Unit	UEPOP525A Co-ordinate Direct Switching Program	Test Number	1
Total Marks	100	Time allowed	2 hr

Instruction to assessors
• Please provide the blank A4 sheets to students to write the answers on them • Please tell the students not to write on the question papers • Online test can also be supplemented. • The marking can be done by referring the attached marking guide • Giving the marks based on students' effort & demonstration of the absorbed study & competency rather than the final answer is to made • The necessary formulas can be provided on the white board. • The formula which can be provided will be advised separately. • No notes, digital storage devices, programmable calculators are allowed. • Page 1 = Instruction to assessors & students • Page 2+3= Question Paper • Page 4 and the remaining pages= Marking Guide
Instruction to students
• Write the answers on provided A4 blank sheets • Do write the answers on the question papers • Online test can also be supplemented. • The marking can be done by referring the attached marking guide • The necessary formulas can be provided on the white board on request.. • The formula which can be provided will be advised separately. • No notes, digital storage devices, programmable calculators are allowed.

1	Sketch Star Delta starting method and Auto Transformer starting method.	10
2	Explain the following (i) Protection against low voltage (ii) Time delay protection	10
3	Sketch the wound rotor motor.	10
4	Explain the followings (a)Cable Tag (b) Distribution Cable (c) Control Cable	10
5	Explain ship propulsion electrical control system What is steering system?	10

6	Describe turbo electric propulsion system with necessary sketch.	10
7	Explain the synchronous motor based propulsion and control system	10
8	Write the procedure for operation of hydraulic power plant for deck machineries	10
9	What are the safety features in modern electric cranes	10
10	Sketch the arrangement of compressed air system	10

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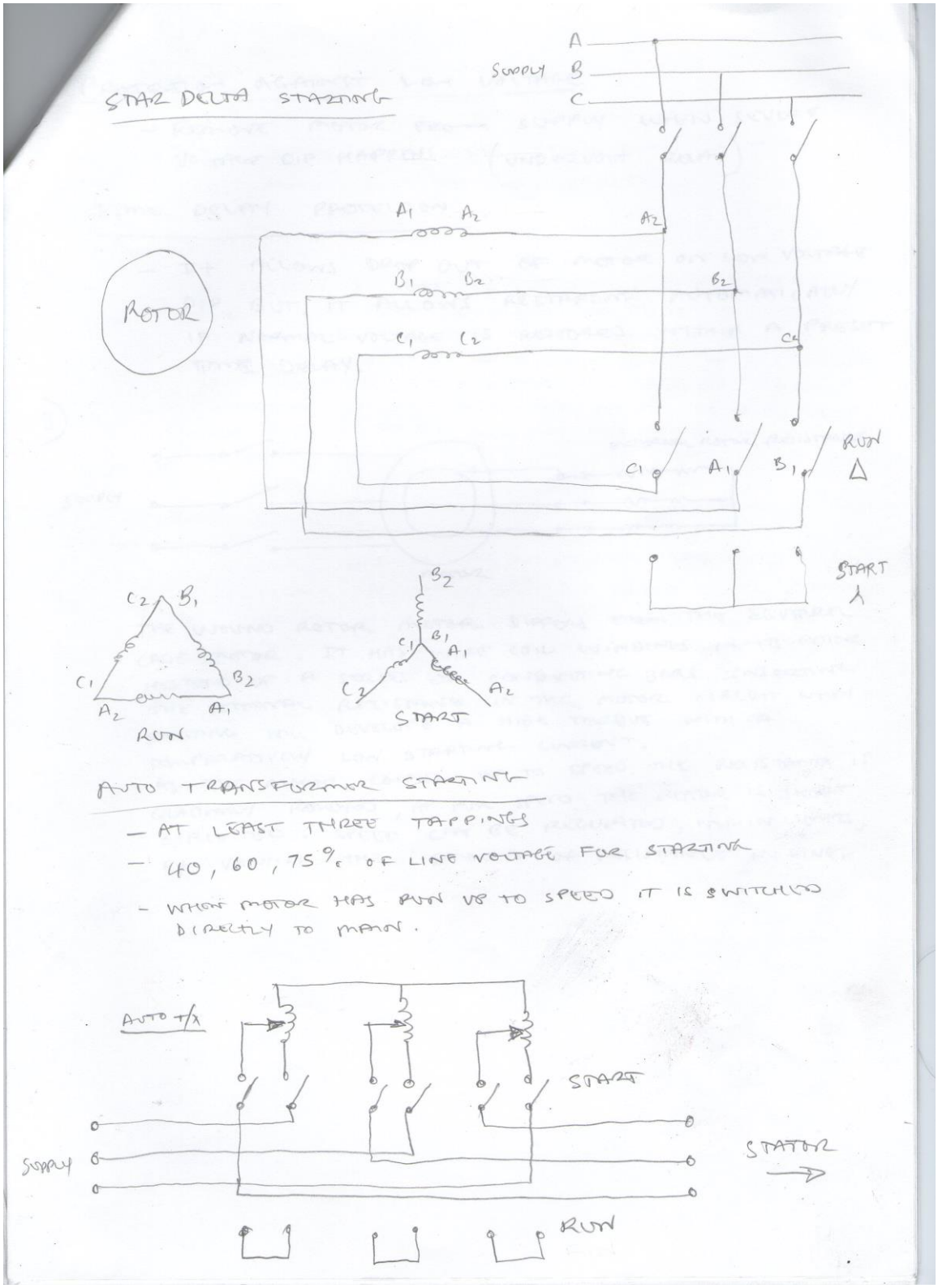
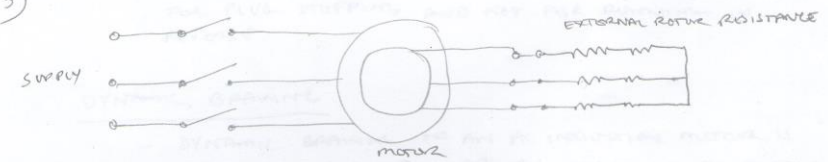
	Marking Guide	Mark
1		10

2	PROTECTION AGAINST LOW VOLTAGE – REMOVE MOTOR FROM SUPPLY WHEN SEVERE VOLTAGE DIP HAPPENS (UNDERVOLT RELAY) TIME DELAY PROTECTION – IT ALLOWS DROP OUT OF MOTOR ON LOW VOLTAGE DIP BUT IT ALLOWS RESTARTING AUTOMATICALLY IF NORMAL VOLTAGE IS RESTORED WITHIN A PRESET TIME DELAY.	10
3	3)  THE WOUND ROTOR MOTOR DIFFERS FROM THE SQUIRREL CAGE MOTOR. IT HAS WIRE COIL WINDINGS IN ITS ROTOR INSTEAD OF A SERIES OF CONDUCTING BARS. INSERTING THE EXTERNAL RESISTANCE IN THE MOTOR CIRCUIT WHEN STARTING WILL DEVELOPE A HIGH TORQUE WITH A COMPARATIVELY LOW STARTING CURRENT. AS THE MOTOR COMES UP TO SPEED THE RESISTANCE IS GRADUALLY REMOVED, AT FULL SPEED THE ROTOR IS SHORT CIRCUITED. SPEED CAN BE REGULATED, WITHIN LIMITS, BY VARYING THE AMOUNT OF RESISTANCE IN LINE.	10
4	Cable Tag Embossed metal tags are used to identify cables throughout the vessel. The tags are located at the distribution panel and the component. Tags are also attached to the cables where penetration of the bulkhead is necessary. The first part of tag code indicates the type of circuit. In many cases, the cores are also numbered and they correspond to those given in the manuals.	3

Distribution cable

3

These cables are used for power distribution up to the rated voltage and current of the cable. Low-voltage (600-volts) cables are generally found on ships for this purpose. They are used for most electrical connections.

Control Cable

These are multiple parallel conductor multi-coloured cables used for:

4

- Control circuits where an electrical signal energizes a magnetic control device to physically open or close the main contacts of a motor. The control cable does not carry the motor's operating current, but only the current used in energizing the coil of the magnetic control device (found in switchboards too).
- Indicating circuits in meters and other audio and visual indicating apparatus.
- Communication, electronic, and other similar circuits.

5

10

A Propulsion System

This provides the necessary thrust to give the vessel in question a specified speed *(in some cases the static thrust or bollard pull is also of importance)*. The normal answer to this function is a conventional marine propeller with a shaft line, stern tube with seals, and line shaft bearing and reduction gearbox (*in the case of medium or high-speed diesels*). Remote control of the machinery from the bridge is normally incorporated as well (Refer Figure 17.1).

A Steering System

This provides for control of the ship's steering and course keeping at ship speeds, at which the rudder is efficient. The standard solution is of course a conventional rudder with a rudderpost, bearings and steering gear with auxiliaries. In the wheelhouse, a means for rudder control is available (a wheel, lever or a similar device) with a control link to the steering gear system. An interface for an autopilot system is normally arranged.

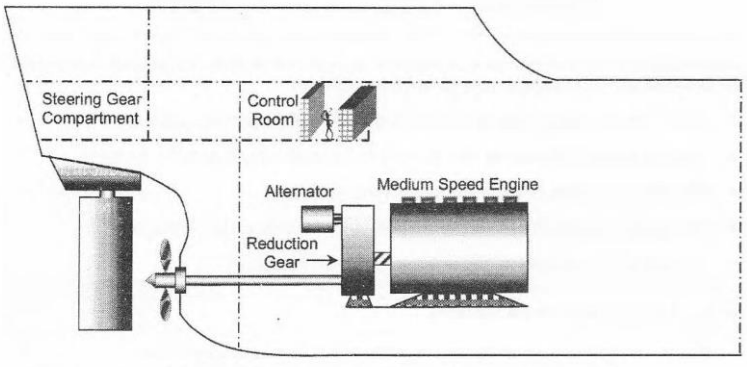
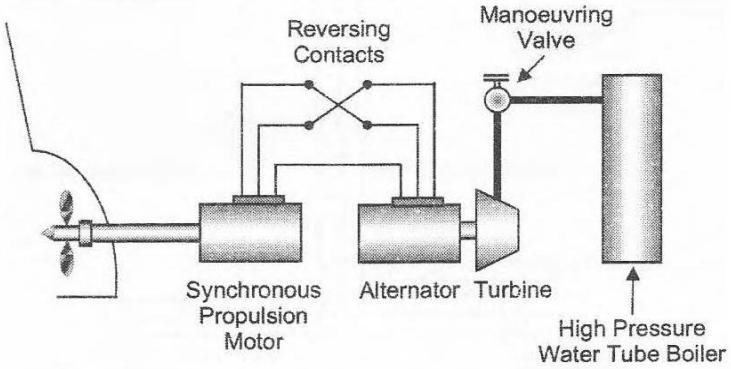


Figure 17.1 – Machinery Arrangement – Conventional Propeller

6	The necessary reversal and speed changes essential for a synchronous motor coupled to a fixed-pitch propeller are obtained in the classic turbo-electric installation by switching two phases of the three-phase power supply to the motor and by altering the speed of the steam turbine, respectively. With this scheme, the variable-speed a.c. generator and the electric propulsion motor provide a system, which is a substitute for a gearbox. (Refer Figure 17.4). Manoeuvring is partly by electrical and partly by mechanical means.  **Figure 17.4 – Basic Turbo-Electric Propulsion System** The arrangement allows flexibility in the positioning of equipment, but the change of speed and frequency of the turbine-driven alternator is essential for the control of the propulsion motor's speed. This means that the alternator must be dedicated to the propulsion motor and cannot be used simultaneously to supply power to other motors. The drawback of having the generator involved with control (as with the d.c. Ward-Leonard system) is avoided when constant-speed alternators are used either with constant-speed motors and controllable-pitch propellers, or with propulsion motors with variable speed and direction, coupled to fixed-pitch propellers. Control of propulsion motors is provided by modern solid-state equipment and generator power can also be used for thrusters, pumps and other auxiliary machinery.	10

7	The potential for using static electronic equipment to convert an electrical supply can be seen from the description of an a.c. drive for a d.c. propulsion motor in this chapter. Static frequency converters are used in a number of ship's installations as the controlling intermediary between fixed-speed alternators and variable-speed synchronous propulsion motors (Refer Figure 17.10).	10

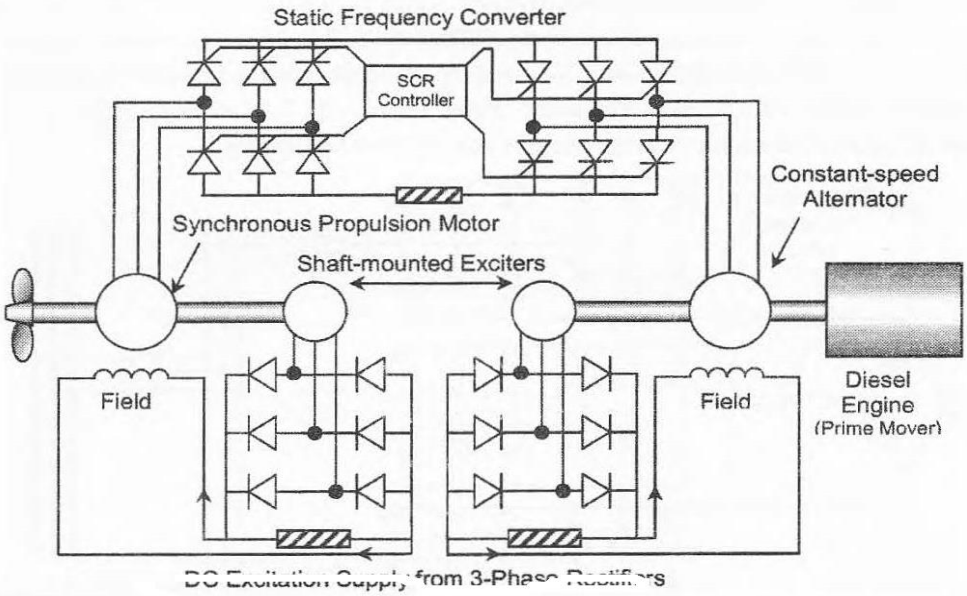


Figure 17.10 – Schematic Diagram of a Synchronous Motor-based Propulsion System

The output from the alternators is delivered at constant voltage and frequency. For manoeuvring or slow speeds, the output is passed on to propulsion motors at a lower frequency and with its voltage adjusted. The speed of a synchronous motor is governed by the frequency of the current supplied. Many synchronous drives are based on conversion of the output (from fixed-speed alternators), first to direct current and then back to a.c. at a lower frequency (the opposite of the converter scheme for variable-speed shaft generators). The vessel, when operating at full speed, will receive power at normal frequency and voltage

8	***Suggested Procedure for the Operation of the Hydraulic Power Units*** a) Check the level of the tank. If it is low, then transfer oil from the reserve tank. b) Ensure that the filters are clean and that their shut off valves are secured in the normal position. c) Check that the shut off valves are secured in the normal position. d) Check that the changeover cocks are secured in the normal position. e) Close the isolators for each pump and start the supply fan. f) At the auxiliary function panel for the power unit, set the cooling fan and circulation pump selection to "Auto". The fan and circulation pump will cut in when the oil temperature has reached 45°C and cut out at 40°C. g) Start the required pumps one by one in the "standby low pressure" mode. h) After starting, check for any leakage and ensure the sound of the pump is normal. i) When the mooring operation is ready to commence, switch the start control to either working pressure or standby high pressure.	10

9

High-Pressure Sensing in the System

High pressure in the hydraulic system could mean overloading or some undesired resistance in the system. This could lead to bursting of lines and hoses, etc. Thus high-pressure switches are used to protect the system in case of an emergency.

These pressure switches will sometimes be used to operate solenoid-operated relief valves and thus prevent unnecessary build-up of pressure.

High Oil Temperature

This causes a PTC type of thermistor to activate a trip and stop the respective motor; a lamp glows to indicate overheating. There can be two levels – one a warning level and the other a trip level too.

Overloading of the Electric Motor

This protection feature is with the help of bimetallic strips or thermal relays; this is particularly important for the hoisting arrangement. In this case, it will be necessary to lower the load and investigate the cause. Whatever happens, the brake holds the load in position to facilitate safe lowering.

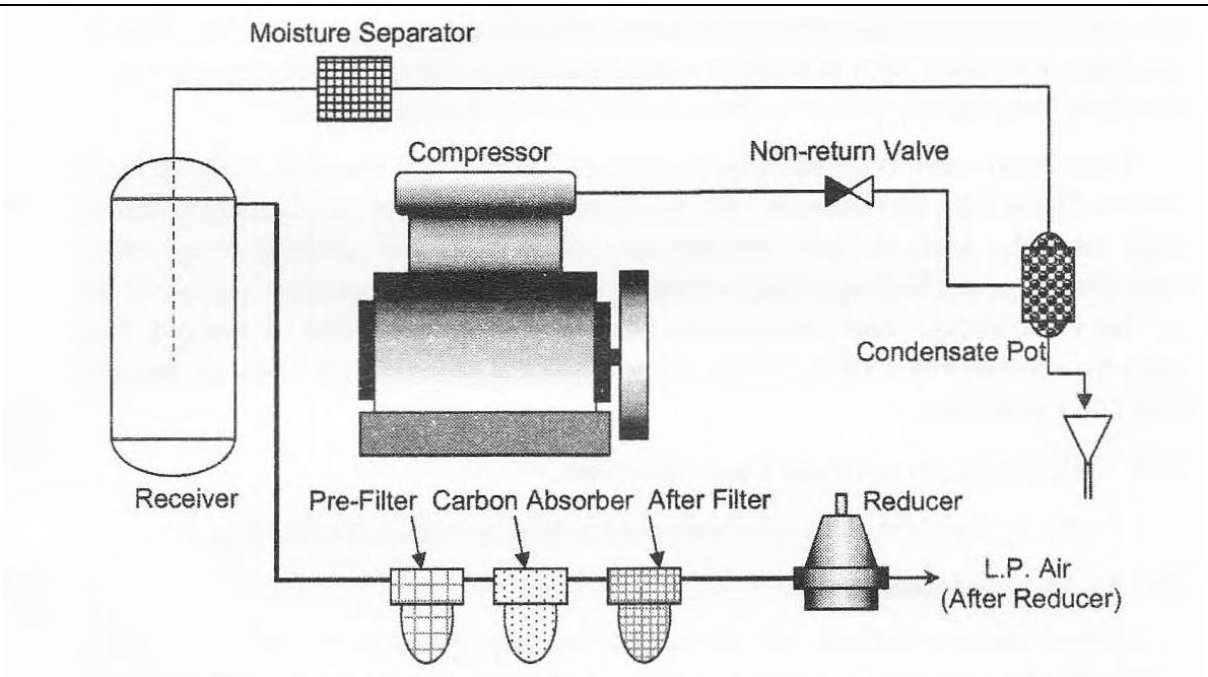
Emergency Stop

The control station has an "Emergency Stop" button that permits the stoppage of all movements and simultaneous stopping of the main feed pump; the crane can be re-started only after a period of 3 minutes

Slack Wire Trip

This feature is depicted in Figure 19.12. In case the cable turns slack when the crane's hook reaches the bottom of the hold or similarly, touches the deck and the cable continues to be paid out, there is a possibility of fouling or slipping off the pulley and further complications when hoisting. The same could be the case when the rope snaps and there is no tension on the cable.

10

10	 Moisture Separator Compressor Non-return Valve Condensate Pot Receiver Pre-Filter Carbon Absorber After Filter Reducer L.P. Air (After Reducer)	10

8		10
9		10

10		10
