and nodal analysis for direct current (d.c.) linear circuits	
• Norton's principles for d.c. linear circuits	
• phasors	Q15 Phasor Revise (UEEEL0020)
• problem-solving techniques	Q10+11
• relevant complex multiple path circuits	
• relevant industry standards	
• relevant job safety assessments or risk mitigation processes	
• relevant manufacturer specifications and operating instructions	
• relevant materials, tools, equipment, product and testing devices	

• relevant sustainable energy principles • relevant tools, equipment and products • relevant WHS/OHS legislated requirements • relevant workplace documentation • relevant workplace instructions, policies and procedures	
• series and parallel a.c. linear circuits	Q29+Q30
• star-delta conversions	Q12+13+14
• superposition principles and Kirchhoff's law applied to a.c. linear circuits	Q16+17+Q7+8
• superposition principles for d.c. linear circuits	
• Thévenin and Norton theorems applied to a.c. linear circuits	Q19+20
• Thévenin's principles for d.c. linear circuits	
• transients	Q31+32+33
• voltage/current sources and Kirchhoff's law for d.c. linear circuits.	Q1+2+3+4+5+6

Class Lesson Slide

- E025.pdf
- G048.pdf

Class Lesson Written Notes

- UEECD0036 Class Lessons.pdf

Video Lesson Lessons

- UEECD0036-Provide engineering solutions for problems in complex multiple path circuits. VIDEO LESSONS

Reference Textbooks

- Hayt Engineering Circuit Analysis 8th.pdf
- Concepts-in-electric-circuits.pdf

Exercises

- UEECD0036 Provide engineering solutions for problems in complex multiple path circuits EXERCISES.pdf

UEECD0039 Provide solutions to basic engineering computational problems

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Provide computational solutions to engineering problems**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	Safety check in classroom
		1.2	Scope of problem/s is obtained from documentation and/or from work instructions to determine work	Problem calculation
		1.3	Problems are documented and/or diagrammatic form and appropriate methods identified to resolve them	Problem calculation
		1.4	Constants and variables to the problem are obtained from measured values and/or problem documentation	Problem calculation
		1.5	Alternative methods for resolving the problem are considered and, as required, discussed with relevant person/s	Problem calculation

Elements		Performance criteria		
		1.6	Problems are resolved using mathematical processes in accordance with workplace procedures	Problem calculation
2	**Complete work and documentation**	**2.1**	Justification for solutions used to solve engineering problems is documented in work records in accordance with workplace procedures and relevant industry standards	Problem calculation
		2.2	Work completion is documented and relevant person/s notified in accordance with workplace procedures	Problem calculation

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:	
• applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • completing work and documenting problem-solving activities • dealing with unplanned events in accordance with problem-solving techniques and workplace	• Problem calculation • Safety check

procedures • documenting justification of solutions provided • obtaining known constants and variables • solving problems using appropriate mathematical processes • stating problems in documented and diagrammatic form.	

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:	
• algebraic manipulation • complex numbers • estimations, errors and approximations • exponential and logarithmic functions • graphs of linear functions • graphs of trigonometric functions • laws of indices • matrices • plane figures - quadrilaterals and circles • plane figures – triangles and basic trigonometry • problem-solving techniques • quadratic functions • rational, irrational numbers and algebra • relevant manufacturer specifications • relevant job safety assessments or risk mitigation processes • relevant WHS/OHS legislated requirements • relevant workplace documentation • relevant workplace instruction, policies and procedures • simultaneous equations	All exercises and assessment tasks in E050 Lesson 1 Polynomials E050 Lesson 2 Non linear equations E050 Lesson 3 Logarithmic equation E050 Lesson 4 Circular function E050 Lesson 5 Trigonometric identities E050 Lesson 6 Vector E050 Lesson 7 Mensuration+Area E050 Lesson 8 Differentiation E050 Lesson 9 Integration E050 Lesson 10 Integration of trigo functions E050 Lesson 11 Definite integral+Electrical application E050 Lesson 11 Exercises

• vectors and phasors.	

UEECD0049 Use advanced computational processes to provide solutions to energy sector engineering problems

Elements and performance criteria

Elements		Performance criteria		
Elements describe the essential outcomes.		Performance criteria describe the performance needed to demonstrate achievement of the element.		
1	**Provide solutions to engineering problems**	**1.1**	Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied	Safety check
		1.2	Scope of problems are obtained from documentation and/or work instruction to solve problems	Problem calculation
		1.3	Problems are documented and/or provided in diagrammatic form and appropriate methods identified to resolve them	Problem calculation
		1.4	Constants and variables to problems are obtained from measured values and/or problem documentation	Problem calculation
		1.5	Alternative methods for resolving problems are	Problem calculation

Elements		Performance criteria		
			reviewed and, as required, discussed with relevant person/s	
		1.6	Problems are resolved using mathematical processes in accordance with workplace procedures	Problem calculation
2	**Complete work and documentation**	**2.1**	Justification for solutions used to solve engineering problems is documented in work records in accordance with workplace procedures and relevant industry standards	Problem calculation
		2.2	Work completion is documented and relevant person/s notified in accordance with workplace procedures	Problem calculation

Performance evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least two separate occasions and include:	
• applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including ○ using risk control measures • completing work and documenting problem-solving activities	• Safety check • Problem Calculation

• dealing with unplanned events in accordance with problem-solving techniques and workplace procedures • documenting justification of solutions provided • obtaining known constants and variables • providing computational solutions to energy sector engineering problems • solving problems using appropriate mathematical processes • stating problems in written and diagrammatic form.	

Knowledge evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions and include knowledge of:

• problem-solving techniques
• relevant advanced engineering mathematics, including:
  ○ differential calculus
  ○ differential equations
  ○ integral calculus
  ○ linear algebra
  ○ number
  ○ sequences and series
  ○ statistics
  ○ variables
  ○ vectors
• relevant constants and variables
• relevant diagrammatic form
• relevant industry standards
• relevant manufacturer specifications
• relevant job safety assessments or risk mitigation processes
• relevant WHS/OHS legislated requirements
• relevant workplace documentation
	All exercises and assessment tasks in
	
	E026 Lesson 1-Fourier
	
	E026 Lesson 2-Differential equation
	
	E026 Lesson 3-Gamma+Beta Function
	
	E026 Lesson 4-Vector analysis
	
	E026-Lesson 5-Laplace Transform
	
	E026 Harmonic Exercises
	
	E026 Definite Integral
	
	E026 Harmonics
	
	E026 Multiple Integral

• relevant workplace instruction, policies and procedures.	

REFERENCE
Engineering Mathematics
TEXTBOOKS
introductory-finite-difference-methods-for-pdes.pdf
www.iqytechnicalcollege.com/introductory-finite-difference-methods-for-pdes.pdf

Maths 101 Engineering Mathematics.pdf
www.iqytechnicalcollege.com/Maths 101 Engineering Mathematics.pdf

Maths 301 Introductory-finite-difference-methods-for-pdes.pdf
www.iqytechnicalcollege.com/Maths 301 Introductory-finite-difference-methods-for-pdes.pdf

Maths 301-an-introduction-to-the-theory-of-complex-variables.pdf
www.iqytechnicalcollege.com/Maths 301-an-introduction-to-the-theory-of-complex-variables.pdf

Maths 302 elementary-linear-algebra.pdf
www.iqytechnicalcollege.com/Maths 302 elementary-linear-algebra.pdf

Maths 303 essential-engineering-mathematics.pdf
www.iqytechnicalcollege.com/Maths 303 essential-engineering-mathematics.pdf

Maths 303 Introductory-finite-volume-methods-for-pdes.pdf
www.iqytechnicalcollege.com/Maths 303 Introductory-finite-volume-methods-for-pdes.pdf

Maths 304 integration-and-differential-equations.pdf
www.iqytechnicalcollege.com/Maths 304 integration-and-differential-equations.pdf

Maths 401 continuous-distributions.pdf
www.iqytechnicalcollege.com/Maths 401 continuous-distributions.pdf

Maths 402 discrete-distributions.pdf
www.iqytechnicalcollege.com/Maths 402 discrete-distributions.pdf

Maths 403 engineering-mathematics-youtube-workbook.pdf
www.iqytechnicalcollege.com/Maths 403 engineering-mathematics-youtube-workbook.pdf

Maths 403 second-order-ordinary-differential-equations.pdf
www.iqytechnicalcollege.com/Maths 403 second-order-ordinary-differential-equations.pdf

Maths 501 introduction-to-probability.pdf
www.iqytechnicalcollege.com/Maths 501 introduction-to-probability.pdf

Maths 501 linear-algebra-c-1.pdf
www.iqytechnicalcollege.com/Maths 501 linear-algebra-c-1.pdf

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Maths 501 linear-algebra-c-2.pdf
www.iqytechnicalcollege.com/Maths 501 linear-algebra-c-2.pdf

Maths 501 linear-algebra-i-matrices-and-row-operations.pdf
www.iqytechnicalcollege.com/Maths 501 linear-algebra-i-matrices-and-row-operations.pdf

Maths 502 introductory-finite-difference-methods-for-pdes.pdf
www.iqytechnicalcollege.com/Maths 502 introductory-finite-difference-methods-for-pdes.pdf
Maths 502 mathematical-modeling-i-preliminary.pdf
www.iqytechnicalcollege.com/Maths 502 mathematical-modeling-i-preliminary.pdf

Maths 601 random-variables-i.pdf
www.iqytechnicalcollege.com/Maths 601 random-variables-i.pdf
http://www.iqytechnicalcollege.com/Passwordprotect/2-john-bird-higher-engineering-mathematics.pdf
For the units

UEECD0039	Provide solutions to basic engineering computational problems*
UEECD0049	Use advanced computational processes to provide solutions to energy sector engineering problems*

Class Lessons
E126+127

www.highlightcomputer.com/Maths1E050G047Mod.zip

www.iqytechnicalcollege.com/Maths 2-E026 Mod.zip

VIDEO LESSONS

Engineering Mathematics I

E126	Engineering Mathematics

E050/E126
Page 87 to 101

www.highlightcomputer.com/Video Lessons.pdf

Mathematics
E050Part1.zip
Lesson 1
http://youtu.be/67MNuPQMiKw
http://youtu.be/GMrOtiVGcSg
Lesson 2
http://youtu.be/GMrOtiVGcSg
Lesson 3
http://youtu.be/3MnPK4HC0oc
Lesson 4

http://youtu.be/4Qiv5gvcxG0
Lesson 5
http://youtu.be/NJFYPLXjNDM
Lesson 6
http://youtu.be/Ejr9Genn5ZM
E050 Lesson 7 Mensuration+Area.zip
http://youtu.be/PSdB3--AHZM

E050 Lesson 8 Differentiation.zip
http://youtu.be/rLmLY8fj2l8
http://youtu.be/VLhQD_wrWY8

E050 Lesson 9 Integration.zip
http://youtu.be/ax_k2-qvhpA

E050 Lesson 10 Integration of trigo functions.zip
http://youtu.be/Xp6RiXES0qs

E050 Lesson 11 Definite integral+Electrical application.zip
http://youtu.be/GS26UxVilPA
http://youtu.be/AYXFn88n4yM

E050 Lesson 11 Exercises.zip

The links contain the following lessons
E050 Lesson 1 Polynomials
E050 Lesson 2 Non linear equations
E050 Lesson 3 Logarithmic equation
E050 Lesson 4 Circular function
E050 Lesson 5 Trigonometric identities
E050 Lesson 6 Vector
E050 Lesson 7 Mensuration+Area
E050 Lesson 8 Differentiation
E050 Lesson 9 Integration
E050 Lesson 10 Integration of trigo functions
E050 Lesson 11 Definite integral+Electrical application
E050 Lesson 11 Exercises

Engineering Mathematics II

E127	Advanced Engineering Mathematics

E026/E127
Page 26 to 50 of
www.highlightcomputer.com/Video Lessons.pdf
Engineering Mathematics
E026 Lesson 1 to 5
The links contain the following lessons
E026 Lesson 1-Fourier
https://www.youtube.com/watch?v=QzYO2qCJGNg

http://youtu.be/fGL7VYtEBV4

E026 Lesson 2-Differential equation
http://youtu.be/RjhgggxG2p0

E026 Lesson 3-Gamma+Beta Function
http://youtu.be/D-bUQ1UyI_Y
http://youtu.be/6rNFJbbqzyI

E026 Lesson 4-Vector analysis
http://youtu.be/T9OYT8RpqbA

E026-Lesson 5-Laplace Transform
Links
E026 Harmonic Exercises
https://www.youtube.com/watch?v=VSdug1mECDE
E026 Definite Integral
https://www.youtube.com/watch?v=oaI27HPNvhA
E026 Harmonics
https://www.youtube.com/watch?v=yFM7ajxKnXw
http://youtu.be/d5drjXEZKv0
http://youtu.be/NDUvNSO6il8
http://youtu.be/d5drjXEZKv0

E026 Multiple Integral
http://youtu.be/amV5KiBi0jk
http://youtu.be/IAKJvYUTPiI

E026-Lesson 6-Inverse Laplace+ Differential equation solution
http://youtu.be/yXulBJeI_2w
http://youtu.be/SPGeFn2icU0
http://youtu.be/4VLHZp6joYg
http://youtu.be/bYkyLGd17PU
http://youtu.be/GrYCm8FzAMY
E026-Lesson 7-Matrices
http://youtu.be/99cNSVx4hgU
http://youtu.be/ztHu2UYwA5c
http://youtu.be/m_7oVlLNSsI
http://youtu.be/5hq-ZfZdCRI

E026-Lesson 8 Legendre Function
http://youtu.be/VWyysJQ1grs
E026-Lesson 9 Binomial Theorem+ Partial Differential equation
http://youtu.be/jNj4dWucl50
E026-Lesson 10 Multiple Integral
http://youtu.be/amV5KiBi0jk

Unit Learning Plan

UEERE0061 – Design grid-connected photovoltaic power supply systems

July 2023
Release No. 1.0

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A. Overview

Competency Standard Unit (CSU)	**UEERE0061 Design grid-connected photovoltaic power supply systems**		
CSU Application	This unit involves the skills and knowledge required to design grid-connected photovoltaic (PV) power supply systems. It includes designing grid-connected PV power supply system, following design briefs, utilising data/information from site survey to determine design requirements, ensuring safety and performance standards and functional requirements are met, documenting and obtaining approval for design. This unit is appropriate for Licenced Electricians or Electrical Engineers with responsibility for designing grid-connected photovoltaic power supply systems. Licensing, legislative or certification requirements that apply to this unit may differ between jurisdictions and system types. They should be checked prior to commencing this unit.		
Purpose of ULP	The purpose of the Unit Learning Plan (ULP) is to define the depth and breadth of the knowledge and skills required to address the Competency Standard Unit (CSU) Assessment Requirements. It also indicates the recommended sequence and duration for the structured learning program, and provides a list of resources suitable for the delivery of the material using a blended approach. In the context of this ULP, the term 'structured learning program' encompasses both the imparting of knowledge and skills and the completion of evidence gathering activities designed to address the Assessment Requirements. The structured learning program is generally undertaken off-the-job in a controlled learning environment.		
Unit aspects addressed in this ULP	PC-UEERE0061	Performance Criteria	
	PE-UEERE0061	Performance Evidence	
	KE-UEERE0061	Knowledge Evidence	
Suggested Durations	Completion of ULP topics 1 to 7		52 hours
	Completion of Unit Knowledge Test		2 hours
	Completion of Unit Skills Test		6 hours
	Total duration of structured learning program		60 hours
	Note: These durations do not include the necessary workplace experience and final assessment of all evidence that must occur before competence can be determined.		
Sequence	Before undertaking this ULP a learner is to have completed the following Competency Standard Units or equivalent: • UEERE0054 Conduct site survey for grid-connected photovoltaic and battery storage systems		

AND

- UEEEL0039 Design, install and verify compliance and functionality of general electrical installations*

OR

- UEERE0051 Apply electrical principles to renewable energy design

*Note that the following units are pre-requisites of UEEEL0039 (but are missing from the pre-requisite chain of UEERE0061 as shown on training.gov.au):

- HLTAID009 Provide cardiopulmonary resuscitation
- UEECD0007 Apply work health and safety regulations, codes and practices in the workplace
- UEECD0016 Document and apply measures to control WHS risks associated with electrotechnology work
- UEECD0019 Fabricate, dismantle and assemble utilities industry components
- UEECD0020 Fix and secure electrotechnology equipment
- UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications
- UEEEL0003 Arrange circuits, control and protection for general electrical installations
- UEEEL0005 Develop and connect electrical control circuits
- UEEEL0008 Evaluate and modify low voltage heating equipment and controls
- UEEEL0009 Evaluate and modify low voltage lighting circuits, equipment, and controls
- UEEEL0010 Evaluate and modify low voltage socket outlets circuits
- UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories
- UEEEL0014 Isolate, test and troubleshoot low voltage electrical circuits
- UEEEL0018 Select wiring systems and cables for low voltage general electrical installations
- UEEEL0019 Solve problems in direct current (d.c.) machines
- UEEEL0020 Solve problems in low voltage a.c. circuit
- UEEEL0021 Solve problems in electromagnetic devices
- UEEEL0023 Terminate cables, cords and accessories for low voltage circuits
- UEEEL0024 Solve problems in alternating current (a.c.) rotating machines
- UEEEL0025 Test and connect transformers
- UEEEL0047 Identify, shut down and restart systems with alternate supplies
- UETDRRF004 Perform rescue from a live LV panel

AND

- UEECD0043 Solve problems in direct current circuits

OR

- UEECD0044 Solve problems in multiple path circuits
- UEECD0046 Solve problems in single path circuits

B. Knowledge and Skills Delivery

1 Grid Connected PV Systems	
Purpose:	In this topic you will learn about the arrangement and operational features of grid connected PV power systems, including functions such as synchronisation, safety and control features. You will also learn about how to determine the solar resource available at a given location, and the factors to consider when planning out a PV system.
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.

Knowledge and Skills Specification Content Areas	Unit Mapping[1]			Energy Space Resources
	KE	PC	PE	
1.1 PV System Features				
Knowledge				
Describe the basic installation configurations for a grid connected PV power systems.	7.2, 14	-	-	Topic 1 Content Quiz Topic 1.1 Learning Activity
Describe the operation of grid interactive PV systems including: • Synchronisation. • Safety features. • Power flow control. • Passive and active anti-islanding. • Metered energy.	10	-	-	
Skills				
Draw the block diagram of a PV grid connected system.	10, 14	-	-	Topic 1.1 Skills Practice
Draw schematic diagrams of common grid connected inverter circuit configurations including metering arrangements, isolation and connection with respect to RCDs in accordance with AS/NZS 4777.1.	7.2, 14	-	-	

1 Grid Connected PV Systems				
1.2 Solar Resource				
Knowledge				
Define the following terms: • Sunshine hours. • Irradiance. • Irradiation. • Latitude. • Azimuth and altitude angles. • Tilt angle.	1.1	-	-	Topic 1 Content Quiz Topic 1.2 Learning Activity
State the units and symbols for irradiation and irradiance.	1.1	-	-	
State the types and features of commonly available solar data.	1.2	-		
1.3 Array Positioning				
Knowledge				
Describe how radiation varies throughout the year on the surface of a fixed collector.	1.3	-	-	Topic 1 Content Quiz Topic 1.3 Learning Activity
Explain the factors affecting the optimal tilt and orientation of PV arrays	1.4	-	-	
Explain the principle and effect of solar tracking.	1.5	-	-	
Skills				
Determine the solar access for a given site.	1.2, 18, 19, 21	1.2	1, 2	Topic 1.3 Skills Practice
Select an appropriate location and tilt angle for a PV array at a given site.	1.4, 13, 18, 19, 21	2.1	1, 2	
Determine whether any shading will occur at a given site, and estimate its effect on the system.	18, 19, 21	1.2	1, 2	

1 Grid Connected PV Systems				
Estimate the solar resource for a given site.	1.2, 18, 19, 21	1.2	1, 2	
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 4509 Stand-alone power systems.
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

2 PV Technology					
Purpose:	In this topic you will learn about the various terminology used in relation to the various types of photovoltaic modules and operating principles of the photovoltaic modules.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
2.1 PV Cells and Modules					
Knowledge					
Define the following terms: • Cell. • Module. • String. • Array.		2.1	-	-	Topic 2 Content Quiz Topic 2.1 Learning Activity
Explain the different types of PV technology and their applications, including monocrystalline, polycrystalline and amorphous.		2.2, 17	-	-	
Describe the mechanical and electrical features necessary for the long life of a PV module under a wide range of operating conditions		2.3	-	-	
Skills					
Draw an equivalent circuit for a PV cell, labelling each of the elements and the polarity of the terminals.		2.1	-	-	Topic 2 Content Quiz Topic 2.2 Skills Practice
2.2 PV Module Characteristics					
Knowledge					
Define the following terms: • I-V curve. • Operating point.		3.1, 17	-	-	Topic 2 Content Quiz Topic 2.2 Learning Activity

2 PV Technology				
• Maximum power point (MPP). • Power and voltage temperature co-efficient. • Standard test conditions (STC). • Nominal operating cell temperature (NOCT).				
List the major ratings of a PV module as specified in manufacturer's data.	3.2, 17	-	-	
Skills				
Draw and label a family of I-V curves for a PV module, labelling major points.	3.1, 17	-	-	Topic 2.2 Skills Practice
Determine the major ratings of a PV module from the manufacturer's data.	3.2, 17	1.2	-	
Determine the electrical characteristics of a PV module.	3.1, 17	1.2	-	

Reference Text:
- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.

Standards:
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

Equipment:
- Manufacturer's catalogues.

3 PV Arrays					
Purpose:	In this topic you will learn about the arrangement of PV arrays, including series and parallel module configurations, and the arrangement of blocking and bypass diodes. You will also learn about BIPV products, and the factors to consider when selecting PV modules for a given installation.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
3.1 PV Module Arrangements					
Knowledge					
Describe the configuration of a typical PV array, including the function, placement and ratings of blocking and bypass diodes.		3.3, 6.2	-	-	Topic 3 Content Quiz Topic 3.1 Learning Activity
Explain the effect of partial shading of a PV module or array, the impact of bypass diodes and the significance of their configuration on output current in typical operating conditions.		3.4	-	-	
Skills					
Specify a PV array wiring plan for series connected modules to minimise power loss due to shading at a particular site.		3.3, 3.4, 21	2.1, 2.2, 2.3	2	Topic 3.1 Skills Practice
Determine the minimum and maximum number of PV modules required in a string to achieve a specified operating voltage.		6.2, 21	2.1, 2.2, 2.3	2	
3.2 PV Array Selection					
Knowledge					
State the WHS/OHS requirements and risk management for selecting PV equipment.		18, 19	-	-	Topic 3 Content Quiz

3 PV Arrays				
Explain the factors that need to be considered and documented when selecting and sizing a PV array for a grid-connected inverter system, including: • Verification of site survey data. • Annual energy demand. • Budget constraints. • Architectural constraints. • Limitations on available inverter sizes.	5, 6.1, 13, 20, 21	-	-	Topic 3.2 Learning Activity
Skills				
Select and size a PV array for a grid-connected inverter system based on annual energy demand, budget constraints, architectural constraints and/or inverter limitations.	5, 6.1, 17, 18, 19, 21	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	Topic 5.2 Skills Practice
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	

Reference Text:
- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.

Standards:
- AS/NZS 4509 Stand-alone power systems.
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

Equipment:
- Manufacturer's catalogues.

4 Basic Inverter Principles					
Purpose:	In this topic you will learn about the purpose and basic operation of inverters. You will also have the opportunity to connect an inverter and measure the input and output parameters.				
Duration:	This topic represents around 6.7% of the knowledge and skills specification contents, and should take the learner approximately 4 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
4.1 Introduction to Inverters					
Knowledge					
List the different types of inverters used in grid connected systems.		9.1	-	-	Topic 4 Content Quiz Topic 4.1 Learning Activity
Describe the basic function of an inverter.		9.2	-	-	
Skills					
Draw the Australian standard symbol for a low voltage inverter.		9.1	-	-	Topic 4.1 Skills Practice
Draw a simple block diagram of a typical inverter used in a grid connected system.		9.2	-	-	
4.2 Inverter Operations					
Knowledge					
Explain the basic principle of operation of a single-phase inverter bridge.		9.3	-	-	Topic 4 Content Quiz Topic 4.2 Learning Activity
Describe the function of PWM techniques in square wave, modified square wave and synthesised sine wave inverters.		9.3	-	-	
Skills					
Connect a grid inverter and measure the inverter parameters for various loads.		9.3	-	-	Topic 4.2 Skills Practice

4 Basic Inverter Principles

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.

Equipment:

- Grid-connected inverter.
- d.c. supply.
- Variable a.c. load.
- a.c. and d.c. voltmeters.
- a.c. and d.c. ammeters.
- Cathode ray oscilloscope.
- PV array.
- PPE and hand tools.
- Connection leads.

5 Grid-Connect Inverters					
Purpose:	In this topic you will learn about the types of inverters that are suitable for grid connected applications, and the factors to consider when selecting grid connect inverters.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
5.1 GC Inverter Characteristics					
Knowledge					
List the characteristics that distinguish inverters suitable for grid connected photovoltaic array application from standard inverters.		9.4	-	-	Topic 5 Content Quiz Topic 5.1 Learning Activity
Outline the function and operation of a "grid protection device" as specified in AS/NZS 4777.		10	-	-	
5.2 GC Inverter Selection					
Knowledge					
State the key inverter ratings and specifications, including: • Continuous rating. • Half-hour rating. • Surge rating. • Operating window. • Efficiency. • IP rating.		11.1, 17	-	-	Topic 5 Content Quiz Topic 5.2 Learning Activity
Explain the factors that need to be considered and documented when selecting and sizing a grid connected inverter.		11.2, 17, 20, 21	-	-	
Skills					

5 Grid-Connect Inverters				
Determine the operating window of an inverter for given minimum and maximum effective cell temperatures.	11.1, 17, 18, 19, 21	-	-	Topic 5 Content Quiz Topic 5.2 Learning Activity Topic 5.2 Skills Practice
Select a grid connected inverter for a given PV array.	5, 11.1, 11.2, 17, 18, 19, 21	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.

Equipment:

- Manufacturer's catalogues.

6 Other Design Factors	
Purpose:	In this topic you will learn about various other factors to consider in the design of PV power systems, including the selection of wiring and switchgear. You will practice selecting equipment for given scenarios, and also learn how to estimate the energy yield, specific yield and performance ratio of a given system.
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.

Knowledge and Skills Specification Content Areas	**Mapping[1]**			**Energy Space Resources**
	KE	**PC**	**PE**	
6.1 Wiring and Switchgear Selection				
Knowledge				
Explain the factors that need to be considered when selecting and sizing control and protection equipment for grid-connected inverter systems.	4, 5, 7.1, 17, 21	-	-	Topic 6 Content Quiz Topic 6.1 Learning Activity
List the factors to be considered when selecting and sizing wiring systems for grid-connected PV systems.	4, 5, 7.1, 17, 21	-	-	
Describe the other economic/financial, contractual/institutional, and legislative/regulatory factors that impact the design, installation and operation of grid-connected PV systems.	8.3	-	-	
Skills				
Verify the details for a proposed grid-connected inverter system from a given job specification.	5, 21	1.1, 1.2, 1.3, 1.4	1, 2	Topic 6.2 Skills Practice
Select and size a.c. and d.c. wiring systems for a given grid-connected PV system.	7.1, 17, 18, 19, 21	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	
Select and size control and protection equipment for a given grid-connected PV system.	7.1, 17, 18, 19, 21	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	

6 Other Design Factors				
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	
6.2 PV System Performance				
Knowledge				
Explain what is meant by the term 'energy yield' in relation to PV power systems.	8.1	-	-	Topic 6 Content Quiz Topic 6.3 Learning Activity
Explain what is meant by the term 'specific energy yield' in relation to PV power systems.	8.1	-	-	
Explain what is meant by the term 'performance ratio' in relation to PV power systems.	8.2	-	-	
State the factors affecting the need for monitoring PV system performance at a given site.	8.1, 8.2	-	-	
Skills				
Determine and document the energy yield, specific energy yield and performance ratio for the annual reduction in greenhouse gas emissions for a given grid-connected PV system.	8.1, 8.2, 21	2.3, 2.4	2, 3	Topic 6.2 Skills Practice

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.

Standards:

- AS/NZS 3000 Wiring Rules.
- AS/NZS 3008.1.1 Electrical installations – Selection of cables.
- AS/NZS 4509 Stand-alone power systems.
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

7 PV System Installations					
Purpose:	In this topic you will learn the various factors, standards and safety practices associated with the installation of grid connected PV power systems, including working on roofs, and installation labelling and identification requirements.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
7.1 PV Array Installation Practices					
Knowledge					
State the safety hazards, risks and control measures for working on roofs.		12, 18, 19	-	-	Topic 7 Content Quiz Topic 7.1 Learning Activity
Describe common types of roof-mounted and free-standing PV array frame construction, brackets, mounting and fixing methods.		12, 15, 17	-	-	
Skills					
Perform a risk assessment for installing a PV array on a roof at a given site.		18, 19	1.1	1	Topic 7.1 Skills Practice
7.2 Installation Requirements					
Knowledge					
State the major AS/NZS 4777 and AS/NZS 5033 installation requirements for grid-connected inverter systems to ensure correct operation, long life, safety and ease of maintenance.		4, 12, 15, 20	-	-	Topic 7 Content Quiz Topic 7.2 Learning Activity
7.3 Identification and Labelling					
Knowledge					

7 PV System Installations				
Outline the labelling and signage requirements for switchboards supplied with power from grid connected inverters, as set out in AS/NZS 4777.1.	16, 20	-	-	Topic 7 Content Quiz Topic 7.3 Learning Activity
Outline the additional requirements for the use of multimode inverters incorporating stand-alone (previously UPS) functionality, as specified in AS/NZS 4777.1.	16, 20	-	-	

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.
- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.

Legend:

KE	Knowledge Evidence	**PC**	Performance Criteria
PE	Performance Evidence		

IQY TECHNICAL COLLEGE

Clustered Learning Plan

UEERE0061 – Design grid-connected photovoltaic power supply systems

UEERE0080 – Install photovoltaic power conversion equipment to grid

UEERE0081 – Install photovoltaic systems to power conversion equipment

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A. Overview	
UoC – Unit of Competency 1	**UEERE0061 Design grid-connected photovoltaic power supply systems**
UoC 1 Application	This unit involves the skills and knowledge required to design grid-connected photovoltaic (PV) power supply systems. It includes designing grid-connected PV power supply system, following design briefs, utilising data/information from site survey to determine design requirements, ensuring safety and performance standards and functional requirements are met, documenting and obtaining approval for design. This unit is appropriate for Licenced Electricians or Electrical Engineers with responsibility for designing grid-connected photovoltaic power supply systems. Licensing, legislative or certification requirements that apply to this unit may differ between jurisdictions and system types. They should be checked prior to commencing this unit.
UoC – Unit of Competency 2	**UEERE0080 Install photovoltaic power conversion equipment to grid**
UoC 2 Application	This unit involves the skills and knowledge required to install and commission photovoltaic (PV) power conversion equipment (PCE) to grid. It includes working safely to industry installation standards, installing components in accordance with design, placing and securing system components accurately, making required circuit connections, testing and commissioning the installation and completing the necessary installation documentation. The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations, which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c.). Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, is required. Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations. Note: Those holding an Unrestricted Electrician's Licence or equivalent issued in an Australian state or territory meet the prerequisite requirements of UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories. All other prerequisite requirements must be met.
UoC – Unit of Competency 3	**UEERE0081 Install photovoltaic systems to power conversion equipment**

<table>
<tr><td>UoC 3 Application</td><td colspan="2">This unit involves the skills and knowledge required to install and commission a photovoltaic (PV) power system to power conversion equipment (PCE).
It includes working safely to industry installation standards, matching PV components specified for a given location, placing and securing system components accurately, making required circuit connections and completing the necessary installation documentation.
The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations, which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c.).
Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, is required.
Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.
Note: Those holding an Unrestricted Electrician’s Licence or equivalent issued in an Australian state or territory meet the prerequisite requirements of UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories. All other prerequisite requirements must be met.</td></tr>
<tr><td>Purpose of CLP</td><td colspan="2">The purpose of the Clustered Learning Plan (CLP) is to define the depth and breadth of the knowledge and skills required to address the Competency Standard Units (CSUs) Assessment Requirements. It also indicates the recommended sequence and duration for the structured learning program, and provides a list of resources suitable for the delivery of the material using a blended approach.
In the context of this CLP, the term ‘structured learning program’ encompasses both the imparting of knowledge and skills and the completion of evidence gathering activities designed to address the Assessment Requirements. The structured learning program is generally undertaken off-the-job in a controlled learning environment.</td></tr>
<tr><td rowspan="8">Unit aspects addressed in this CLP</td><td>PC-UEERE0061</td><td>Performance Criteria</td></tr>
<tr><td>RC-UEERE0061</td><td>Range of Conditions</td></tr>
<tr><td>PE-UEERE0061</td><td>Performance Evidence</td></tr>
<tr><td>KE-UEERE0061</td><td>Knowledge Evidence</td></tr>
<tr><td>PC-UEERE0080</td><td>Performance Criteria</td></tr>
<tr><td>RC-UEERE0080</td><td>Range of Conditions</td></tr>
<tr><td>PE-UEERE0080</td><td>Performance Evidence</td></tr>
</table>

	KE-UEERE0080	Knowledge Evidence
	PC-UEERE0081	Performance Criteria
	RC-UEERE0081	Range of Conditions
	PE-UEERE0081	Performance Evidence
	KE-UEERE0081	Knowledge Evidence

Suggested Durations	Completion of CLP topics 1 to 8	49.5 hours
	Completion of Clustered Knowledge Test	2.5 hours
	Completion of Clustered Skills Test (Tasks A, B, C and D)	8 hours
	Total duration of structured learning program	60 hours
	Note: These durations do not include the necessary workplace experience and final assessment of all evidence that must occur before competence can be determined.	

Sequence

Before undertaking this CLP a learner is to have completed the following Competency Standard Units or equivalent:

- UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories*
- UEERE0054 Conduct site survey for grid-connected photovoltaic and battery storage systems

AND

- UEEEL0039 Design, install and verify compliance and functionality of general electrical installations

OR

- UEERE0051 Apply electrical principles to renewable energy design

*Note that the following units are pre-requisites of UEEEL0012 (but are missing from the pre-requisite chain of UEERE0080 and UEERE0081 as shown on training.gov.au):

- UEECD0007 Apply work health and safety regulations, codes and practices in the workplace
- UEECD0019 Fabricate, assemble and dismantle utilities industry components
- UEECD0020 Fix and secure electrotechnology equipment
- UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications
- UEEEL0003 Arrange circuits, control and protection for electrical installations
- UEEEL0020 Solve problems in low voltage a.c. circuits
- UEEEL0023 Terminate cables, cords and accessories for low voltage circuits
- UEEEL0018 Select wiring systems and select cables for low voltage electrical installations
- UEEEL0005 Develop and connect electrical control circuits
- UEEEL0019 Solve problems in direct current (d.c.) machines
- UEEEL0021 Solve problems in magnetic and electromagnetic devices

- UEEEL0014 Isolate, test and troubleshoot low voltage electrical circuits
- UEEEL0008 Evaluate and modify low voltage heating equipment and controls
- UEEEL0009 Evaluate and modify low voltage lighting circuits, equipment and controls
- UEEEL0010 Evaluate and modify low voltage socket outlets circuits
- UEEEL0024 Test and connect alternating current (a.c.) rotating machines
- UEEEL0025 Test and connect transformers

AND

- UEECD0043 Solve problems in direct current circuits

OR

- UEECD0044 Solve problems in multiple path circuits
- UEECD0046 Solve problems in single path circuits

B. Knowledge and Skills Delivery

1 Grid Connected PV Systems	
Purpose:	In this topic you will learn about the arrangement and operational features of grid connected PV power systems, including functions such as synchronisation, safety and control features. You will also learn about how to determine the solar resource available at a given location, and the factors to consider when planning out a PV system.
Duration:	This topic represents around 12.5% of the knowledge and skills specification contents, and should take the learner approximately 7.5 hours to achieve the topic requirements.

Knowledge and Skills Specification Content Areas	Clustered Unit Mapping[1]			IQY Resources
	KE	PC	PE	
1.1 PV System Features				
Knowledge				
Describe the basic installation configurations for a grid connected PV power systems.	7.2, 14, 25.2	-	-	Topic 1 Content Quiz Topic 1.1 Learning Activity
Describe the operation of grid interactive PV systems including: • Synchronisation. • Safety features. • Power flow control. • Passive and active anti-islanding. • Secondary protection. • Metered energy.	10, 24.1, 31.4	-	-	
Skills				
Draw the block diagram of a PV grid connected system.	10, 14, 24.1, 25.2	-	-	Topic 1.1 Skills Practice
Draw schematic diagrams of common grid connected inverter circuit configurations including metering arrangements, isolation and connection with respect to RCDs in accordance with AS/NZS 4777.1.	7.2, 14, 24.2, 27, 34.2, 37, 39	-	-	

1 Grid Connected PV Systems				
1.2 Solar Resource				
Knowledge				
Define the following terms: • Sunshine hours. • Irradiance. • Irradiation. • Latitude. • Azimuth and altitude angles. • Tilt angle.	1.1	-	-	Topic 1 Content Quiz Topic 1.2 Learning Activity
State the units and symbols for irradiation and irradiance.	1.1	-	-	
State the types and features of commonly available solar data.	1.2	-		
1.3 Array Positioning				
Knowledge				
Describe how radiation varies throughout the year on the surface of a fixed collector.	1.3	-	-	Topic 1 Content Quiz Topic 1.3 Learning Activity
Explain the factors affecting the optimal tilt and orientation of PV arrays	1.4	-	-	
Explain the principle and effect of solar tracking.	1.5	-	-	
Skills				
Determine the solar access for a given site.	1.2, 18, 19, 21	1.2	1, 2	Topic 1.3 Skills Practice
Select an appropriate location and tilt angle for a PV array at a given site.	1.4, 13, 18, 19, 21	2.1	1, 2	
Determine whether any shading will occur at a given site, and estimate its effect on the system.	18, 19, 21	1.2	1, 2	

1 Grid Connected PV Systems				
Estimate the solar resource for a given site.	1.2, 18, 19, 21	1.2	1, 2	
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 4509 Stand-alone power systems.
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

2 PV Technology				
Purpose:	In this topic you will learn about the various terminology used in relation to the various types of photovoltaic modules and operating principles of the photovoltaic modules.			
Duration:	This topic represents around 6.7% of the knowledge and skills specification contents, and should take the learner approximately 4 hours to achieve the topic requirements.			
Knowledge and Skills Specification Content Areas	**Clustered Unit Mapping[1]**			**IQY Resources**
	KE	**PC**	**PE**	
2.1 PV Cells and Modules				
Knowledge				
Define the following terms: • Cell. • Module. • String. • Array.	2.1, 32.1	-	-	Topic 2 Content Quiz Topic 2.1 Learning Activity
Explain the different types of PV technology and their applications, including monocrystalline, polycrystalline and amorphous.	2.2, 17, 32.2, 32.3, 36	-	-	
Describe the mechanical and electrical features necessary for the long life of a PV module under a wide range of operating conditions	2.3, 32.4, 36	-	-	
Skills				
Draw an equivalent circuit for a PV cell, labelling each of the elements and the polarity of the terminals.	2.1, 32.1	-	-	Topic 2 Content Quiz Topic 2.2 Skills Practice
2.2 PV Module Characteristics				
Knowledge				
Define the following terms: • I-V curve. • Operating point.	3.1, 17, 33.1, 36	-	-	Topic 2 Content Quiz Topic 2.2 Learning Activity

2 PV Technology				
• Maximum power point (MPP). • Power and voltage temperature co-efficient. • Standard test conditions (STC). • Nominal operating cell temperature (NOCT).				
List the major ratings of a PV module as specified in manufacturer's data.	3.2, 17, 34.2, 36	-	-	
Skills				
Draw and label a family of I-V curves for a PV module, labelling major points.	3.1, 17, 33.1, 36	-	-	Topic 2.2 Skills Practice
Determine the major ratings of a PV module from the manufacturer's data.	3.2, 17, 33.2, 36	1.2, 5.1, 5.7	-	
Determine the electrical characteristics of a PV module.	3.1, 17, 33.1, 36	1.2, 5.1, 5.7	-	

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.

Standards:

- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

Equipment:

- Manufacturer's catalogues.

3 PV Arrays					
Purpose:	In this topic you will learn about the arrangement of PV arrays, including series and parallel module configurations, and the arrangement of blocking and bypass diodes. You will also learn about BIPV products, and the factors to consider when selecting PV modules for a given installation.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Clustered Unit Mapping[1]**			**IQY Resources**
		KE	**PC**	**PE**	
3.1 PV Module Arrangements					
Knowledge					
Describe how PV arrays can be configured to achieve specified operating parameters.		3.3, 6.2, 33.3	-	-	Topic 3 Content Quiz Topic 3.1 Learning Activity
Describe methods used in wiring and connecting PV arrays in accordance with AS/NZS 5033.		27, 29.1, 29.2.1, 37, 39	-	-	
Explain the effect of partial shading of a PV module or array, the impact of bypass diodes and the significance of their configuration on output current in typical operating conditions.		3.4, 33.4	-	-	
Skills					
Determine the minimum and maximum number of PV modules required in a string to achieve a specified operating voltage.		6.2, 21, 33.3	2.1, 2.2, 2.3, 5.1, 5.7	2	Topic 3 Content Quiz Topic 3.1 Learning Activity Topic 3.1 Skills Practice
Specify a PV array wiring plan for series connected modules to minimise power loss due to shading.		3.3, 3.4, 21, 33.3, 33.4	2.1, 2.2, 2.3, 5.1, 5.6	2	
3.2 PV System Layout					
Knowledge					

3 PV Arrays				
State the factors that will affect the locations of PV arrays and junction boxes at a given site, including: • Orientation and tilt. • Location of connecting switchboard. • Length of cable runs. • Access and fixing. • Installation requirements. • Aesthetic considerations.	29.1, 29.2.1, 29.2.2, 29.2.3	-	-	Topic 3 Content Quiz Topic 3.2 Learning Activity
Explain the need for vegetation control to reduce shading and soiling of PV arrays.	30.3	-	-	
State the considerations involved in choosing the locations of associated PV system equipment.	29.2.2	-	-	
List the factors to consider when selecting cable routes between PV arrays and inverters.	29.2.3	-	-	
Skills				
Select suitable locations for a PV array, inverter and other components at a given site.	29.2.2	5.1, 5.6	4, 5, 9.1, 9.2	Topic 3.2 Skills Practice
Plan cable routes and estimate the lengths of cable runs between a PV array, inverter and connecting switchboard at a given site.	29.2.3	5.1, 5.6	4, 5, 9.1, 9.2	
Identify the need for vegetation control to reduce shading and soiling of PV arrays.	30.3	5.1, 5.6	4, 5, 9.1, 9.2	
3.3 PV Array Selection				
Knowledge				
State the WHS/OHS requirements and risk management for selecting PV equipment.	18, 19	-	-	Topic 3 Content Quiz

3 PV Arrays				
Explain the factors that need to be considered and documented when selecting and sizing a PV array for a grid-connected inverter system, including: • Verification of site survey data. • Annual energy demand. • Budget constraints. • Architectural constraints. • Limitations on available inverter sizes.	5, 6.1, 13, 20, 21	-	-	Topic 3.3 Learning Activity
Skills				
Select and size a PV array for a grid-connected inverter system based on annual energy demand, budget constraints, architectural constraints and/or inverter limitations.	5, 6.1, 17, 18, 19, 21	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	Topic 5.2 Skills Practice
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	

Reference Text:
- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.

Standards:
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

Equipment:
- Manufacturer's catalogues.

4 Basic Inverter Principles					
Purpose:	In this topic you will learn about the purpose and basic operation of inverters. You will also have the opportunity to connect an inverter and measure the input and output parameters.				
Duration:	This topic represents around 6.7% of the knowledge and skills specification contents, and should take the learner approximately 4 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Clustered Unit Mapping[1]**			**IQY Resources**
		KE	**PC**	**PE**	
4.1 Introduction to Inverters					
Knowledge					
List the different types of inverters used in grid connected systems.		9.1, 22.1, 31.1	-	-	Topic 4 Content Quiz Topic 4.1 Learning Activity
Describe the basic function of an inverter.		9.2, 22.2, 31.2	-	-	
Skills					
Draw the standard symbol for a low voltage inverter.		9.1, 22.1, 31.1	-	-	Topic 4.1 Skills Practice
Draw a simple block diagram of a typical inverter used in a grid connected system.		9.2, 22.2, 31.2	-	-	
4.2 Inverter Operations					
Knowledge					
Explain the basic principle of operation of a single-phase inverter bridge, and how they are connected.		9.3, 23.1, 27, 31.3, 39	-	-	Topic 4 Content Quiz Topic 4.2 Learning Activity
Describe pulse width modulation (PWM) techniques used in square wave, modified square wave and synthesised sine wave inverters.		9.3, 31.3	-	-	
Skills					

4 Basic Inverter Principles				
Connect a grid inverter and measure the inverter parameters for various loads.	9.3, 23.1, 27, 31.3, 31.4, 38, 39, 40	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, 5.7, 5.8, 6.1, 6.3, 6.4	4, 9.1, 9.3, 9.4, 9.5, 9.7, 9.8	Topic 4.2 Skills Practice

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.

Equipment:

- Grid-connected inverter.
- d.c. supply.
- Variable a.c. load.
- a.c. and d.c. voltmeters.
- a.c. and d.c. ammeters.
- Cathode ray oscilloscope.
- PV array.
- PPE and hand tools.
- Connection leads.

5 Grid-Connect Inverters					
Purpose:	In this topic you will learn about the types of inverters that are suitable for grid connected applications, and the factors to consider when selecting grid connect inverters.				
Duration:	This topic represents around 10% of the knowledge and skills specification contents, and should take the learner approximately 6 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas		**Clustered Unit Mapping[1]**			**IQY Resources**
		KE	**PC**	**PE**	
5.1 GC Inverter Characteristics					
Knowledge					
List the characteristics that distinguish inverters suitable for grid connected photovoltaic array application from standard inverters.		9.4, 22.2, 23.2, 31.4, 36	-	-	Topic 5 Content Quiz Topic 5.1 Learning Activity
Outline the function and operation of a "grid protection device" as specified in AS/NZS 4777.		10, 22.2, 23.2, 25.3, 27, 31.4, 36, 37, 39	-	-	
5.2 GC Inverter Selection					
Knowledge					
State the key inverter ratings and specifications, including: • Continuous rating. • Half-hour rating. • Surge rating. • Operating window. • Efficiency. • IP rating.		11.1, 17, 22.2, 31.4, 36	-	-	Topic 5 Content Quiz Topic 5.2 Learning Activity
Explain the factors that need to be considered and documented when selecting and sizing a grid connected inverter.		11.2, 17, 20, 21	-	-	

5 Grid-Connect Inverters				
Skills				
Determine the operating window of an inverter for given minimum and maximum effective cell temperatures.	11.1, 17, 18, 19, 21	-	-	Topic 5 Content Quiz Topic 5.2 Learning Activity Topic 5.2 Skills Practice
Select a grid connected inverter for a given PV array.	5, 11.1, 11.2, 17, 18, 19, 21, 23.2	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.

Equipment:

- Manufacturer's catalogues.

6 Other Design Factors	
Purpose:	In this topic you will learn about various other factors to consider in the design of PV power systems, including the selection of wiring and switchgear. You will practice selecting equipment for given scenarios, and also learn how to estimate the energy yield, specific yield and performance ratio of a given system.
Duration:	This topic represents around 6.7% of the knowledge and skills specification contents, and should take the learner approximately 4 hours to achieve the topic requirements.

Knowledge and Skills Specification Content Areas	**Clustered Unit Mapping[1]**			**IQY Resources**
	KE	**PC**	**PE**	
6.1 Wiring and Switchgear Selection				
Knowledge				
Explain the factors that need to be considered when selecting and sizing control and protection equipment for grid-connected inverter systems.	4, 5, 7.1, 17, 21	-	-	Topic 6 Content Quiz Topic 6.1 Learning Activity
List the factors to be considered when selecting and sizing wiring systems for grid-connected PV systems.	4, 5, 7.1, 17, 21	-	-	
Describe the other economic/financial, contractual/institutional, and legislative/regulatory factors that impact the design, installation and operation of grid-connected PV systems.	8.3	-	-	
Skills				
Verify the details for a proposed grid-connected inverter system from a given job specification.	5, 21	1.1, 1.2, 1.3, 1.4	1, 2	Topic 6.2 Skills Practice
Select and size a.c. and d.c. wiring systems for a given grid-connected PV system.	7.1, 17, 18, 19, 21	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	
Select and size control and protection equipment for a given grid-connected PV system.	7.1, 17, 18, 19, 21	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2	

6 Other Design Factors				
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	20, 21	2.3, 2.4	3	
6.2 PV System Performance				
Knowledge				
Explain what is meant by the term 'energy yield' in relation to PV power systems.	8.1	-	-	Topic 6 Content Quiz Topic 6.3 Learning Activity
Explain what is meant by the term 'specific energy yield' in relation to PV power systems.	8.1	-	-	
Explain what is meant by the term 'performance ratio' in relation to PV power systems.	8.2	-	-	
State the factors affecting the need for monitoring PV system performance at a given site.	8.1, 8.2	-	-	
Skills				
Determine and document the energy yield, specific energy yield and performance ratio for the annual reduction in greenhouse gas emissions for a given grid-connected PV system.	8.1, 8.2, 21	2.3, 2.4	2, 3	Topic 6.2 Skills Practice

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.

Standards:

- AS/NZS 3000 Wiring Rules.
- AS/NZS 3008.1.1 Electrical installations – Selection of cables.
- AS/NZS 4509 Stand-alone power systems.
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

7 PV System Installation					
Purpose:	In this topic you will learn the various factors, standards and safety practices associated with the installation of grid connected PV power systems, including working on roofs, and installation labelling and identification requirements.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas	**Clustered Unit Mapping[1]**			**IQY Resources**	
	KE	**PC**	**PE**		
7.1 PV Array Installation Practices					
Knowledge					
State the safety hazards, risks and control measures for working on roofs.	12, 18, 19, 27, 28.1, 38, 39, 40	-	-	Topic 7 Content Quiz Topic 7.1 Learning Activity	
Describe common types of roof-mounted and free-standing PV array frame construction and methods of tilt angle adjustment and tracking.	12, 15, 17, 27, 28.3, 28.4, 39	-	-		
Describe the various brackets, mounting and fixing methods for different roof types.	12, 15, 17, 27, 28.3, 39	-	-		
Describe the methods to ensure the integrity of roof waterproofing is maintained in accordance with AS/NZS 5033.	12, 15, 17, 27, 28.2, 37, 39	-	-		
Skills					
Perform a risk assessment for installing a PV array on a roof at a given site.	18, 19, 21, 27, 28.1, 38, 39, 40	1.1, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 5.1, 5.2, 5.3, 5.4, 5.7, 5.8	1, 4, 8, 9.1, 9.4, 9.11	Topic 7.1 Skills Practice	
7.2 Installation Requirements					
Knowledge					

7 PV System Installation				
State the major installation requirements for a grid-connected PV power system, to ensure correct operation, long life, safety and ease of maintenance.	4, 12, 15, 20, 23.2, 25.1, 27, 30.1, 36, 37, 39	-	-	Topic 7 Content Quiz Topic 7.2 Learning Activity
Outline the additional requirements for the use of multiple mode inverters incorporating independent supply (previously standalone) functionality, as specified in AS/NZS 4777.1 and AS/NZS 4777.2.	16, 20, 23.2, 27, 36, 37, 39	-	-	
7.3 Identification and Labelling				
Knowledge				
Outline the labelling and signage requirements for grid connected PV system equipment, as set out in AS/NZS 4777.1.	16, 20, 23.2, 25.4, 27, 30.1, 37, 39	-	-	Topic 7 Content Quiz Topic 7.3 Learning Activity
Skills				
Install a grid connected PV power system in accordance with relevant standards and WHS guidelines.	12, 15, 16, 17, 18, 19, 20, 21, 23.2, 25.1, 25.4, 27, 28.1, 28.2, 28.3, 28.4, 30.1, 37, 38, 39, 40	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1, 4.2, 4.3, 4.4, 4.6, 4.7, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 6.1, 6.2, 6.3, 6.4, 6.6, 6.7	4, 5, 6, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.10	Topic 7.3 Skills Practice

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

7 PV System Installation

- AS/NZS 3000 Wiring Rules.
- AS/NZS 3008.1.1 Selection of cables.
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.
- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.

Equipment:

- PV modules and array mounting system.
- Grid-connect inverter.
- Suitable a.c. and d.c. cabling.
- HD PVC conduit.
- Suitable fixings/fasteners.
- Power drill and battery drill.
- Test equipment – insulation resistance tester, multimeter, clamp meter.
- PPE, hand tools, socket set.

8 PV System Verification					
Purpose:	In this topic you will learn the commissioning procedures required to confirm compliance and functionality of grid connected PV power systems, including inspection, testing, fault finding and rectification.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas	**Clustered Unit Mapping[1]**			**IQY Resources**	
	KE	**PC**	**PE**		
8.1 PV Isolation Procedures					
Knowledge					
List the steps required for the safe isolation of a grid-connected PV power system.	26.1, 26.2, 27, 30.2, 39	-	-	Topic 8 Content Quiz Topic 8.1 Learning Activity	
Skills					
Demonstrate the safe shutdown, isolation, lockout and tag out procedures for a grid-connected PV power system.	26.1, 26.2, 27, 30.2, 39	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1, 5.1, 5.2, 5.3, 5.4, 5.7, 5.8, 6.1	4, 7, 9.1, 9.3, 9.4, 9.5, 9.9	Topic 8.1 Skills Practice	
8.2 PV System Testing					
Knowledge					
Describe the tests needed to confirm compliance and functionality of grid connected PV power systems.	26.2, 26.3, 37	-	-	Topic 8 Content Quiz Topic 8.2 Learning Activity	
Describe the commissioning procedures for grid connected inverter systems, including start-up and shut-down procedures.	26.2, 26.4, 27, 34.1, 37, 39	-	-		
Explain the documentation required when commissioning grid-connected PV power systems.	35, 37, 39	-	-		
Skills					

8 PV System Verification				
Perform commissioning work on a PV power system in accordance with AS/NZS 5033, AS 4777.1 and AS/NZS 3000, including testing a grid-connected inverter system for correct operation.	26.2, 26.3, 26.4, 27, 34.1, 35, 37, 39	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1, 4.4, 4.5, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 6.1, 6.4, 6.5	4, 7, 8, 9.1, 9.3, 9.4, 9.5, 9.9, 9.10, 9.11	Topic 8.2 Skills Practice
8.3 PV System Fault Finding				
Knowledge				
List the common faults in PV systems and associated fault-finding procedures.	26.3, 26.4, 27, 39	-	-	Topic 8 Content Quiz Topic 8.3 Learning Activity
Skills				
Locate and document electrical faults within a PV array/inverter and wiring.	26.3, 26.4, 27, 35, 39	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1, 4.4, 4.5, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 6.1, 6.4, 6.5	4, 7, 8, 9.1, 9.3, 9.4, 9.5, 9.9, 9.10, 9.11	Topic 8.3 Skills Practice

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill

Standards:

- AS/NZS 3000 Wiring Rules
- AS/NZS 4777 (Series) Grid connection of energy systems via inverters
- AS/NZS 4836 Safe working on or near low-voltage electrical installations and equipment
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays

8 PV System Verification
Equipment: • Simulated grid-connected PV system with fault switches • Selection of test equipment (ohmmeter/continuity tester, insulation resistance tester, tong tester, digital multimeter etc.) • PPE and hand tools

Legend:

KE	Knowledge Evidence	**PE**	Performance Evidence
PC	Performance Criteria		

IQY TECHNICAL COLLEGE

Clustered Learning Plan

UEERE0060 – Design grid-connected battery storage systems
UEERE0077 – Install battery storage equipment power conversion equipment to grid
UEERE0078 – Install battery storage to power conversion equipment

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A. Overview	
UoC – Unit of Competency 1	**UEERE0060 Design grid-connected battery storage systems**
UoC 1 Application	This unit involves the skills and knowledge required to design battery storage systems. This unit applies to a person with a sound knowledge of the components and different system configurations of battery storage systems for grid-connected photovoltaic (PV) systems and suitable energy management strategies that can be applied to the site where a system can be installed. A person competent in this unit will be able to design a system, which includes calculating and selecting the correct sized equipment, so the system output performance meets the client specific objectives, within the guidelines of relevant industry standards, regulations and manufacturer requirements. The unit involves designing a system taking into consideration all necessary work health and safety requirements relevant for the selected system and documenting the design including all calculations, equipment specifications and layouts. This unit is appropriate for Licenced Electricians or Electrical Engineers with responsibility for designing grid-connected battery storage systems. Licensing, legislative or certification requirements that apply to this unit may differ between jurisdictions and system types. They should be checked prior to commencing this unit.
UoC – Unit of Competency 2	**UEERE0077 Install battery storage equipment power conversion equipment to grid**
UoC 2 Application	This unit involves the skills and knowledge required to install battery storage equipment power conversion equipment (PCE) to grid. It includes working safely and to industry installation standards, placing and securing system components accurately, making required circuit connections and completing the necessary installation documentation. The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations, which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c.). Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, is required. Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations.

	Note: Those holding an Unrestricted Electrician's Licence or equivalent issued in an Australian state or territory meet the prerequisite requirements of UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories. All other prerequisite requirements must be met.	
UoC – Unit of Competency 3	**UEERE0078 Install battery storage to power conversion equipment**	
UoC 3 Application	This unit involves the skills and knowledge required to install battery storage systems to Power Conversion Equipment (PCE). It includes working safely and to industry installation standards, placing and securing system components accurately, making required circuit connections and completing the necessary installation documentation. The skills and knowledge described in this unit require a licence or permit to practice in the workplace where work is carried out on electrical installations, which are designed to operate at voltages greater than 50 volt (V) alternating current (a.c.) or 120 V direct current (d.c.). Competency development activities in this unit are subject to regulations directly related to licensing. Where a licence or permit to practice is not held, a relevant contract of training, such as an Australian Apprenticeship, is required. Additional and/or other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to work health and safety (WHS)/occupational health and safety (OHS) regulations. Note: Those holding an Unrestricted Electrician's Licence or equivalent issued in an Australian state or territory meet the prerequisite requirements of UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories. All other prerequisite requirements must be met.	
Purpose of CLP	The purpose of the Clustered Learning Plan (CLP) is to define the depth and breadth of the knowledge and skills required to address the Competency Standard Units (CSUs) Assessment Requirements. It also indicates the recommended sequence and duration for the structured learning program, and provides a list of resources suitable for the delivery of the material using a blended approach. In the context of this CLP, the term 'structured learning program' encompasses both the imparting of knowledge and skills and the completion of evidence gathering activities designed to address the Assessment Requirements. The structured learning program is generally undertaken off-the-job in a controlled learning environment.	
Unit aspects addressed in this CLP	PC-UEERE0060	Performance Criteria
	RC-UEERE0060	Range of Conditions
	PE-UEERE0060	Performance Evidence

	KE-UEERE0060	Knowledge Evidence
	PC-UEERE0077	Performance Criteria
	RC-UEERE0077	Range of Conditions
	PE-UEERE0077	Performance Evidence
	KE-UEERE0077	Knowledge Evidence
	PC-UEERE0078	Performance Criteria
	RC-UEERE0078	Range of Conditions
	PE-UEERE0078	Performance Evidence
	KE-UEERE0078	Knowledge Evidence

Suggested Durations	Completion of CLP topics 1 to 7	49.5 hours
	Completion of Clustered Knowledge Test	2.5 hours
	Completion of Clustered Skills Test (Tasks A and B)	8 hours
	Total duration of structured learning program	60 hours
	Note: These durations do not include the necessary workplace experience and final assessment of all evidence that must occur before competence can be determined.	

Sequence

Before undertaking this CLP a learner is to have completed the following Competency Standard Units or equivalent:

- UEEEL0012 Install low voltage wiring, appliances, switchgear and associated accessories*
- UEERE0054 Conduct site survey for grid-connected photovoltaic and battery storage systems

AND

- UEEEL0039 Design, install and verify compliance and functionality of general electrical installations

OR

- UEERE0051 Apply electrical principles to renewable energy design

*Note that the following units are pre-requisites of UEEEL0012 (but are missing from the pre-requisite chain of UEERE0080 and UEERE0081 as shown on training.gov.au):

- UEECD0007 Apply work health and safety regulations, codes and practices in the workplace
- UEECD0019 Fabricate, assemble and dismantle utilities industry components
- UEECD0020 Fix and secure electrotechnology equipment
- UEECD0051 Use drawings, diagrams, schedules, standards, codes and specifications
- UEEEL0003 Arrange circuits, control and protection for electrical installations
- UEEEL0020 Solve problems in low voltage a.c. circuits
- UEEEL0023 Terminate cables, cords and accessories for low voltage circuits

- UEEEL0018 Select wiring systems and select cables for low voltage electrical installations
- UEEEL0005 Develop and connect electrical control circuits
- UEEEL0019 Solve problems in direct current (d.c.) machines
- UEEEL0021 Solve problems in magnetic and electromagnetic devices
- UEEEL0014 Isolate, test and troubleshoot low voltage electrical circuits
- UEEEL0008 Evaluate and modify low voltage heating equipment and controls
- UEEEL0009 Evaluate and modify low voltage lighting circuits, equipment and controls
- UEEEL0010 Evaluate and modify low voltage socket outlets circuits
- UEEEL0024 Test and connect alternating current (a.c.) rotating machines
- UEEEL0025 Test and connect transformers

AND

- UEECD0043 Solve problems in direct current circuits

OR

- UEECD0044 Solve problems in multiple path circuits
- UEECD0046 Solve problems in single path circuits

B. Knowledge and Skills Delivery

1 Grid-Connected Battery Systems

Purpose:	In this topic you will learn about the purpose and application of battery storage systems designed for use as part of a grid-connected PV power system, including the various different system configurations.
Duration:	This topic represents around 9.2% of the knowledge and skills specification contents, and should take the learner approximately 5.5 hours to achieve the objectives.

Knowledge and Skills Specification Content Areas	**Clustered Unit Mapping[1]**			**Energy Space Resources**
	KE	**PC**	**PE**	
1.1 Energy Use				
Knowledge				
Explain how energy is typically used in domestic and commercial premises.	2.1, 2.2.1	-	-	Topic 1 Content Quiz Topic 1.1 Learning Activity
List the strategies that can be used to reduce energy use at a given premises.	6	-	-	
1.2 Energy Usage Profiles				
Knowledge				
Explain typical load profiles, including identification of peak and average demand.	2.1, 2.2.1, 14, 22.1.2, 22.1.3	-	-	Topic 1 Content Quiz Topic 1.2 Learning Activity
1.3 Energy Management				
Knowledge				
State the typical time frames for rectification of grid-outages.	2.2.2, 15.4, 22.1.1	-	-	Topic 1 Content Quiz Topic 1.2 Learning Activity

1 Grid-Connected Battery Systems				
List the applications for battery storage systems, including: • To provide electrical supply during grid outages. • To provide electrical supply to loads during peak periods.	3.1.1, 3.1.2, 3.3, 6, 7.4, 14, 15.3, 15.4, 22.1.1, 22.1.2, 22.4	-	-	
Explain the current techniques available for consumers to monitor and switch between energy sources to reduce reliance on grid-supply.	3.2, 3.3, 6, 14, 22.3	-	-	
1.4 Battery System Configurations				
Knowledge				
List and explain the purpose of each major component in a grid-connected PV battery storage system, including: • Batteries. • Charge controller. • Inverter. • Control and protection devices. • Interconnecting wiring.	3.3, 3.4, 6, 12, 14, 22.2, 22.5	-	-	Topic 1 Content Quiz Topic 1.4 Learning Activity
Explain the common types of local requirements relating to gid-connected battery storage imposed by network providers.	3.1.3, 9, 11.1.1, 11.1.2, 22.1.3	-	-	
Describe the different functional arrangements and configurations of grid-connected PV battery storage systems.	3.5, 6, 7.4, 12, 14, 15.4, 22.6	-	-	
Skills				
Draw the block diagrams of different grid-connected PV battery storage system configurations.	3.5, 7.4, 12, 14, 15.4, 22.6	-	-	Topic 1.4 Skills Practice

1 Grid-Connected Battery Systems

Standards:

- AS/NZS 5139 Safety of battery systems for use with power conversion equipment.
- AS/NZS 4777 (series) Grid connection of energy systems via inverters.
- AS/NZS 5033 Installation and safety requirements for photovoltaic (PV) arrays.

2 Grid-Connect Batteries					
Purpose:	In this topic you will learn about the types of batteries used in grid-connected storage systems, including terms, definitions and parameters, charging modes and battery life. You will also learn about the safe working practices for handling, installing, maintaining and disposing of storage system batteries.				
Duration:	This topic represents around 6.7% of the knowledge and skills specification contents, and should take the learner approximately 4 hours to achieve the objectives.				
Knowledge and Skills Specification Content Areas		**Clustered Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
2.1 Terms and Definitions					
Knowledge					
Define the following terms in relation to grid-connected battery systems: • Battery. • Cell. • Primary and secondary cells. • Nominal voltage. • Charge and discharge rate. • Ampere hour capacity. • Watt hour capacity. • State of charge (SOC). • Depth of discharge (DOD). • Useable capacity. • Cycle life.		1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.1.8, 1.1.9, 1.1.10, 1.1.11, 21.1.1, 21.1.2, 21.1.3, 21.1.4, 21.1.5, 21.1.6, 21.1.7, 21.1.8, 21.1.9, 21.1.10, 21.1.11	-	-	Topic 2 Content Quiz Topic 2.1 Learning Activity
Describe the arrangement of battery banks and the effect of connecting batteries in series and parallel.		3.5, 22.6	-	-	
2.2 Types of Batteries					
Knowledge					

2 Grid-Connect Batteries				
List the major types and features of batteries suitable for grid-connected PV battery storage systems.	1.3, 21.2	-	-	Topic 2 Content Quiz Topic 2.2 Learning Activity
Explain the different charging modes used with grid-connected PV battery storage systems.	1.6, 21.5	-	-	
State the factors that can affect the life of commercially available storage system batteries.	1.4, 21.3			
Explain the factors and techniques for estimating the service life of a PV battery storage system.	1.4, 21.3	-	-	
2.3 Battery Safety				
Knowledge				
State the hazards and associated risk control measures when handling, installing or maintaining battery storage banks, including hazards under fault conditions.	1.2, 10, 21.6, 21.7	-	-	Topic 2 Content Quiz Topic 2.2 Learning Activity
State the common causes of battery failure in commercially available batteries, including sulphation and stratification in lead acid batteries.	1.5, 21.4	-	-	
State the procedures for safe disposal and recycling of batteries.	1.7, 21.8	-	-	
Skills				
Perform a risk assessment for a work task involving the handling, installation, or maintenance of battery storage banks.	1.2, 10, 11.7, 21.6	1.1, 5.1, 5.2, 5.3, 5.4, 5.7	1, 12, 13, 17	Topic 2.3 Skills Practice
Equipment: • Manufacturer's catalogues.				

3 Power Conversion Equipment (PCE)					
Purpose:	In this topic you will learn about the different types, features and ratings of PCE used in grid-connected PV battery storage systems. You will also learn how to connect different types of PCE and measure the input and output parameters.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the objectives.				
Knowledge and Skills Specification Content Areas		**Clustered Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
3.1 Types of PCE					
Knowledge					
List the different types of PCE used in grid-connected PV systems with battery storage.		4, 12, 23	-	-	Topic 3 Content Quiz Topic 3.1 Learning Activity
Describe the basic function of inverters and charge controllers.		4, 12, 23	-	-	
State the differences between a grid-connect inverter and a multiple mode inverter.		7.1, 15.1, 15.4, 23	-	-	
Identify the standard symbols for a charge controller and an inverter.		4, 12, 23	-	-	
3.2 Charge Controller Specifications					
Knowledge					
List the key input and output ratings for a charge controller, including: • d.c. voltages. • d.c. currents. • Efficiency.		4, 7.2.1, 7.2.2, 12, 23	-	-	Topic 3 Content Quiz Topic 3.2 Learning Activity
Explain what is meant by the 'operating window' of a charge controller.		4, 7.2.2, 12, 23	-	-	

3 Power Conversion Equipment (PCE)				
Skills				
Connect a charge controller and measure the input and output parameters.	4, 12, 23	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.1, 4.5, 4.6, 4.7, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 6.1, 6.5, 6.6, 6.7	11, 12, 13, 14, 16, 17	Topic 3.2 Skills Practice
3.3 Multiple Mode Inverter Specifications				
Knowledge				
List the key output ratings for a multiple mode inverter, including: • Required maximum demand. • Battery charging capacity. • d.c. voltages. • d.c. currents. • Efficiency.	4, 7.2.1, 7.2.2, 15.2.1, 15.2.2, 23	-	-	Topic 3 Content Quiz Topic 3.2 Learning Activity
List the typical features and settings of multiple mode inverters that may need to be adjusted to ensure correct operation.	4, 6, 7.3, 7.4, 12, 15.3, 15.4, 23	-	-	
Skills				
Select PCE for given applications.	4, 7.2.1, 7.2.2, 7.3, 7.4	1.1, 2.1	1, 2, 3	Topic 3.3 Skills Practice 1 Topic 3.3 Skills Practice 2
Connect a multiple mode inverter, set required parameters, and measure the input and output parameters for various loads.	4, 7.2.1, 7.2.2, 7.3, 7.4, 15.2.1, 15.2.2, 15.3, 23	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.1, 4.4, 4.5, 4.6, 4.7, 5.1, 5.2, 5.3,	4, 5, 6, 7.3, 9, 11, 12, 13, 14, 15.4, 16, 17	

3 Power Conversion Equipment (PCE)				
		5.4, 5.5, 5.6, 5.7, 6.1, 6.4, 6.5, 6.6, 6.7		

Reference Text:

- Photovoltaic Power Systems – Resource Book, Commonwealth of Australia and Brisbane Institute of TAFE.
- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.
- AS/NZS 5139 Safety of battery systems for use with power conversion equipment.

Equipment:

- Manufacturer catalogues/data sheets (PCE).
- Multiple mode inverter.
- Charge controller
- Battery bank.
- d.c. supply.
- Variable a.c. load.
- d.c. voltmeters and ammeters.
- a.c. voltmeters and ammeters.
- PV array.
- PPE.
- Hand tools.
- Connection leads.

4 Battery System Design					
Purpose:	In this topic you will learn about the factors to consider when selecting and sizing battery banks, interconnecting wiring, earthing, control and protection. You will practice selecting equipment for given scenarios, and also learn how to estimate the energy capacity/yield for a given system.				
Duration:	This topic represents around 20% of the knowledge and skills specification contents, and should take the learner approximately 12 hours to achieve the topic requirements.				
Knowledge and Skills Specification Content Areas	**Clustered Unit Mapping[1]**			**Energy Space Resources**	
	KE	**PC**	**PE**		
4.1 WHS/OHS Practices					
Knowledge					
State the WHS/OHS requirements and risk management for selecting battery system equipment.	10	-	-	Topic 4 Content Quiz Topic 4.1 Learning Activity	
4.2 Battery Sizing and Selection					
Knowledge					
Explain the factors and methods for selecting and sizing battery storage banks for grid-connected battery systems, including: • Customer objectives and budget. • Upfront costs, ongoing costs, warranty and payback period. • Energy profile, monitoring and metering. • Local network requirements.	3.1.3, 3.2, 8.1, 8.2, 9	-	-	Topic 4 Content Quiz Topic 4.2 Learning Activity	
4.3 BoS Equipment Selection					
Knowledge					
Explain the factors and methods for selecting and sizing switchgear, wiring and earthing equipment for grid-connected battery systems.	8.1, 8.3	-	-	Topic 4 Content Quiz Topic 4.3 Learning Activity	

4 Battery System Design				
4.4 Battery System Documentation				
Knowledge				
List the details to be documented in battery system design documentation to meet relevant industry standards, regulations and manufacturer requirements.	8.6	-	-	Topic 4 Content Quiz Topic 4.4 Learning Activity
Skills				
Design and document the proposed battery installation, including: • Battery storage type, capacity and configuration. • Inverter type and capacity. • Charge controller type, capacity and settings. • Selecting and sizing cables, protection and isolation devices • Equipment locations and cable routes. • Required system signage. • System cost. • Warranty periods.	3.1.3, 3.2, 8.1, 8.2, 8.3, 8.6, 9	1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3	1, 2, 3	Topic 4.4 Skills Practice
Present system design to teacher/trainer/assessor and finalise any alternations if necessary.	-	2.4	3	
Standards: • AS/NZS 3000 Wiring Rules. • AS/NZS 3008.1.1 Selection of cables. • AS/NZS 4777 (Series) Grid connection of energy systems via inverters. • AS/NZS 5139 Safety of battery systems for use with power conversion equipment. **Equipment:** • Manufacturer catalogues/data sheets (battery system equipment).				

4 Battery System Design
• Battery system schematic drawings. • Battery system layout drawings.

5 Battery System Installation					
Purpose:	In this topic you will learn the various factors, standards and safety practices associated with the installation of grid-connected PV battery storage systems, including interpreting specifications, installation layouts and requirements for batteries, charge controllers, inverters, balance of system (BoS) equipment, and labelling/identification.				
Duration:	This topic represents around 13.3% of the knowledge and skills specification contents, and should take the learner approximately 8 hours to achieve the objectives.				
Knowledge and Skills Specification Content Areas		**Clustered Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
5.1 Installation Specifications					
Knowledge					
Describe typical schematic and physical layouts of the major components in a grid-connected PV battery storage system, including: • Batteries. • Charge controller. • Inverter. • Control and protection devices. • Earthing. • PV, battery and grid supplies. • Metering.		5.1, 5.2, 13.1.1, 13.1.2, 13.1.3, 13.1.4, 13.1.5, 13.1.6, 13.1.7, 13.3, 24.1, 24.2, 24.3, 24.4, 24.5, 24.6, 24.7, 24.9, 24.11	-	-	Topic 5 Content Quiz Topic 5.1 Learning Activity
Describe typical diagrams showing the physical layout of equipment, fittings and cabling for grid-connected PV battery storage systems.		5.1, 5.2, 13.2, 13.4, 24.8, 24.10	-	-	
Skills					
Interpret schematic and layout diagrams to determine the quantity and locations for battery system equipment.		5.1, 5.2, 13.1.1, 13.1.2, 13.1.3, 13.1.4, 13.1.5, 13.1.6, 13.1.7, 13.2,	3.1, 5.1	4, 9, 11, 17	Topic 5.1 Skills Practice

5 Battery System Installation				
	13.3, 13.4, 24.1, 24.2, 24.3, 24.4, 24.5, 24.6, 24.7, 24.8, 24.9, 24.10, 24.11			
5.2 Installation Requirements				
Knowledge				
State the major requirements for a grid-connected PV battery storage systems, relating to the safe installation and operation of: • Battery storage devices. • Charge controllers. • Inverters. • Essential circuit supply. • Balance of system (BoS) equipment.	11.1.1, 11.1.2, 22.6	-	-	Topic 5 Content Quiz Topic 5.2 Learning Activity
State the AS/NZS 5139 requirements for earthing of grid-connected battery systems.	11.1.2, 22.6	-	-	
Outline the requirements for the use of multiple mode inverters incorporating independent supply (previously standalone) functionality, as specified in AS/NZS 4777.1.	11.1.1, 22.6	-	-	
5.3 Identification and Labelling				
Knowledge				
Outline the labelling and signage requirements for grid connected PV battery storage systems, as set out in AS/NZS 4777.1 and AS/NZS 5139.	8.4, 11.1.1, 11.1.2, 22.6	-	-	Topic 5 Content Quiz Topic 5.3 Learning Activity
Skills				

5 Battery System Installation				
Install a grid-connected PV battery storage system in accordance with relevant safe practices, Australian standards and manufacturer guidelines, including the batteries and all balance of system (BoS) equipment up to the inverter.	8.4, 11.1.1, 11.1.2, 22.6	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.1, 4.2, 4.3, 4.4, 4.5, 4.7, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 6.1, 6.2, 6.3, 6.4, 6.5, 6.7	4, 5, 6, 7.1, 7.2, 7.3, 9, 11, 12, 13, 14, 15.1, 15.2, 15.3, 15.4, 17	Topic 5.3 Skills Practice

Standards:

- AS/NZS 3000 Wiring Rules.
- AS/NZS 3008.1.1 Selection of cables.
- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.
- AS/NZS 5139 Safety of battery systems for use with power conversion equipment.

Equipment:

- Battery bank.
- Suitable d.c. cabling.
- Multiple mode inverter.
- Suitable cable supports.
- Suitable fixings/fasteners.
- Power drill or battery drill.
- Test equipment – insulation resistance tester, multimeter, clamp meter.
- PPE, hand tools, socket set.

6 Battery System Testing and Fault Finding					
Purpose:	In this topic you will learn the commissioning procedures required to confirm compliance and functionality of grid connected PV battery storage systems, including inspection, testing, fault finding and rectification.				
Duration:	This topic represents around 10% of the knowledge and skills specification contents, and should take the learner approximately 6 hours to achieve the objectives.				
Knowledge and Skills Specification Content Areas	**Clustered Unit Mapping[1]**			**Energy Space Resources**	
	KE	**PC**	**PE**		
6.1 Battery System Testing					
Knowledge					
Describe the safe commissioning procedures for grid-connected battery storage systems, including: • Inspecting equipment. • Testing equipment. • System start-up and Shut-down. • Performance testing. • System shut-down.	19.1, 19.2, 20, 28.1, 28.2, 29	-	-	Topic 6 Content Quiz Topic 6.1 Learning Activity	
Explain the need to brief the client on the safe and correct operation of the system.	20, 29	-	-		
Skills					
Demonstrate commissioning procedures on a grid-connected battery storage system in accordance with AS/NZS 5139, AS/NZS 4777.1 and AS/NZS 3000.	19.1, 19.2, 20, 28.1, 28.2, 29	3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 4.1, 4.6, 4.7, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 6.1, 6.6, 6.7	4, 5, 6, 8, 9, 11, 12, 13, 14, 16, 17	Topic 6.1 Skills Practice	
Brief the client (teacher/trainer/assessor) on the safe and correct use of the battery system.	20, 29	4.8, 6.8	10, 18		

6 Battery System Testing and Fault Finding				
6.2 Battery System Fault Finding				
Knowledge				
List the common faults that can arise in grid-connected battery storage systems.	16.1, 16.2, 25.1.1, 25.1.2	-	-	Topic 6 Content Quiz Topic 6.2 Learning Activity
State the safe procedures for finding faults in grid-connected battery storage systems and associated components.	16.1, 16.2, 25.1.1, 25.1.2	-	-	
Skills				
Locate and rectify electrical faults within a grid-connected battery storage system and document outcomes.	16.1, 16.2, 19.1, 25.1.1, 25.1.2, 28.1	3.7, 4.1, 4.5, 4.6, 5.7, 6.1, 6.5, 6.6	4, 5, 6, 8, 9, 11, 12, 13, 14, 17	Topic 6.2 Skills Practice

Reference Text:

- Pethebridge, K. and Neeson, I., Electrical Wiring Practice, McGraw-Hill.

Standards:

- AS/NZS 3000 Wiring Rules.
- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.
- AS/NZS 4836 Safe working on or near low-voltage electrical installations and equipment.
- AS/NZS 5139 Safety of battery systems for use with power conversion equipment.

Equipment:

- Simulated grid-connected PV battery storage system with fault switches.
- Ohmmeter/continuity tester.
- Insulation resistance tester.
- tong tester.
- digital multimeter.
- PPE and hand tools.

7 Battery System Maintenance					
Purpose:	In this topic you will learn how to carry out isolation and shutdown procedures to allow maintenance tasks to be performed. You will also learn how to perform routine maintenance tasks on battery storage systems.				
Duration:	This topic represents around 10% of the knowledge and skills specification contents, and should take the learner approximately 6 hours to achieve the objectives.				
Knowledge and Skills Specification Content Areas		**Clustered Unit Mapping[1]**			**Energy Space Resources**
		KE	**PC**	**PE**	
7.1 Battery System Isolation					
Knowledge					
List the steps required for the safe isolation of a grid-connected PV battery storage system.		19.1, 28.1	-	-	Topic 7 Content Quiz Topic 7.1 Learning Activity
Skills					
Carry out correct isolation and shutdown procedures prior to carrying out maintenance tasks.		19.1, 28.1	3.7, 5.7	5, 6, 8, 12, 13, 14, 16	Topic 7.2 Skills Practice 2
7.2 Battery System Maintenance					
Knowledge					
State the individual maintenance requirements for: • Battery storage devices • Charge controllers • Inverters • Balance of system (BoS) equipment		8.5, 17, 18.1, 26, 27.1	-	-	Topic 7 Content Quiz Topic 7.2 Learning Activity
State the maintenance requirements for grid-connected PV battery storage systems.		8.5, 17, 18.2, 26, 27.2	-	-	
Skills					

7 Battery System Maintenance				
Develop a maintenance schedule for a given grid-connected PV battery storage system.	8.5, 17, 18.1, 18.2, 26, 27.1, 27.2	2.1	1, 2	Topic 7.2 Skills Practice 1 Topic 7.2 Skills Practice 2
Perform routine maintenance tasks on a battery storage system.	8.5, 17, 18.1, 18.2, 26, 27.1, 27.2	4.5, 6.5	4, 5, 6, 9, 11, 12, 13, 14, 17	

Standards:

- AS/NZS 3000 Wiring Rules.
- AS/NZS 4777 (Series) Grid connection of energy systems via inverters.
- AS/NZS 4836 Safe working on or near low-voltage electrical installations and equipment.
- AS/NZS 5139 Safety of battery systems for use with power conversion equipment.

Equipment:

- Battery storage installation/specifications.
- Battery storage installation.
- d.c. voltmeter.
- Digital multimeter.
- Lock-out devices.
- Danger tags.
- PPE.

Legend:

KE	Knowledge Evidence	**PE**	Performance Evidence
PC	Performance Criteria		