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1 Introduction

1.1 Summary

This information package is intended to provide guidance for any country or organisation concerning the training of the professional worker (the Orthopaedic Technologist) in a complementary way through modular courses in order to attain the status of a Category II Orthopaedic Technologist within a particular field of prosthetics and orthotics – for example within the area of Lower Limb Prosthetics, Lower Limb Orthotics and Upper Limb Prosthetics/Orthotics and Spinal Orthotics in the developing world. The International Society for Prosthetics (ISPO) accept the concept of following different pathways to train professionals at Cat. II level in various fields within prosthetics and orthotics as long as the content of the training and competencies of the graduates are in line with standards within those fields of a “full” Cat II training and includes 6 months clinical placement.

Appendix A contains a description of the professional profile of “full” Cat II training or the Category II worker (Orthopaedic Technologist). Furthermore for comparison *Appendix B* contains the Professional Profile of the Category I worker (Prosthetist/Orthotist) *Appendix C* gives an example of an appropriate Code of Ethics.

This package outlines the learning objectives of a full course for Category II professional and *Appendices D, E and F* gives examples of acceptable syllabuses for modular courses that cover lower limb orthotics technology, lower limb prosthetics technology and upper limb prosthetics/orthotics and spinal orthotics technology. It describes appropriate arrangements for final examinations for a modular Category II course.

The package also outlines arrangements for recognition by ISPO of training programmes and for registration of those who qualify through attendance at such programmes or otherwise meet the same educational and training standards.

1.2 ISPO Categorization

A major difficulty encountered in this field is that of nomenclature. Different titles are used in different areas for the same kind of worker and this confusion is made worse by differences introduced by language and translation. This led ISPO to develop a categorisation system which would be based on the levels of education and training provided and would avoid dependence on titles.

The categories may be displayed as follows:

<i>Category I</i>	Prosthetist/Orthotist (or equivalent term) Entry requirement: University entry level (or equivalent) Training: 3/4 years formal structured leading to University Degree (or equivalent)
<i>Category II</i>	Orthopaedic Technologist (or equivalent term) Entry requirement: ‘O’ level (or equivalent) - the usual requirement for paramedical education in developing countries Training: 3 years formal structured - lower than degree level
<i>Category III</i>	Prosthetic/Orthotic Technician (or equivalent term) Entry requirement: Elementary school diploma Training: On the job

The Society’s education philosophy encompasses these three categories and has been concentrated on Category I and II professionals who take part in patient care activities as opposed to Category III workers who are concerned with only manufacture and assembly.

1.3 Modular Courses

There are situations where there is a need for a number of practitioners who have only training in a single or limited facet of prosthetics and orthotics, e.g. lower limb orthotics or lower limb prosthetics.

The purpose of this document is to provide guidelines to outline how these courses can be developed to comply with the ISPO guidelines for training Category II professionals in order that they may gain ISPO recognition in the area in which they are trained. After having completed one module including 6 months of clinical placement, a student receives a certificate with a title that reflects the subject area of the module - i.e as a Lower Limb Orthotics Technologist (ISPO - LLOT Professional) - and a statement that this title was obtained through a modular course. At the same time the student will be registered in the ISPO Professional Register under modular courses.

Individuals may gain full Category II recognition by completing other complementary modules to cover all aspects of Category II training and will then receive a "full" Category II Certificate (Orthopaedic Technologist) and be entered into the register of Orthopaedic Technologists. As some theory is the same from one module to another (i.e. anatomy), credit for common trunk courses obtained in the first course could be recognized for another modules (if the content is the same).

These courses are intended for students to have the same entry qualifications as the applicants for the three years Category II training course in Orthopaedic Technology. The minimum length of a module is 18 months – broken into 12 months in training (theory and practice) and 6 months clinical placement. The three modular courses presented in these guidelines have broken up the content of the full Category II course into the following aspects:

- Lower Limb Orthotics Technology (*Appendix D*)
- Lower Limb Prosthetics Technology (*Appendix E*)
- Upper Limb Prosthetics and Orthotics and Spinal Orthotics Technology (*Appendix F*)

It is recognised, however, that it is possible to break the full Category II into other different subject areas, e.g. lower and upper limb prosthetics or lower and upper limb and spinal orthotics. All these approaches are acceptable and encouraged provided that they all contain the following aspects of training and education which should all be properly examined:

- teaching of theoretical subjects
- closely supervised practical instruction
- structured and controlled clinical experience

2 Professional Profile for Category II (Orthopaedic Technologists)

The professional profile of the full Category II Orthopaedic Technologist can be found in *Appendix A*. Below are details of the Lower Limb Orthotics Technologist's, Lower Limb Prosthetics Technologist's and the Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technologist's professional profile.

2.1 Lower Limb Orthotics Technologist Professional Profile

The Lower Limb Orthotics Technologist is a full member of the rehabilitation/clinic team which is concerned with the orthotic treatment of the lower limb. His/her tasks are to:

- participate in clinics
- advise on the design of the prosthetic/orthotic appliance
- record and report pertinent information
- formulate a range of lower limb orthotic designs as specified in the curriculum guidelines
- make all necessary cast/measurements
- make the choice of components and materials
- perform or supervise the assembly of the orthotic components and the bench alignment
- look for the most appropriate technology. If the necessary components are not locally available, he/she should be able to supervise their production by a technician or to make them him/herself
- perform the static and dynamic alignment and fitting to the patient

- perform or supervise the finishing of the prosthesis/orthosis
- give the patient all information needed about use, maintenance and replacement times of the prosthesis/orthosis
- carry out necessary repair work and indicated corrective management of the prosthesis/orthosis
- instruct the family of the patient in the use and care of the appliance
- know about adaptive devices, such as walking aids
- take part in community services
- supervise the activity of supporting staff as appropriate
- manage workshop activities as necessary

2.2 Lower Limb Prosthetics Technologist Profile

The Lower Limb Prosthetics Technologist is a full member of the rehabilitation/clinic team which is concerned with the prosthetic treatment of the lower limb. His/her tasks are to:

- participate in clinics
- advise on the design of the prosthetic/orthotic appliance
- record and report pertinent information
- formulate a range of lower limb prosthetic designs as specified in the curriculum guidelines
- make all necessary cast/measurements
- make the choice of components and materials
- perform or supervise the assembly of the prosthetic components and the bench alignment
- look for the most appropriate technology. If the necessary components are not locally available, he/she should be able to supervise their production by a technician or to make them him/herself
- perform the static and dynamic alignment and fitting to the patient
- perform or supervise the finishing of the prosthesis/orthosis
- give the patient all information needed about use, maintenance and replacement times of the prosthesis/orthosis
- carry out necessary repair work and indicated corrective management of the prosthesis/orthosis
- instruct the family of the patient in the use and care of the appliance
- know about adaptive devices, such as walking aids
- take part in community services
- supervise the activity of supporting staff as appropriate
- manage workshop activities as necessary

2.3 Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technologist's Professional Profile

The Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technologist is a full member of the rehabilitation/clinic team which is concerned with the prosthetic/orthotic treatment of the upper limb and the orthotics treatment of the spine. His/her tasks are to:

- participate in clinics
- advise on the design of the prosthetic/orthotic appliance
- record and report pertinent information
- formulate a range of upper limb prosthetic and orthotic and spinal orthotic designs as specified in the curriculum guidelines
- make all necessary cast/measurements
- make the choice of components and materials
- perform or supervise the assembly of the prosthetic/orthotic components and the bench alignment
- look for the most appropriate technology. If the necessary components are not locally available, he/she should be able to supervise their production by a technician or to make them him/herself
- perform the static and dynamic alignment and fitting to the patient
- perform or supervise the finishing of the prosthesis/orthosis

- give the patient all information needed about use, maintenance and replacement times of the prosthesis/orthosis
- carry out necessary repair work and indicated corrective management of the prosthesis/orthosis
- instruct the family of the patient in the use and care of the appliance
- know about adaptive devices, such as walking aids
- take part in community services
- supervise the activity of supporting staff as appropriate
- manage workshop activities as necessary

3 Entry Qualifications

The entry qualifications are similar to those of the full Orthopaedic Technologist Category II course.

To qualify for admission to the course, the applicant must:

- Possess O level or equivalent certificate (10-11 years of schooling) and have passes in a range of science subjects from physics, chemistry, biology, engineering and mathematics. It should be in line with the national requirement for paramedical education

(Depending on the educational institution the entry qualifications may be higher in order to fulfil national requirements.)

4 Duration of the course

The minimum length of a module is 18 months – broken into 12 months in training (theory and practice) and 6 months clinical placement.

After completion of the 12 months training, the student has to pass a final examination and complete a minimum of a 6 months supervised clinical placement in an approved prosthetics and orthotics rehabilitation facility. The clinical placement is full time and should follow the following requirements:

- The clinical placement should be fully under the responsibility of the institution providing the training and take place in centres approved by the institution.
- If the institution has service provision units separate from the training facility it can be used for clinical placements
- The clinical placement centre should have fully qualified personnel (Orthopaedic Technologist Category II ISPO/WHO or a Prosthetist/Orthotist Category I ISPO/WHO) to supervise the work of students.
- Centres should make sure that the student has a comprehensive range of lower limb prosthetics experiences. It is expected that the student should manufacture and fit orthotic or prosthetic devices.
- The institution is encouraged to visit the clinical placement centres on a regular basis to advice on the conduct of the placement.
- During the clinical placement the students are expected to develop the following skills:
 - Patient handling skills
 - Clinical skills
 - Technical skills
 - Interpersonal skills
- Assessment of the student's performance in the above skills should be made by the clinical supervisor.
- A log book should be kept by the student to record information regarding the orthotic or prosthetic work carried out. This book should be presented to the patient presentation in the final examination as evidence of work performed during clinical placement.

The final Certificate for the modular course will only be issued on successful completion of this attachment and the final examination at the patient presentation at the end of the course.

5 Learning Objectives of Modular Courses

The main aim of modular training is to train professionals in a particular field of Prosthetics and Orthotics with the appropriate clinical and technical knowledge, skills and attitude so that they are able to provide proper services within that field. The following learning objectives provide the general learning objectives of all modular training. Example of learning objectives for each module could be found in Appendix D, E, and F

5.1 Learning Objectives - 12 months theoretical training

At the end of the theoretical training the graduate should be able to:

- Assess physical and other relevant characteristics of the patient.
- Formulate a range of prosthetic or orthotic designs as specified in the curriculum guidelines. This includes selection of materials, components and additional aids.
- Record and report any information regarding patients.
- Take all casts and measurements required for proper fabrication and fitting of an orthoses or prostheses.
- Modify positive and/or negative models and/or layouts of design to obtain optimal fit and alignment.
- Carry out fitting, static alignment and, where appropriate, preliminary training and initial checkout.
- Perform and/or supervise fabrication and final checkout, evaluation fit and function of the orthoses or prostheses.
- Instruct the patient or family in the use and care of the orthoses or prostheses.
- Take part in the follow-up procedure

5.2 Learning Objectives – Clinical Placement

At the completion of the clinical placement the graduate will be able to:

- Provide appropriate Prosthetic or Orthotic services in a clinical environment
- Provide patient care within a recognized code of ethics that complies with medical/legal requirements.
- Participate in the clinic team; take part in examinations and prescriptions

6 Syllabus

The following syllabus outlines the full Category II course as described by ISPO (1997). In a complementary approach using modular courses the following subjects should be carefully considered and selected to ensure that each particular module fully covers the subject matter required for teaching it. Examples of syllabuses for modules covering lower limb orthotics technology, lower limb prosthetics technology and upper limb prosthetics/orthotics and spinal orthotics technology are given in *Appendices D, E and F*.

Any module courses developed should have three elements; theoretical, practical, and clinical placement. The theoretical part of the course will covers Anatomy, Pathology, Biomechanics, Technical subjects and other ancillary subjects. The practical part of the course will include the fabrication and fitting of devices to students and patients. The first section of the practical training instructs the student in basic workshop practice and teaches him/her to work with different materials which are needed to fabricate orthoses and prostheses. The remainder of the practical work is entirely devoted to clinical training where the students will produce a minimum number of devices. The student will learn to measure, cast, align and fit each practical prescribed device as well as manufacturing them him/herself.

This course should carefully integrates the theory with the practical work is designed to give the graduate the basic information and the practical skills that will be needed when he/she takes up employment as a professional. Different techniques of fitting and manufacture are taught as well as the use of different materials as the graduate must be able to adapt to the different local conditions that he/she may find.

The final part of the course is a six months supervised, structured clinical placement in an approved prosthetics and orthotics rehabilitation facility.

The following outlines the syllabus of a course for Category II workers in respect of theoretical subjects (6.1 to 6.9) and closely supervised practical instruction (6.10). It should be emphasised that this is a guideline and local variations may still produce an acceptable course. In respect of the supervised practical instruction, regional requirements may influence the emphasis in areas of patient treatment. However, the outline in 4.10 is considered to represent the minimum essential elements of prosthetic and orthotic practice which should be contained within the syllabus. Where possible, other elements of provision should also be included.

Examples given in Appendix D, E and F are not intended to be a model but only a useful guide as to detailed content and subject breakdown for those involved in course construction.

6.1 Anatomy and physiology

In the area of anatomy and physiology the student should have knowledge of the following:

- basic cell biology and histology;
- the structure of the skeletal system, particularly the bones and joints of the lower and upper limbs, the shoulder girdle, the spine and the thorax;
- the structure and function of the muscular system, with emphasis on the muscular systems of the lower and upper limbs, the shoulder girdle and the spine and thorax;
- the structure and function of joints, including axes of rotation, range of movements and stabilisation;
- consideration of the body as a whole system, identification of physiological deviations and of their significance;
- the nervous system, tissues, cardiovascular system, pulmonary system, immune system, endocrine system, and the secretory organs.

The student should have an understanding of the function of individual joints and muscles and be proficient in explaining their interaction. He/she should be knowledgeable in the area of pathological deviations and be able to analyse them by means of appropriate measuring instruments as well as by applying his/her knowledge of range of motion in order to be able to identify a viable prosthetic/orthotic treatment. The student should recognise that biomechanical as well as pathological factors must be viewed concurrently with anatomical factors.

6.2 Pathology

The student will have an understanding of the following areas:

- inflammatory diseases;
- degenerative diseases;
- post-traumatic conditions;
- tumours;
- metabolic disorder;
- abnormalities present at birth (congenital deformities);
- aseptic bone necrosis;
- paralysis resulting from nerve lesion;
- circulatory disorders;
- amputations;
- post-traumatic osteoporosis;
- diseases of the spine;
- spinal and thoracic deformities;
- diseases of the pelvis and hip;
- diseases of the knee;
- diseases of the foot;
- diseases of the shoulder, elbow and hand;
- limb deformities;
- skin disorders and wound repair.

The student should be able to comment on the aetiology and progression of the disease in question, as well as on its care and treatment. He/she must demonstrate proficiency in

anatomy, physiology, biomechanics and pathology as well as the ability to coordinate these factors and arrive at the appropriate end result in his/her role as an orthopaedic technologist.

6.3 Biomechanics and prosthetics and orthotics science

The student should have an understanding of the following topics:

- the anatomical planes and reference points of the body;
- prosthetic and orthotic measurement techniques;
- anatomical joint types, their functions and interaction;
- muscle physiology and biomechanics in relation to joint functions;
- the interaction of anatomical joints and prosthetic/orthotic joints;
- normal human locomotion and the gait cycle;
- kinetic and kinematic analysis and the calculation of external and internal force actions;
- biomechanics of the lower limb;
- lower limb prosthetic components and their application;
- stump/socket forces and lower limb socket design;
- bench, static and dynamic alignment of lower limb prostheses with reference to biomechanical implications;
- pathological gait, its analysis and the application of appropriate orthotic treatment;- body/orthoses forces and interface design;
- orthoses for lower limb diseases;
- lower limb orthoses for upper motor neurone diseases;
- lower limb orthotic components and their application;
- biomechanics of the spine and thorax;
- orthoses for diseases and deformation of the spine and thorax;
- biomechanics of the upper limb;
- upper limb prosthetic fitting, alignment and function;
- upper limb prosthetic components and their application;
- upper limb orthotic fitting, alignment and function;

The student requires the above knowledge in order to provide optimal prosthetic and orthotic care to the patient.

6.4 Mathematics

The students will have a knowledge of the following areas of mathematics and their applications to Biomechanics and Prosthetics and Orthotics Science:

- elementary mathematics: simple algebraic manipulation, indices, logarithms, solution of equations, trigonometric functions, standard trigonometric identities, solution of simple trigonometric equations;
- functions: polynomial, rational, exponential, logarithmic;
- differentiation: simple techniques, use in optimisation and curve sketching;
- integration: simple techniques, evaluation of areas, use of approximation procedures;
- differential equations: first order equations, uses in biological modelling;
- mastery and proper usage of resources such as mathematical tables, formulae and calculators.

6.5 Mechanics

The student will have an understanding of the applications of the following in the area of Biomechanics and Prosthetics and Orthotics Science:

- terminology and units;
- vector and scalar quantities;
- linear/angular motion and motion of a solid body;
- resolution of forces and moments in two dimensions;
- equations of equilibrium;
- free body diagrams;
- calculations of centre of gravity and mass;
- Newton's Laws of Motion;
- work, power and energy;

- strength of materials: stress, strain and Hooke's Law.

6.6 Materials technology

The student will have an understanding of the characteristics, properties and the processing of the following commonly used materials with particular reference to their applications in prosthetics and orthotics:

- steel and its alloys;
- non-ferrous metals and their alloys;
- plastics: thermoforming, thermosetting, composites;
- wood;
- leather;
- plaster of Paris;
- adhesives.

6.7 Workshop technology

The student will understand and be able to apply, in the field of orthopaedic technology, the following areas of knowledge:

- hand tools: their selection, use and maintenance;
- measuring instruments: use and methods of application;
- machine tools: selection, installation, use and maintenance;
- welding processes and equipment for metals and plastics;
- sewing machines: selection, use and maintenance;
- general equipment: ovens, compressors, vacuum pumps, fume and dust extraction apparatus;
- workshop layout;
- health and safety regulations and practice.

6.8 Clinic, workshop and business management

The student will have knowledge of the theory and application of:

- materials acquisition, handling and stock control;
- workforce management;
- production cost calculations;
- budgeting, invoicing, receipting and accounting;
- clinic management, appointment systems, record keeping;
- property management, care and maintenance;
- environmental/ecological considerations.

6.9 Technical drawing

The student will have knowledge and practice in the following:

- isometric sketching and three-dimensional visualisation;
- first and third angle projection;
- auxiliary views and sections;
- use of drawing standards;
- application of machining tolerances;
- simple assembly drawings;
- applications in orthopaedic technology.

6.10 Workshop and clinical practice

The student will be proficient in the following practical areas and clinical applications with an understanding based on the integration of his/her theoretical studies:

- general workshop practice: use of hand tools, machine tools and materials, component production;
- patient examinations and prescription;
- measuring and casting, cast rectification, fabrication, fitting, aligning and finishing the following devices:
- ankle/partial foot prostheses

- trans-tibial prostheses
- knee disarticulation prostheses
- trans-femoral prostheses
- shoe modifications
- shoe inserts/foot orthoses
- ankle-foot orthoses
- knee-ankle-foot orthoses
- hip-knee-ankle-foot orthoses
- cervical orthoses
- cervico-thoraco-lumbo-sacral orthoses
- wrist-hand orthoses

For each module a minimum number of devices should be fabricated and fitted by the students.

For Lower Limb Orthotics Technology

- The student should fabricate and fit at minimum: 2 Foot Orthoses, 5 Ankle Foot Orthoses, 1 Knee Orthoses, 4 Knee Ankle Foot Orthoses and, 1 Hip Knee Ankle Foot Orthoses

For Lower Limb Prosthetics Technology

- The student should fabricate and fit at minimum: 1 Partial-Foot Prostheses, 1 Ankle Disarticulation Prostheses, 5 Trans-Tibial Prostheses, 1 Knee Disarticulation Prostheses, 4 Trans-Femoral Prostheses, and 1 Hip Disarticulation Prostheses

For Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technology

The student should fabricate and fit at minimum: 2 Trans Humeral Prostheses, 2 Trans Radial Prostheses, 2 Wrist Hand Orthoses, 1 Elbow Orthoses, 1 Finger Orthoses, 1 Cervical Orthosis, 1 Lumbo Sacral Orthosis and 1 Thoraco Lumbo Sacral Orthosis, before accessing the final examination.

6.11 Clinical Placement

The student will have experience in the clinical environment of supplying prostheses and orthoses to patients undergoing treatment. This experience should cover as wide a range as possible but with emphasis on the major levels of provision. The aim is to develop skills in:

- assessment and prescription;
- communication
- clinical provision of prostheses and orthoses;
- manufacture of prostheses and orthoses;
- interpersonal relationships;
- professional activity;
- communication;
- organisation and management;
- clinical research.
- contributing too and learning from the clinic team.

Where the clinical practice takes place in centres other than the main teaching institution such clinical placement centres must satisfy specified standards of the teaching institution and the student's work must be supervised by qualified personnel (Orthopaedic Technologist Category II ISPO/WHO or a Prosthetist/Orthotist Category I ISPO/WHO) who is accountable to the school.

7 Examination for Category II

The following provides a model of an examination structure for a Category II modular training course. It is recognised that national or institutional practices or regulations may introduce or require variations. The model is intended generally to be helpful in outlining internationally acceptable standards. More specifically, although variations may be acceptable, it is provided as a guideline for those institutions which intend to seek ISPO recognition.

7.1 Candidates

Candidates should have completed a modular course in an aspect of Orthopaedic Technology at an appropriate educational establishment and have met the requirements to present for the final examinations.

7.2 Scope of examination

The examination should be comprised of theoretical and practical sections as well as examination of the clinical placement. Each section must be successfully completed in order for the candidate to pass.

7.3 Board of examiners

- For each examination, a Board of Examiners must be formed whose role is to oversee the documentation, ensure that the examination is representative of the syllabus and certify the examination results.
- The Examiners shall be appointed and the Examination Board constituted in accordance with national or institutional regulations but normally shall include at least one appropriate medical specialist and one Category I professional. Where possible, a qualified international assessor should be integrated into the local board.

7.4 Theoretical section

7.4.1 The theoretical section will examine the candidate's knowledge of the following subjects:

- Anatomy and Physiology
- Pathology
- Biomechanics and Prosthetics and Orthotics Science
- Mathematics
- Mechanics
- Materials Technology
- Workshop Technology
- Clinic, Workshop and Business Management

7.4.2 Where an institution is seeking ISPO recognition it is recommended that the theoretical papers are prepared in a multiple choice format to overcome the language barriers sometimes found in developing countries. For guidance these might comprise of approximately 60 questions per subject which should be representative of the balance of the syllabus and last about 90 minutes per subject.

7.5 Practical section

7.5.1 The practical training shall be examined by means of continuous assessment of the candidate's practical work by means of a minimum of two continuous assessment tests covering assessment, prescription, fabrication, fitting and checkout.

7.6 Clinical placement

7.6.1 The clinical placement shall be marked with consideration to the following:

- Supervisor's assessment of the candidates clinical work (20%)
- Log book (10%)
- Case presentations (70%)

7.6.2 The supervisors' assessment shall be made up by aggregating the marks/grades of the student's performance for each individual patient fitting and the overall performance of the student's performance during the placement.

7.6.3 The log book should be marked by the clinical placement supervisor which should be confirmed by the school through an oral interview with the candidate.

7.6.4 The case presentations will examine the candidates technical, workshop and clinical skills and will comprise the following tasks:

- assessment of the subject
- prescription, fabrication and fitting of orthopaedic devices
- evaluation of practical work
- presentation of case histories of the subjects
- cost calculation of the devices

- 7.6.5 For each candidate the practical examination shall be representative of the clinical content of the curriculum and will comprise of fitting up to two subjects with different levels of disability.
- 7.6.6 The examination subjects will normally be determined and indicated to the individual candidates 7 days prior to examination.
- 7.6.7 The candidate is obliged to perform all stages of the fitting and fabrication procedures on his/her own without assistance from other parties. This process must be completed under scrutiny of appointed members of the Board of Examiners.
- 7.6.8 The scrutiny must be undertaken by more than one examiner who will retain responsibility for patient safety.
- 7.6.9 The examiners are required to grade independently all the elements involved.
- 7.6.10 The time allowed during the examination for completion of each subject may exceed the accepted standard within the profession by 30%.
- 7.6.11 A cost calculation must be made for each device which includes:
 - material costs
 - overhead costs
 - workforce costs.
 - Profit margins should not be included.
- 7.6.12 The candidate shall present his/her subjects to the examiners and include subject medical history, prescription rationale and outcome.
- 7.6.13 The marking of the examined subject cases should encompass all aspects of the work presented.
- 7.6.14 The final result of the practical section is obtained by averaging the results of:
 - the practical work
 - the functional outcome
 - the oral presentation.

7.7 Repeat examinations

- 7.7.1 Normally candidates are eligible to repeat any failed portion of the theoretical examinations under conditions set out by the Board of Examiners.
- 7.7.2 For the practical and clinical examinations a repeat examination should not normally be earlier than 6 months after completion of the examination.
- 7.7.3 Candidates may repeat any portion of the examination normally to a maximum of two (2) attempts.

8 ISPO Recognition of Category II Courses

Courses which satisfy the requirements of ISPO with respect to this information package may apply for ISPO recognition. This is a method which has already been used by several international organisations, non-governmental organisations and different prosthetics and orthotics schools. This recognition by ISPO is an assurance to government or other funding agencies that any such approved course of training for orthopaedic technologists meets the accepted international standard.

An applying institution would be asked to complete a questionnaire which seeks detailed information on the course itself and the framework in which it operates. Questionnaires are available at the ISPO Secretariat.

If the response displays that the course appears to meet the minimal requirements, ISPO would arrange an inspection, funded by the applying institution and preferably coinciding with a final examination. The inspection would concentrate on such issues as:

- i) entry level to course
- ii) content of course with regards theoretical subjects, workshop practice, clinical practice
- iii) duration of course with regard overall time and hours available for instruction
- iv) recognition of course by the Education and Health authorities
- v) level of training compared with other paramedical professionals
- vi) teaching staff available for theoretical subjects
- vii) staff available for prosthetic and orthotic teaching
- viii) proper examination of all subjects
- ix) high standard of practical and clinical work
- x) failure rates

- xi) access to patients
- xii) access to medical and other paramedical personnel
- xiii) teaching materials
- xiv) facilities such as classrooms, workshops, equipment, clinic areas
- xv) employment prospects of graduates
- xvi) internship arrangements
- xvii) certification of course
- xviii) permanency of course

If the inspection displays that the course meets the requirements in respect of Category II education and training it will be recognised by ISPO for a period of three years. Maintenance of recognition requires a triennial inspection by ISPO.

9 ISPO Registration

The modular route to qualification is not intended to compromise standards but provide access to a recognised qualification for candidates who have followed an alternative training route. All such arrangements must have the prior approval of ISPO.

A Category II professional who successfully completes a modular course which has ISPO recognition will be registered by the institution with ISPO and will thereafter be entitled to describe him/herself as a:

- Lower Limb Orthotic Technologist (Category II)
- Lower Limb Prosthetic Technologist (Category II)
- Upper Limb Prosthetic, Orthotics and Spinal Technologist (Category II)
- Prosthetics Technologist (Category II)
- Orthotics Technologist (Category II)
- or some other appropriate combination of topics

If an individual receives the equivalent of full Category II training by successfully completing a number of ISPO recognised modular it can lead to full Category II recognition and which would entitle the individual to describe him/herself as a:

- ISPO Registered Orthopaedic Technologist (Category II)

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11 Appendix A Professional Profile for Cat.II professional

A. PROFESSIONAL PROFILE FOR CATEGORY II (ORTHOPAEDIC TECHNOLOGIST)

This professional profile is specific to workers in the developing world. Its origin is in the Guidelines for Training Personnel in Developing Countries for Prosthetic and Orthotic Services (WHO 2005) and it has been further refined by ISPO to ensure compliance with its categorization system.

A.1 Patient care

Formulation of treatment

A.1.1 In the absence of a Category I professional, participates as full member of the clinic team; takes part in the examination and prescription; and advises on the design of the prosthetic/orthotic device interface, suspension and selection of the proper components.

A.1.2 Assists and advises on relevant aspects of pre-surgical, post-surgical, medical and therapeutic management of individuals requiring prosthetic/orthotic devices.

A.1.3 Records and reports any pertinent information regarding patients and their families, including a determination of expectations and needs.

A.1.4 Communicates appropriate information to patients and their families.

Fitting, fabrication and treatment

A.1.5 Identifies physical and other relevant characteristics of the patient.

A.1.6 Formulates a range of prosthetic or orthotic designs as specified in the curriculum guidelines. This includes selection of materials, components and additional aids.

A.1.7 Takes all casts and measurement required for proper fabrication and fitting.

A.1.8 Modifies positive and/or negative models and/or layouts of design to obtain optimal fit and alignment.

A.1.9 Carries out fitting, static and dynamic alignment and, where appropriate, preliminary training and initial check-out.

A.1.10 Performs and/or supervises fabrication of the prosthesis or orthosis.

Evaluation and follow-up

A.1.11 Advises the team and participates directly in final check-out and evaluation of fit, function and cosmesis.

A.1.12 Instructs the patient or family in the use and care of the device.

A.1.13 Takes part in follow-up procedures as well as maintenance, repair and replacement of the appliance

A.1.14 Recognises the need to repeat any of the identified steps in order to optimise fit and function.

A.1.15 Collaborates and consults with others engaged in the management of the patient.

A.2 Management and supervision

A.2.1 Supervises the activity of supporting staff as appropriate.

A.2.2 Manages clinical and laboratory/workshop activities assigned to him, including:

- use and maintenance of tools and equipment
- maintenance of safe working environment and procedures
- inventory and stock control
- personnel matters
- financial matters
- appropriate record keeping
- total quality management

A.2.3 Devises improved job methods for increasing efficiency.

A.2.4 Interacts with professional groups as well as governmental and non-governmental agencies.

A.2.5 Takes part in planning and implementation of technical orthopaedic care systems

A.3 Training and education

A.3.1 May supervise and take part in the training of individuals in Category II (orthopaedic technologists) and Category III (technicians).

A.3.2 May lecture and demonstrate to colleagues in his profession and other professionals concerned with prosthetics/orthotics and also to community and other interested groups.

A.3.3 Is required to take part in and contribute to the process of continuing professional development.

A.3.4 Keeps abreast of new developments concerning prosthetics/orthotics.

A.4 Community services

A.4.1 Makes a professional contribution to and takes part in community rehabilitation programmes.

A.5 Medical, legal and ethical requirements

A.5.1 Provides patient care within a recognised prosthetics/orthotics code of ethics.

A.5.2 Provides patient care which complies with medical/legal requirements.

12 Appendix B Professional Profile for Cat.I professional

The following professional profile has its basis in the Report of the United Nations Inter-Regional Seminar on Standards for the Training of Prosthetists (UN 1968) - the so-called Holte Report. It has moreover been modified to comply with Guidelines for Training Personnel in Developing Countries for Prosthetic and Orthotic Services (WHO 1990) and further refined by the Education and Certification Committees of ISPO.

B.1 Patient care

Formulation of treatment

- B.1.1 Participates as full member of the clinic team; takes part in the examination and prescription; and advises on the design of the prosthetic/orthotic device, including the socket or body/device interface, suspension and selection of proper components.
- B.1.2 Assists and advises on relevant aspects of pre-surgical, post-surgical, medical and therapeutic management of individuals requiring prosthetic/orthotic devices.
- B.1.3 Records and reports any pertinent information regarding patients and patients' families, including a determination of expectations and needs.
- B.1.4 Communicates appropriate information to the patients and their families.

Fitting, fabrication and treatment

- B.1.5 Supervises and directs the activities of individuals in Category II (orthopaedic technologist) and Category III (orthopaedic technician) in fitting and fabrication.
- B.1.6 Identifies physical and other relevant characteristics of the patient.
- B.1.7 Formulates prosthetic or orthotic designs, including selection of materials, components and additional aids.
- B.1.8 Takes all casts and measurements required for proper fabrication and fitting.
- B.1.9 Modifies positive and/or negative models and/or layout of design to obtain optimal fit and alignment.
- B.1.10 Carries out fitting, static and dynamic alignment and, where appropriate, preliminary training and initial check-out.
- B.1.11 Performs and/or supervises fabrication of the prosthesis or orthosis.

Evaluation and follow-up

- B.1.12 Advises the team and participates directly in final check-out and evaluation of fit, function and cosmesis.
- B.1.13 Instructs the patient or family in the use and care of the device.
- B.1.14 Takes part in follow-up procedures as well as maintenance, repairs and replacement of the appliance
- B.1.15 Recognises the need to repeat any of the identified steps in order to optimise fit and function.
- B.1.16 Collaborates and consults with others engaged in the management of the patient. - - 20 -

B.2 Management and supervision

- B.2.1 Supervises the activity of supporting staff as appropriate.
- B.2.2 Manages clinical and laboratory/workshop activities assigned to him, including:
 - • use and maintenance of tools and equipment
 - • maintenance of safe working environment and procedures
 - • inventory and stock control
 - • personnel matters
 - • financial matters
 - • appropriate record keeping
 - • total quality management

- B.2.3 Devises improved job methods for increasing efficiency.
- B.2.4 Interacts with professional groups and, where appropriate, governmental and non-governmental agencies.
- B.2.5 Takes part in planning and implementation of technical orthopaedic care systems

B.3 Training and education

- B.3.1 Supervises and conducts the education and training of individuals in Category I (prosthetists/orthotists), Category II (orthopaedic technologists) and Category III (technicians).
- B.3.2 Lectures and demonstrates to colleagues in his profession and other professionals concerned with prosthetics/orthotics and also to other interested groups
- B.3.3 Is required to take part in and contribute to the process of continuing professional development.
- B.3.4 Keeps abreast of new developments concerning prosthetics/orthotics.

B.4 Community services

- B.4.1 Makes a professional contribution to and takes part in community rehabilitation programmes.

B.5 Research and development

- B.5.1 Conducts continuing evaluation of his activities.
- B.5.2 Participates in formal evaluation and research programmes.
- B.5.3 Participates in scientific/professional meetings and contributes papers to scientific/professional journals.

B.6 Medical, legal and ethical requirements

- B.6.1 Provides patient care within a recognised prosthetics/orthotics code of ethics.
- B.6.2 Provides patient care which complies with medical/legal requirements.

13 Appendix C: Code of Ethics

An appropriate code of ethical behaviour is an essential framework for the activities of any professional responsible for the treatment of patients. The following is based on the code of ethics suggested in the Report of the United Nations Inter-regional Seminar on Standards for the Training of Prosthetists (UN 1969).

This is, however, only given as an example which satisfies the minimal requirements of such a code. It may require elaboration in different cultural, ethnic or religious settings.

Ethical code for the prosthetists/orthotist

- C.1 He/she shall observe loyal relations with his/her colleagues and with other members of the clinic team without assuming roles outside his/her own profession.
- C.2 He/she shall practise absolute discretion regarding personal matters or knowledge he/she might acquire in his/her professional work.
- C.3 He/she, like all other members of the clinic team, should supply service only as a member of that team and respect its conclusions.
- C.4 He/she shall collaborate freely in the necessary exchange of information between colleagues and others in the different but related disciplines.
- C.5 He/she shall strive to perform to the highest possible standard of his/her professional skill.
- C.6 He/she shall provide services to patients in a professional manner; personal, financial or commercial interests shall be secondary.
- C.7 He/she shall always honestly represent himself/herself as well as his/her services to the patient and all others concerned.
- C.8 He/she shall observe similar restrictions in his/her personal relations with patients as are normally accepted by the medical professions.

14 Appendix D: Example of Syllabus for Modular Course in Lower Limb Orthotics Technology

The information below is based on the module for lower limb orthotics technology developed by VIETCOT, Hanoi, Vietnam.

The eighteen months education and training programme in lower limb orthotics leading to the award of a Certificate in Lower Limb Orthotics Technology should be recognised by a national accreditation authority.

The course has three elements; theoretical, practical, and clinical placement.

Objectives of the course

Qualifying candidates of the course will:

- acquire a clear concept of responsibility of the Lower Limb Orthotics Technologist as stipulated in the job description.
- acquire adequate professional knowledge in the use of locally available materials and adapt the technology at his/her level to suit social and environmental conditions

General objectives

At the completion of the training programme the graduate will able to:

- Provide appropriate lower limb orthotics services
- Provide patient care within a recognized code of ethics that complies with medical/legal requirements.
- Participate in the clinic/rehabilitation team; takes part in examination and prescription of lower limb orthotic devices.

Specific objectives

At the end of the educational programme the graduate should able to:

- Assess physical and other relevant characteristic of the patient.
- Formulate a range of lower limb orthotic designs as specified in the curriculum guidelines. This includes selection of materials, components and additional aids.
- Record and report any information regarding patients.
- Take all casts and measurement required for proper fabrication and fitting of lower limb orthoses.
- Modify positive and/or negative models and/or layouts of design to obtain optimal fit and alignment.
- Carry out fitting, static alignment and, where appropriate, preliminary training and initial checkout.
- Perform and/or supervises fabrication and final checkout, evaluation fit and function of the lower limb orthoses.
- Instruct the patient or family in the use and care of the lower limb orthosis.
- Take part in the follow-up procedure.

Duration of the course

The training of the Lower Limb Orthotics Technologist is an 18 months course. The first year consists of 44 weeks with approximately 1540 teaching hours. The minimum length of the course is 18 months. In the first year the instruction should be about 1400 hours not including examination and revision.

After completion of the first year the student has to pass a final examination and complete a minimum of a 6 months supervised clinical placement in an approved prosthetics and orthotics rehabilitation facility in the country. The clinical placement is full time and should be about 800 hours. These clinical placements will be supervised by a fully qualified Orthopaedic Technologist Category II (ISPO/WHO) or a Prosthetist/Orthotist Category I (ISPO/WHO) and they will follow a programme of work outlined by the Principal of the training institute.

The final Certificate in Lower Limb Orthotics Technology Category II will only be issued on successful completion of this attachment and the final examination at the patient presentation at the end of the course.

Course content

A total number of 1,540 hours are available for tuition of the theoretical and practical subjects. At the end of the first year a total number of 70 hours (2 weeks) are available for theoretical and practical examinations.

This is followed by a 6 months clinical placement at the end of which a total of 105 hours (3 weeks) is available for final examination including patient fitting and presentation.

Theory		
Anatomy/Physiology	42 hours	
Pathology/Rehabilitation related to technical orthopaedics	42 hours	
Biomechanics	84 hours	
Mechanics	42 hours	
Mathematics (Revision)	21 hours	
Materials Technology	51 hours	
Workshop Technology	42 hours	
Workshop Management	42 hours	
Clinics/Prescription/Goal Assessment	63 hours	
Total Theory		429 hours
Practice		
General Mechanical Skills	200 hours	
Lower Limb Orthotics	841 hours	
Total Practice		1041 hours
Examinations	70 hours	
First year total		1540 hours
Clinical Placement		
Clinical Placement (six months)	695 hours	
Final examination preparation	70 hours	
Final examination and patient presentation	35 hours	
Six months total		800 hours
Course total		2340 hours

Syllabus of Course

Anatomy and Physiology

Aim:

The student is introduced to the basic elements of connective tissue and studies the detailed anatomy and physiology of the pelvis and lower limb and knowledge of the spine.

Objective:

To enable the student to know and understand the role of connective tissues and detailed anatomy of the lower limb and spine in order to be able to apply them to lower limb orthotics practice.

Content:

- Basic knowledge
- Histology and cytology of the tissues, organs and systems
- The skeleton
 - structure of bones
 - development of bones
 - structure of joints
- General physiology of muscle
- General physiology of the nervous system
- The pelvis, lower limb and spine
 - bones (pelvis, femur, fibula, tibia, tarsals, metatarsals and phalanges, spine)
 - joints (pubic symphysis, sacroiliac, hip, knee, joints of the foot, spinal joints)
 - muscles (pelvis, lower limb, and spine - including origin, insertion, innervation and role)
- Functional anatomy of the lower limb and spine

Pathology

Aim:

The student is introduced to and learns about the basic pathological conditions that are encountered in lower limb orthotics clinical practice.

Objective:

To enable the student to recognise and understand the pathological conditions which are met in lower limb orthotics practice.

Content:

- General pathology
- Introduction to pathology
- Infectious diseases: poliomyelitis, osteomyelitis, meningitis, leprosy, tuberculosis
- Degenerative diseases: arthritis, tendonitis, arthrosis, osteonecrosis of the head of the femur
- Neoplasms: malignant, benign
- Metabolic disorders: rickets, osteomalacia, osteoporosis, gout
- Congenital deficiencies of the skeleton: lower limb deficiencies
- Specific diseases/conditions of the skeletal system: foot disorders, cerebral palsy, trauma, introduction to spinal disorders
- General elements of paralysis. flaccid paralysis, spasticity, upper motor neuron lesions, lower motor neuron lesions, monoplegia, Hemiplegia, paraplegia, quadriplegia (tetraplegia)

Biomechanics

Aim:

The student is introduced to the basic concepts of biomechanics and studies in detail normal human locomotion and the biomechanics of lower limb orthoses.

Objective:

To enable the student in the use of biomechanics and to understand normal and pathological locomotion and the biomechanical principles of lower limb orthotics

Content:

- Introduction: terminology, definitions, planes and directions, proportions of the body, regions and landmarks of the body, centre of gravity of the body
- Joints: axes of rotation, synarthroses, diarthroses
- Muscles: types of contraction, muscle actions about joints
- Normal human locomotion: definitions, characteristics of normal gait, methods of studying locomotion, gait analysis of normal locomotion
- Lower limb orthotics: gait analysis of pathological locomotion, biomechanical principles of lower limb orthotics, introduction to biomechanics of the spine and spinal orthotics.

Mechanics

Aim:

The student is introduced to the basic concepts of mechanics.

Objectives:

To enable the student to apply mechanics to normal and pathological locomotion, lower limb orthotics and workshop practice.

Content:

- Introduction: mechanics and its three branches (kinematics, statics, kinetics - dynamics), scalar and vector quantities (definitions, vector addition, vector subtraction)
- Kinematics
 - motion in a straight line - translatory motion: displacement, velocity, acceleration, equations of motion due to gravity, graphs of (displacement/time, velocity/time, acceleration/time),
 - angular motion - circular motion (radian measure, angular velocity, angular acceleration, relationship between translatory motion, angular motion)
 - motion of a solid body: translation, rotation, helical motion
- Statics of a particle: force (concept, vector representation), coplanar concurrent forces (force systems (equilibrium, resultant, equilibrant), parallelogram of forces, triangle of forces, polygon of forces, notation of forces (Bow's notation), resolution of force)
- Statics of a rigid body: resultant of two like parallel forces, resultant of two unlike parallel forces, centre of parallel forces and centre of gravity, moment of a force, conditions of equilibrium (forces), moments (Varignons Theorem), moment of a couple (torque)
- Friction: concept of friction, effects of friction on a horizontal plane, effects of friction on an inclined plane
- Vectors: definition, vector representation (radius vector)
- Hodographs of: uniformly varied movement, uniformly accelerated movement, uniformly decelerated translatory movement, uniformly circular movement

Mathematics

Aim:

The student is introduced to basic mathematics

Objective:

To enable the student apply basic mathematical principles and concepts to mechanics and biomechanics.

Content:

- Planar geometry
- Triangles: definition, congruence of common triangles, congruence of right angled triangles, Pythagoras's theorem, sum of angles
- Polygons: definition, sum of the angles of a convex polygon
- Quadrilaterals: definition
- Parallel straight lines: definition, equidistant parallel lines
- Parallelograms: definition, rectangle, rhombus, square
- Trapeziums: definition
- Symmetry
- Circles: definitions, arc measurements, arcs and chords, inscribed angle, inscribed angle intersecting a half circle, inscribed quadrilateral, regular polygon
- Areas of plane geometric shapes: rectangle, square, parallelogram, triangle, rhombus, trapezium, polygon, regular polygon, circle
- Segments: proportion of two segments, vector carried by an axis, proportional segments, points dividing a segment in a given proportion, Thanos Theorem
- Algebra
- Rules of algebraic operation: addition, subtraction, multiplication, division
- First order equations: definitions, applications, solution of simultaneous equations
- Trigonometry and use of mathematical tables: multiplication, division, angle functions
- Introduction and application of angle functions: sine, cosine, tangent

Materials Technology

Aim:

The student learns the composition, properties and treatment of metal and non-metal materials used in lower limb orthotics practice

Objective:

To enable the student to understand the materials and their use in lower limb orthotics practice.

Content:

- Non-alloyed and alloyed steel: mild steel, stainless steel
- Non-ferrous metals and their alloys: aluminium, copper, brass
- Wood: hard wood, soft wood
- Leather
- Plaster of Paris: (including other casting materials)
- Plastic Materials: polyethylene (high and low density), polypropylene, resins (acrylic and polyester)
- Films: polyvinyl chloride (PVC), polyvinyl alcohol (PVA)
- Rubbers and Foams
- Reinforcement materials: fibreglass, carbon fibre, dacron felt, stockinette (cotton, nylon, perlon)
- Corks
- Composites
- Heat treatment methods: metals, plastics

Workshop Technology

Aim:

The student is informed of the use, maintenance and care of the hand and machine tools commonly used in lower limb orthotics practice.

Objective:

The student is familiar in the use, maintenance and care of the hand and machine tools used in lower limb orthotics practice.

Content:

- Use, maintenance and care of hand and machine tools
- Hand tools: measuring instruments, drilling tools, cutting tools, shaping tools, carving tools, saws, welding tools, heat guns, sundries
- Machines: drills, lathes, grinding machines, routers, planing machines, bandsaws, vacuum machines, sewing machines
- Equipment: work benches, ovens, welding equipment
- Layout of the working place: tools, machines, equipment, ergonomics
- Health and safety at work: hand tools, machine tools, workshop equipment, materials, safety equipment
- Problem analysis in workshop practice: measuring, filing, shaping, grinding, turning, drilling, riveting, embossing, moulding, gluing, fitting, heat treatment
- Problem analysis in orthotic techniques: aligning metal bars, adjusting orthotic joints, working of braces and casts, assembling and finishing orthosis

Workshop Management

Aim:

The student is introduced to the basic elements of workshop management.

Objective:

The student is equipped to fulfil the duties of a lower limb orthotics workshop leader.

Content:

- Introduction to workshop management: basic information about the sequence of events in workshop management.

- Principles of costing: reasons for costing, general costs of production
- Materials acquisition, handling and storage (stock management): stores management, purchasing, transport, end price, storage, stock control
- Human resource management: the work force, managing the work force, calculation of average man-hour, productive and non-productive hours, general costs related to manpower
- Financial statements: invoices, receipts, statements, budgets
- Production cost calculation: pro forma invoice, end price, profit
- Specific calculation related to prosthetics and orthotics rehabilitation facilities: Introduction to budgeting, planning, preparation, control

Clinics

Aim:

The student is informed about the National Health Services, national disability/ rehabilitation policy, disability data, rehabilitation services, the clinic/rehabilitation team and the role of the lower limb orthotics technologist.

She/he will be aware about the clinic/rehabilitation team at work and can assist to select and examine patients to be fitted with orthotic appliances produced by the students. Orthoses produced by the student will normally be fitted and delivered at these clinics.

In addition, the student will be instructed in proper professional behaviour.

Objective:

The student understands his/her role within the national health services and is able to fulfil the professional duties of a lower limb orthotics technologist in the clinic/rehabilitation team.

Content:

- Introduction: the National Health Services, National disability/rehabilitation policy, disability data, rehabilitation services, the clinic/rehabilitation team, the role of the lower limb orthotics technologist, regular participation in clinics
- Selection and assessment of patients by clinic/rehabilitation team (teamwork)
- Prescription, fitting and delivery of lower limb orthoses
- Professional ethics

General Mechanical Skills

Aim:

The student learns basic workshop practice in handling metals, wood, leather, textiles and plastics for the use in producing lower limb orthotic devices.

Objective:

The student is able to work with the materials used in producing lower limb orthoses.

Content:

- Metals: cutting procedures (filing, grinding, turning, drilling, tapping, cutting), non-cutting procedures (bending, stretching, embossing), connecting techniques (screwing, riveting), fusion procedures (welding, brazing)
- Wood procedures: sawing, chiselling, gluing, coating, grinding, planing, rasping, polishing
- Leather and textiles procedures: sawing, cutting, gluing, moulding, machine sewing, grinding, upholstering and lining
- Plastics procedures: resins (lamination, trimming, surface treatment), semi-finished products (sheets, moulding, films (cutting and welding)), foams (foaming)

Lower Limb Orthotics

Aim:

The student fabricates and fits a number of lower limb orthoses as specified in a log-book and will undergo clinical practice in prescription and fitting of orthotic devices.

Objective:

The student is able to prescribe, design, manufacture and fit lower limb orthoses.

Content:

- Insoles: metal, leather, plastic
- Height Compensation: wood, plastic
- Foot Orthoses (FO): plastic, leather, metal
- Ankle-Foot Orthoses (AFO): AFO to fix the ankle joint (polyethylene, acrylic, polyester), AFO with patellar tendon bearing brim for weight bearing (acrylic, polyester), AFOs for dorsiflexor weakness (PE, PP, leather, metal), Clubfoot night splint (PE, PP), Clubfoot dynamic walking splint, (metal joints, PE, PP)
- Knee-Ankle-Foot Orthoses (KAFO): Shells (PE, PP), Posterior shell with foot part (PE, PP), KAFO calf/thigh band type with side bars and lock, KAFO ischial weight bearing (PE, PP, leather, metal)
- Hip Orthoses (HiO): Pelvic band and jointed sidebar for hip orthoses, Hip immobiliser (metal, PP, PE)

Notes:

- At the start of the production of the lower limb orthoses the student will receive a practical procedure book with a selection of 12 orthotic devices which have to be fabricated and fitted.
- It is recommended that a log book should be used to record information regarding the orthotic work.
- For each piece of work performed there is a separate sheet which must be completed containing the following: particulars of patient, prescribed device, comments by the student on production and fitting, instructor's assessment
- The practical procedure book has to be presented to final examination as evidence of work performed and will be used for the assessment of the practical work of the student.

Clinical Placement

Aim:

The student learns to apply his/her knowledge and skills in lower limb orthotics in a clinical environment.

Objective:

The student is able to perform the clinical duties of a lower limb orthotics technologist.

Notes:

- The following notes are intended to ensure the good conduct of the clinical placement:
- The clinical placement should be fully under the responsibility of the educational institution and take place in centres approved by the institution.
- If the educational institution has service provision units separate from the training facility it can be used for clinical placements.
- The clinical placement centre should have fully qualified personnel to supervise the work of the student.
- Centres should make sure that the student has a comprehensive range of lower limb orthotics experiences. It is expected that the student should manufacture and fit 29 lower limb orthotic devices.
- The educational institution is encouraged to visit the clinical placement centres on a regular basis to advise on the conduct of the placement.
- During the clinical placement the students are expected to develop the following skills: Patient handling skills, Clinical skills, Technical skills, and Interpersonal skills
- Assessment of the student's performance in the above skills should be made by the clinical supervisor.
- A log book should be kept by the student to record information regarding the orthotic work carried out. This book should be presented to the patient presentation in the final examination as evidence of work performed during clinical placement.

15 Appendix E: Example of Syllabus for Modular Course in Lower Limb Prosthetics Technology

The information below is based on the module for lower limb prosthetics technology developed by VIETCOT, Hanoi, Vietnam.

The eighteen months education and training programme in lower limb prosthetics leading to the award of a Certificate in Lower Limb Prosthetics Technology should be recognised by a national accreditation authority.

The course has three elements; theoretical, practical, and clinical placement.

Objectives of the course

Qualifying candidates of the course will:

- acquire a clear concept of responsibility of the Lower Limb Prosthetics Technologist as stipulated in the job description.
- acquire adequate professional knowledge in the use of locally available materials and adapt the technology at his/her level to suit social and environmental conditions

General objectives

At the completion of the training programme the graduate will able to:

- Provide appropriate lower limb prosthetics services
- Provide patient care within a recognized code of ethics that complies with medical/legal requirements.
- Participate in the clinic/rehabilitation team; takes part in examination and prescription of lower limb prosthetic devices.

Specific objectives

At the end of the educational programme the graduate should able to:

- Assess physical and other relevant characteristic of the patient.
- Formulate a range of lower limb prosthetic designs as specified in the curriculum guidelines. This includes selection of materials, components and additional aids.
- Record and report any information regarding patients.
- Take all casts and measurement required for proper fabrication and fitting of lower limb orthoses.
- Modify positive and/or negative models and/or layouts of design to obtain optimal fit and alignment.
- Carry out fitting, static alignment and, where appropriate, preliminary training and initial checkout.
- Perform and/or supervises fabrication and final checkout, evaluation fit and function of the lower limb prostheses.
- Instruct the patient or family in the use and care of the lower limb prosthesis.
- Take part in the follow-up procedure.

Duration of the course

The training of the Lower Limb Prosthetics Technologist is an 18 months course. The first year consists of 44 weeks with approximately 1540 teaching hours. The minimum length of the course is 18 months. In the first year the instruction should be about 1400 hours not including examination and revision.

After completion of the first year the student has to pass a final examination and complete a minimum of a 6 months supervised clinical placement in an approved prosthetics and orthotics rehabilitation facility in the country. The clinical placement is full time and should be about 800 hours. These clinical placements will be supervised by a fully qualified Orthopaedic Technologist Category II (ISPO/WHO) or a Prosthetist/Orthotist Category I (ISPO/WHO) and they will follow a programme of work outlined by the Principal of the training institute.

The final Certificate in Lower Limb Prosthetics Technology Category II will only be issued on successful completion of this attachment and the final examination at the patient presentation at the end of the course.

Course content

A total number of 1,540 hours are available for tuition of the theoretical and practical subjects. At the end of the first year a total number of 70 hours (2 weeks) are available for theoretical and practical examinations.

This is followed by a 6 months clinical placement at the end of which a total of 105 hours (3 weeks) is available for final examination including patient fitting and presentation.

Theory

Anatomy/Physiology	42 hours	
Pathology/Rehabilitation related to technical orthopaedics	42 hours	
Biomechanics	84 hours	
Mechanics	42 hours	
Mathematics (Revision)	21 hours	
Materials Technology	51 hours	
Workshop Technology	42 hours	
Workshop Management	42 hours	
Clinics/Prescription/Goal Assessment	63 hours	
Total Theory		429 hours

Practice

General Mechanical Skills	200 hours	
Lower Limb Prosthetics	841 hours	
Total Practice		1041 hours

Examinations	70 hours	
First year total		1540 hours

Clinical Placement

Clinical Placement (six months)	695 hours	
Final examination preparation	70 hours	
Final examination and patient presentation	35 hours	
Six months total		800 hours

Course total		2340 hours
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Syllabus of Course

Anatomy and Physiology

Aim:

The student is introduced to the basic elements of connective tissue and studies the detailed anatomy and physiology of the pelvis and lower limb and knowledge of the spine.

Objective:

To enable the student to know and understand the role of connective tissues and detailed anatomy of the lower limb and spine in order to be able to apply them to lower limb orthotics practice.

Content:

- Basic knowledge
- Histology and cytology of the tissues, organs and systems
- The skeleton
 - structure of bones
 - development of bones
 - structure of joints
- General physiology of muscle
- General physiology of the nervous system
- The pelvis, lower limb and spine
 - bones (pelvis, femur, fibula, tibia, tarsals, metatarsals and phalanges, spine)
 - joints (pubic symphysis, sacroiliac, hip, knee, joints of the foot, spinal joints)
 - muscles (pelvis, lower limb, and spine - including origin, insertion, innervation and role)
- Functional anatomy of the lower limb and spine

Pathology

Aim:

The student is introduced to and learns about the basic pathological conditions that are encountered in lower limb orthotics clinical practice.

Objective:

To enable the student to recognise and understand the pathological conditions which are met in lower limb orthotics practice.

Content:

- General pathology
- Introduction to pathology
- Infectious diseases: poliomyelitis, osteomyelitis, meningitis, leprosy, tuberculosis
- Degenerative diseases: arthritis, tendonitis, arthrosis, osteonecrosis of the head of the femur
- Neoplasms: malignant, benign
- Metabolic disorders: rickets, osteomalacia, osteoporosis, gout
- Congenital deficiencies of the skeleton: lower limb deficiencies
- Specific diseases/conditions of the skeletal system: foot disorders, cerebral palsy, trauma, introduction to spinal disorders
- Amputation: causes, amputation levels and techniques

Biomechanics

Aim:

The student is introduced to the basic concepts of biomechanics and studies in detail normal human locomotion and the biomechanics of lower limb orthoses.

Objective:

To enable the student in the use of biomechanics and to understand normal and pathological locomotion and the biomechanical principles of lower limb orthotics

Content:

- Introduction: terminology, definitions, planes and directions, proportions of the body, regions and landmarks of the body, centre of gravity of the body
- Joints: axes of rotation, synarthroses, diarthroses
- Muscles: types of contraction, muscle actions about joints
- Normal human locomotion: definitions, characteristics of normal gait, methods of studying locomotion, gait analysis of normal locomotion
- Lower limb prosthetics: gait analysis of pathological locomotion, biomechanical principles of lower limb prosthetics, design lower limb prosthetics (partial-foot, trans-tibial, knee disarticulation, trans-femoral, hip disarticulation), introduction to biomechanics of the spine and spinal orthotics.

Mechanics

Aim:

The student is introduced to the basic concepts of mechanics.

Objectives:

To enable the student to apply mechanics to normal and pathological locomotion, lower limb orthotics and workshop practice.

Content:

- Introduction: mechanics and its three branches (kinematics, statics, kinetics - dynamics), scalar and vector quantities (definitions, vector addition, vector subtraction)
- Kinematics
 - motion in a straight line - translatory motion: displacement, velocity, acceleration, equations of motion due to gravity, graphs of (displacement/time, velocity/time, acceleration/time),
 - angular motion - circular motion (radian measure, angular velocity, angular acceleration, relationship between translatory motion, angular motion)
 - motion of a solid body: translation, rotation, helical motion
- Statics of a particle: force (concept, vector representation), coplanar concurrent forces (force systems (equilibrium, resultant, equilibrant), parallelogram of forces, triangle of forces, polygon of forces, notation of forces (Bow's notation), resolution of force)
- Statics of a rigid body: resultant of two like parallel forces, resultant of two unlike parallel forces, centre of parallel forces and centre of gravity, moment of a force, conditions of equilibrium (forces), moments (Varignons Theorem), moment of a couple (torque)
- Friction: concept of friction, effects of friction on a horizontal plane, effects of friction on an inclined plane
- Vectors: definition, vector representation (radius vector)
- Hodographs of: uniformly varied movement, uniformly accelerated movement, uniformly decelerated translatory movement, uniformly circular movement

Mathematics

Aim:

The student is introduced to basic mathematics

Objective:

To enable the student apply basic mathematical principles and concepts to mechanics and biomechanics.

Content:

- Planar geometry
- Triangles: definition, congruence of common triangles, congruence of right angled triangles, Pythagoras's theorem, sum of angles
- Polygons: definition, sum of the angles of a convex polygon
- Quadrilaterals: definition
- Parallel straight lines: definition, equidistant parallel lines
- Parallelograms: definition, rectangle, rhombus, square
- Trapeziums: definition
- Symmetry
- Circles: definitions, arc measurements, arcs and chords, inscribed angle, inscribed angle intersecting a half circle, inscribed quadrilateral, regular polygon
- Areas of plane geometric shapes: rectangle, square, parallelogram, triangle, rhombus, trapezium, polygon, regular polygon, circle
- Segments: proportion of two segments, vector carried by an axis, proportional segments, points dividing a segment in a given proportion, Thanos Theorem
- Algebra
- Rules of algebraic operation: addition, subtraction, multiplication, division
- First order equations: definitions, applications, solution of simultaneous equations
- Trigonometry and use of mathematical tables: multiplication, division, angle functions
- Introduction and application of angle functions: sine, cosine, tangent

Materials Technology

Aim:

The student learns the composition, properties and treatment of metal and non-metal materials used in lower limb orthotics practice

Objective:

To enable the student to understand the materials and their use in lower limb orthotics practice.

Content:

- Non-alloyed and alloyed steel: mild steel, stainless steel
- Non-ferrous metals and their alloys: aluminium, copper, brass
- Wood: hard wood, soft wood
- Leather
- Plaster of Paris: (including other casting materials)
- Plastic Materials: polyethylene (high and low density), polypropylene, resins (acrylic and polyester)
- Films: polyvinyl chloride (PVC), polyvinyl alcohol (PVA)
- Rubbers and Foams
- Reinforcement materials: fibreglass, carbon fibre, dacron felt, stockinette (cotton, nylon, perlon)
- Corks
- Composites
- Heat treatment methods: metals, plastics

Workshop Technology

Aim:

The student is informed of the use, maintenance and care of the hand and machine tools commonly used in lower limb orthotics practice.

Objective:

The student is familiar in the use, maintenance and care of the hand and machine tools used in lower limb orthotics practice.

Content:

- Use, maintenance and care of hand and machine tools
- Hand tools: measuring instruments, drilling tools, cutting tools, shaping tools, carving tools, saws, welding tools, heat guns, sundries
- Machines: drills, lathes, grinding machines, routers, planing machines, bandsaws, vacuum machines, sewing machines
- Equipment: work benches, ovens, welding equipment
- Layout of the working place: tools, machines, equipment, ergonomics
- Health and safety at work: hand tools, machine tools, workshop equipment, materials, safety equipment
- Problem analysis in workshop practice: measuring, filing, shaping, grinding, turning, drilling, riveting, embossing, moulding, gluing, fitting, heat treatment
- Problem analysis in prosthetic techniques: aligning metal bars, aligning prosthetic components, working of casts and prostheses, assembling and finishing prostheses

Workshop Management

Aim:

The student is introduced to the basic elements of workshop management.

Objective:

The student is equipped to fulfil the duties of a lower limb orthotics workshop leader.

Content:

- Introduction to workshop management: basic information about the sequence of events in workshop management.

- Principles of costing: reasons for costing, general costs of production
- Materials acquisition, handling and storage (stock management): stores management, purchasing, transport, end price, storage, stock control
- Human resource management: the work force, managing the work force, calculation of average man-hour, productive and non-productive hours, general costs related to manpower
- Financial statements: invoices, receipts, statements, budgets
- Production cost calculation: pro forma invoice, end price, profit
- Specific calculation related to prosthetics and orthotics rehabilitation facilities: Introduction to budgeting, planning, preparation, control

Clinics

Aim:

The student is informed about the National Health Services, national disability/ rehabilitation policy, disability data, rehabilitation services, the clinic/rehabilitation team and the role of the lower limb prosthetics technologist.

She/he will be aware about the clinic/rehabilitation team at work and can assist to select and examine patients to be fitted with prosthetic appliances produced by the students. Prostheses produced by the student will normally be fitted and delivered at these clinics.

In addition, the student will be instructed in proper professional behaviour.

Objective:

The student understands his/her role within the national health services and is able to fulfil the professional duties of a lower limb prosthetics technologist in the clinic/rehabilitation team.

Content:

- Introduction: the National Health Services, National disability/rehabilitation policy, disability data, rehabilitation services, the clinic/rehabilitation team, the role of the lower limb prosthetics technologist, regular participation in clinics
- Selection and assessment of patients by clinic/rehabilitation team (teamwork)
- Prescription, fitting and delivery of lower limb orthoses
- Professional ethics

General Mechanical Skills

Aim:

The student learns basic workshop practice in handling metals, wood, leather, textiles and plastics for the use in producing lower limb orthotic devices.

Objective:

The student is able to work with the materials used in producing lower limb orthoses.

Content:

- Metals: cutting procedures (filing, grinding, turning, drilling, tapping, cutting), non-cutting procedures (bending, stretching, embossing), connecting techniques (screwing, riveting), fusion procedures (welding, brazing)
- Wood procedures: sawing, chiselling, gluing, coating, grinding, planing, rasping, polishing
- Leather and textiles procedures: sawing, cutting, gluing, moulding, machine sewing, grinding, upholstering and lining
- Plastics procedures: resins (lamination, trimming, surface treatment), semi-finished products (sheets, moulding, films (cutting and welding)), foams (foaming)

Lower Limb Prosthetics

Aim:

The student fabricates and fits a number of lower limb prostheses as specified in a log-book and will undergo clinical practice in prescription and fitting of prosthetic devices.

Objective:

The student is able to prescribe, design, manufacture and fit lower limb prostheses.

Content:

- Foot prostheses and partial foot prostheses: prostheses after amputation of toes and/or forefoot, other foot prostheses
- Ankle disarticulation prostheses
- Trans-tibial prostheses: trans-tibial prosthesis with laminated socket, trans-tibial prosthesis with supracondylar laminated socket, trans-tibial prosthesis with polypropylene socket (ICRC system)
- Knee disarticulation prostheses: laminated with sidebars (self-suspending)
- Trans-femoral prostheses: trans-femoral prosthesis with wood socket, trans-femoral prosthesis with polypropylene socket (ICRC system), trans-femoral prosthesis with laminated socket
- Introduction to hip disarticulation prostheses
- Exposure to different types of suspension/technology etc

Notes:

- At the start of the production of the lower limb orthoses the student will receive a practical procedure book with a selection of 12 prosthetic devices which have to be fabricated and fitted.
- It is recommended that a log book should be used to record information regarding the prosthetic work.
- For each piece of work performed there is a separate sheet which must be completed containing the following: Particulars of patient, Prescribed device, Comments by the student on production and fitting and Instructor's assessment
- The practical procedure book has to be presented to final examination as evidence of work performed and will be used for the assessment of the practical work of the student.

Clinical Placement

Aim:

The student learns to apply his/her knowledge and skills in lower limb prosthetics in a clinical environment.

Objective:

The student is able to perform the clinical duties of a lower limb prosthetics technologist.

Notes:

- The following notes are intended to ensure the good conduct of the clinical placement:
- The clinical placement should be fully under the responsibility of the educational institution and take place in centres approved by the institution.
- If the educational institution has service provision units separate from the training facility it can be used for clinical placements.
- The clinical placement centre should have fully qualified personnel to supervise the work of the student.
- Centres should make sure that the student has a comprehensive range of lower limb orthotics experiences. It is expected that the student should manufacture and fit 29 lower limb prosthetics devices.
- The educational institution is encouraged to visit the clinical placement centres on a regular basis to advise on the conduct of the placement.
- During the clinical placement the students are expected to develop the following skills: Patient handling skills, Clinical skills, Technical skills, and Interpersonal skills
- Assessment of the student's performance in the above skills should be made by the clinical supervisor.
- A log book should be kept by the student to record information regarding the orthotic work carried out. This book should be presented to the patient presentation in the final examination as evidence of work performed during clinical placement.

16 Appendix F: Example of Syllabus for Modular Course in Upper Limb Prosthetics / Orthotics and Spinal Orthotics Technology

The one 18 months education and training programme Upper Limb Prosthetics/Orthotics and Spinal Orthotics leads to the certificate of an Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technologist.

The course has three elements theoretical, practical and clinical.

Objectives of the course

Qualifying candidates of the course will:

- acquire a clear concept of responsibility of the Upper Limb Prosthetics/ Orthotics and Spinal Orthotics Technologist as stipulated in the job description.
- acquire adequate professional knowledge in the use of locally available materials and adapt the technology at his/her level to suit social and environmental conditions.

General objectives

At the completion of the training programme the graduate will able to:

- Provide appropriate upper limb prosthetics and orthotics services.
- Provide appropriate spinal orthotics services.
- Provide patient care within a recognised code of ethics that complies with medical/legal requirements.
- Participate in the clinic/rehabilitation team; takes part in examination and prescription of upper limb prosthetic and orthotic devices.
- Participate in the clinic/rehabilitation team; takes part in examination and prescription of spinal orthotic devices

Specific objectives

At the end of the educational programme the graduate should able to:

- Assess physical and other relevant characteristic of the patient.
- Formulate a range of upper limb prosthetic and orthotic designs as specified in the curriculum guidelines. This includes selection of materials, components and additional aids.
- Formulate a range of spinal orthotic designs as specified in the curriculum guidelines. This includes selection of materials, components and additional aids.
- Record and report any information regarding patients.
- Take all casts and measurement required for proper fabrication and fitting of upper limb prostheses and orthoses.
- Take all casts and measurement required for proper fabrication and fitting of spinal orthoses.
- Modify positive and/or negative models and/or layouts of design to obtain optimal fit and alignment.
- Carry out fitting, alignment and, where appropriate, preliminary training and initial checkout.
- Perform and/or supervises fabrication and final checkout, evaluation fit and function of the upper limb prostheses and orthoses.
- Perform and/or supervise fabrication and final checkout, evaluation fit and function of the spinal orthoses.
- Instruct the patient or family in the use and care of the device.
- Take part in the follow-up procedure.

Duration of the course

The training of the Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technologist is an 18 months course. The first year consists of 44 weeks with approximately 1540 teaching hours. The minimum length of the course is 18 months. In the first year the instruction should be about 1400 hours not including examination and revision.

After completion of the first year the student has to pass a final examination and complete a minimum of a 6 months supervised clinical placement in an approved prosthetics and orthotics rehabilitation facility in the country. The clinical placement is full time and should be about 800 hours. These clinical placements will be supervised by a fully qualified Orthopaedic Technologist Category II (ISPO/WHO) or a Prosthetist/ Orthotist Category I (ISPO/WHO) and they will follow a programme of work outlined by the Principal of the training institute.

The final Certificate in Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technology Category II will only be issued on successful completion of this attachment and the final examination at the patient presentation at the end of the course.

Course content

A total number of 1,540 hours are available for tuition of the theoretical and practical subjects. At the end of the first year a total number of 70 hours (2 weeks) are available for theoretical and practical examinations.

This is followed by a 6 months clinical placement at the end of which a total of 105 hours (3 weeks) is available for final examination including patient fitting and presentation.

Theory

Anatomy/Physiology	42 hours	
Pathology/Rehabilitation related to technical orthopaedics	42 hours	
Biomechanics	84 hours	
Mechanics	42 hours	
Mathematics (Revision)	21 hours	
Materials Technology	51 hours	
Workshop Technology	42 hours	
Workshop Management	42 hours	
Clinics/Prescription/Goal Assessment	63 hours	
Total Theory		429 hours

Practice

General Mechanical Skills	200 hours	
Upper Limb Prosthetics/Orthotics and Spinal Orthotics	841 hours	
Total Practice		1041 hours

Examinations	70 hours	
First year total		1540 hours

Clinical Placement

Clinical Placement (six months)	695 hours	
Final examination preparation	70 hours	
Final examination and patient presentation	35 hours	
Six months total		800 hours

Course total		2340 hours
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Syllabus of Course

Anatomy and Physiology

Aim:

The student is introduced to the basic elements of connective tissue and studies the detailed anatomy and physiology of the upper limb, pelvis and spine.

Objective:

To enable the student to know and understand the role of connective tissues and detailed anatomy of the upper limb, pelvis and spine in order to be able to apply them to upper limb prosthetics and orthotics and spinal orthotics practice.

Content:

- Basic Knowledge; Histology and cytology of the tissue, organs and systems, the skeleton (structure of bones, development of bones, structure of the joints), general physiology of muscle, general physiology of the nervous system
- The pelvis, upper limb and spine
- Bones: pelvis, humerus, radius, ulna, carpals, metacarpals and phalanges, spine
- Joints: pubic symphysis, sacroiliac, shoulder girdle, elbow, joints wrist and hand, spinal joints
- Muscles of the pelvis, upper limb and spine: origin, insertion, innervation, role
- Functional anatomy of the upper limb and spine

Pathology

Aim:

The student is introduced to and learns about the basic pathological conditions and amputations that are encountered in upper limb prosthetics and orthotics and spinal orthotics clinical practice.

Objective:

To enable the student to recognise and understand the pathological conditions and amputations which are met in upper limb prosthetics and orthotics and spinal orthotics practice.

Content:

- General Pathology
- Introduction to pathology
- Infectious diseases: poliomyelitis, osteomyelitis, meningitis, leprosy, tuberculosis
- Degenerative diseases: Arthritis, Tendinitis, Arthrosis,
- Neoplasms: Malignant, Benign
- Metabolic disorders: Rickets, Osteomalacia, Osteoporosis, Gout
- Congenital deficiencies of the skeleton: Upper limb deficiencies
- Specific diseases/conditions of the skeletal system: Hand and upper disorders, Introduction to spinal disorders
- General elements of paralysis: Flaccid paralysis, Spasticity, Upper motor neurone lesions, Monoplegia, Hemiplegia, Paraplegia, Quadriplegia (Tetraplegia),
- Problems of the spine: Scoliosis, Kyphosis, Lordosis, Low back pain, Cervical conditions
- Amputation of the upper limb: Causes, Amputation levels and techniques

Biomechanics

Aim:

The student is introduced to the basic concepts of biomechanics and studies in detail upper limb and spinal movement and function and the biomechanics of upper limb prosthetics and orthotics and spinal orthotics.

Objective:

To enable the student in the use of biomechanics; to understand normal and pathological movement and function of the upper limb and spine; and the biomechanical principles of upper limb prosthetics and orthotics and spinal orthotics

Content:

- Introduction, Terminology, Definitions, Planes and directions, Proportions of the body, Regions and landmarks of the body, Centre of gravity of the body
- Joints: Axes of rotation, synarthroses, Diarthroses
- Muscles: Types of contraction, Muscles actions about joints
- Normal human movement: Definitions, Characteristics of normal movement, Methods of studying movement, Biomechanical analysis of normal movement
- Upper limb prosthetics: Biomechanical analysis of the upper limb stump, Biomechanical principles of upper limb prosthetics
- Upper limb orthotics: Biomechanical analysis of upper limb pathological conditions, Biomechanical principles of upper limb orthotics
- Spinal orthotics: Introduction to biomechanics of the spine and spinal orthotics, Functions of a spinal orthosis (Holding, Stretching, Correcting, Extending), Treatment of scoliosis

Aim:

The student is introduced to the basic concepts of mechanics.

Objectives:

To enable the student to apply mechanics to normal and pathological locomotion, lower limb orthotics and workshop practice.

Content:

- Introduction: mechanics and its three branches (kinematics, statics, kinetics - dynamics), scalar and vector quantities (definitions, vector addition, vector subtraction)
- Kinematics
 - motion in a straight line - translatory motion: displacement, velocity, acceleration, equations of motion due to gravity, graphs of (displacement/time, velocity/time, acceleration/time),
 - angular motion - circular motion (radian measure, angular velocity, angular acceleration, relationship between translatory motion, angular motion)
 - motion of a solid body: translation, rotation, helical motion
- Statics of a particle: force (concept, vector representation), coplanar concurrent forces (force systems (equilibrium, resultant, equilibrant), parallelogram of forces, triangle of forces, polygon of forces, notation of forces (Bow's notation), resolution of force)
- Statics of a rigid body: resultant of two like parallel forces, resultant of two unlike parallel forces, centre of parallel forces and centre of gravity, moment of a force, conditions of equilibrium (forces), moments (Varignons Theorem), moment of a couple (torque)
- Friction: concept of friction, effects of friction on a horizontal plane, effects of friction on an inclined plane
- Vectors: definition, vector representation (radius vector)
- Hodographs of: uniformly varied movement, uniformly accelerated movement, uniformly decelerated translatory movement, uniformly circular movement

Mathematics

Aim:

The student is introduced to basic mathematics

Objective:

To enable the student apply basic mathematical principles and concepts to mechanics and biomechanics.

Content:

- Planar geometry
- Triangles: definition, congruence of common triangles, congruence of right angled triangles, Pythagoras's theorem, sum of angles
- Polygons: definition, sum of the angles of a convex polygon
- Quadrilaterals: definition
- Parallel straight lines: definition, equidistant parallel lines
- Parallelograms: definition, rectangle, rhombus, square

- Trapeziums: definition
- Symmetry
- Circles: definitions, arc measurements, arcs and chords, inscribed angle, inscribed angle intersecting a half circle, inscribed quadrilateral, regular polygon
- Areas of plane geometric shapes: rectangle, square, parallelogram, triangle, rhombus, trapezium, polygon, regular polygon, circle
- Segments: proportion of two segments, vector carried by an axis, proportional segments, points dividing a segment in a given proportion, Thales Theorem
- Algebra
- Rules of algebraic operation: addition, subtraction, multiplication, division
- First order equations: definitions, applications, solution of simultaneous equations
- Trigonometry and use of mathematical tables: multiplication, division, angle functions
- Introduction and application of angle functions: sine, cosine, tangent

Materials Technology

Aim:

The student learns the composition, properties and treatment of metal and non-metal materials used in lower limb orthotics practice

Objective:

To enable the student to understand the materials and their use in lower limb orthotics practice.

Content:

- Non-alloyed and alloyed steel: mild steel, stainless steel
- Non-ferrous metals and their alloys: aluminium, copper, brass
- Wood: hard wood, soft wood
- Leather
- Plaster of Paris: (including other casting materials)
- Plastic Materials: polyethylene (high and low density), polypropylene, resins (acrylic and polyester)
- Films: polyvinyl chloride (PVC), polyvinyl alcohol (PVA)
- Rubbers and Foams
- Reinforcement materials: fibreglass, carbon fibre, dacron felt, stockinette (cotton, nylon, perlon)
- Corks
- Composites
- Heat treatment methods: metals, plastics

Workshop Technology

Aim:

The student is informed of the use, maintenance and care of the hand and machine tools commonly used in lower limb orthotics practice.

Objective:

The student is familiar in the use, maintenance and care of the hand and machine tools used in lower limb orthotics practice.

Content:

- Use, maintenance and care of hand and machine tools
- Hand tools: measuring instruments, drilling tools, cutting tools, shaping tools, carving tools, saws, welding tools, heat guns, sundries
- Machines: drills, lathes, grinding machines, routers, planing machines, bandsaws, vacuum machines, sewing machines
- Equipment: work benches, ovens, welding equipment
- Layout of the working place: tools, machines, equipment, ergonomics
- Health and safety at work: hand tools, machine tools, workshop equipment, materials, safety equipment

- Problem analysis in workshop practice: measuring, filing, shaping, grinding, turning, drilling, riveting, embossing, moulding, gluing, fitting, heat treatment
- Problem analysis in prosthetic and orthotic techniques: aligning metal bars, adjusting prosthetic and orthotic components, working of sockets, braces and casts, assembling and finishing prostheses

Workshop Management

Aim:

The student is introduced to the basic elements of workshop management.

Objective:

The student is equipped to fulfil the duties of a lower limb orthotics workshop leader.

Content:

- Introduction to workshop management: basic information about the sequence of events in workshop management.
- Principles of costing: reasons for costing, general costs of production
- Materials acquisition, handling and storage (stock management): stores management, purchasing, transport, end price, storage, stock control
- Human resource management: the work force, managing the work force, calculation of average man-hour, productive and non-productive hours, general costs related to manpower
- Financial statements: invoices, receipts, statements, budgets
- Production cost calculation: pro forma invoice, end price, profit
- Specific calculation related to prosthetics and orthotics rehabilitation facilities: Introduction to budgeting, planning, preparation, control

Clinics

Aim:

The student is informed about the National Health Services, national disability/ rehabilitation policy, disability data, rehabilitation services, the clinic/rehabilitation team and the role of the upper limb prosthetics and orthotics and spinal orthotics technologist.

She/he will be aware about the clinic/rehabilitation team at work and can assist to select and examine patients to be fitted with orthotic and prosthetic appliances produced by the students. Devices produced by the student will normally be fitted and delivered at these clinics. In addition, the student will be instructed in proper professional behaviour.

Objective:

The student understands his/her role within the national health services and is able to fulfil the professional duties of a upper limb prosthetics and orthotics and spinal orthotics technologist in the clinic/rehabilitation team.

Content:

- Introduction: the National Health Services, National disability/rehabilitation policy, disability data, rehabilitation services, the clinic/rehabilitation team, the role of the upper limb prosthetics and orthotics and spinal orthotics technologist, regular participation in clinics
- Selection and assessment of patients by clinic/rehabilitation team (teamwork)
- Prescription, fitting and delivery of lower limb orthoses
- Professional ethics

General Mechanical Skills

Aim:

The student learns basic workshop practice in handling metals, wood, leather, textiles and plastics for the use in producing lower limb orthotic devices.

Objective:

The student is able to work with the materials used in producing lower limb orthoses.

Content:

- Metals: cutting procedures (filing, grinding, turning, drilling, tapping, cutting), non-cutting procedures (bending, stretching, embossing), connecting techniques (screwing, riveting), fusion procedures (welding, brazing)
- Wood procedures: sawing, chiselling, gluing, coating, grinding, planing, rasping, polishing
- Leather and textiles procedures: sawing, cutting, gluing, moulding, machine sewing, grinding, upholstering and lining
- Plastics procedures: resins (lamination, trimming, surface treatment), semi-finished products (sheets, moulding, films (cutting and welding)), foams (foaming)

Upper Limb Prosthetics/Orthotics and Spinal Orthotics

Aim:

The student fabricates and fits a number of upper limb prostheses and orthoses and spinal orthoses as specified in a log-book and will undergo clinical practice in prescription and fitting of prosthetic and orthotic devices.

Objective:

The student is able to prescribe, design, manufacture and fit upper limb prostheses and orthoses and spinal orthoses.

Content:

Upper limb orthotics: Finger orthoses (FO), Hand orthoses (HO), Wrist-hand orthoses (WHO), Elbow-wrist-hand orthoses (EWHO), Elbow orthoses (EO), Shoulder-elbow orthoses (SEO), Shoulder-elbow-wrist-hand orthoses (SEWHO)

Upper limb prosthetics: Finger and partial hand prostheses, Trans-radial prostheses, Introduction to prostheses for elbow disarticulation, Trans-humeral prostheses, Introduction to prostheses for shoulder disarticulation, Introduction to cable controlled prostheses, Design of harnesses

Spinal orthotics: Lumbo-sacral orthoses (LSO), Thoraco-lumbo-sacral orthoses (TLSO), Cervico-lumbo-sacral orthoses (CTLSO)

Notes:

- At the start of the production of the upper limb prostheses/orthoses and spinal orthoses the student will receive a practical procedure book with a selection of 18 prosthetic/orthotic devices which have to be fabricated and fitted
- It is recommended that a log book should be used to record information regarding the prosthetic work.
- For each piece of work performed there is a separate sheet which must be completed containing the following: Particulars of patient, Prescribed device, Comments by the student on production and fitting and Instructor's assessment
- The practical procedure book has to be presented to final examination as evidence of work performed and will be used for the assessment of the practical work of the student.

Clinical Placement

Aim:

The student learns to apply his/her knowledge and skills in upper limb prosthetics and orthotics and spinal orthotics in a clinical environment.

Objective:

The student is able to perform the clinical duties of an upper limb prosthetics and orthotics and spinal orthotics technologist.

Notes:

The following notes are intended to ensure the good conduct of the clinical placement:

- The clinical placement should be fully under the responsibility of the educational institution and take place in centres approved by the institution.
-

- If the educational institution has service provision units separate from the training facility it can be used for clinical placements.
- The clinical placement centre should have fully qualified personnel to supervise the work of the student.
- Centres should make sure that the student has a comprehensive range of upper limb prosthetics/orthotics and spinal orthotics experiences. It is expected that the student should manufacture and fit 20 upper limb prosthetic/orthotic and spinal orthotic devices.
- The educational institution is encouraged to visit the clinical placement centres on a regular basis to advise on the conduct of the placement.
- During the clinical placement the students are expected to develop the following skills: Patient handling skills, Clinical skills, Technical skills, and Interpersonal skills
- Assessment of the student's performance in the above skills should be made by the clinical supervisor.
- A log book should be kept by the student to record information regarding the orthotic work carried out. This book should be presented to the patient presentation in the final examination as evidence of work performed during clinical placement.