LEARNING OBJECTIVES OF COURSE FOR CATEGORY I

The following outlines learning objectives of a course for Category I workers in respect of theoretical subjects (4.1 to 4.12), closely supervised practical instruction (4.13) and clinical practice (4.14). It should be emphasised that this document defines a set of key objectives, but does not include additional subjects that may be required to meet cultural, legal or customary requirements local higher education standards. In respect to the supervised practical instruction, regional requirements may also influence the emphasis on particular pathologies in areas of patient treatment. Within the learning objectives it is recognised that there are different levels of learning, every attempt has been made to reflect the necessary level of learning within each of the subject areas presented.

It should also be noted that the course which encompasses these learning objectives will normally be of three or four years duration full-time study and the entrants will have satisfied University entrance requirements (12/13 years schooling). This provides guidance as to the expected level of the course and its place within the national educational framework.

An example of a detailed syllabus of an appropriate course is given in Appendix C. This is not intended to be a model but only a useful guide as to detailed content and subject breakdown for those involved in course construction.
**Figure 1.1 - Organisation of Category I Subjects**

**CORE SUBJECTS**

**Practical**
- Prosthetics and Orthotics Science – Practical
- Clinical Practice

**Theoretical**
- Prosthetics and Orthotics Science – Theory
- Anatomy and Physiology
- Pathology
- Mechanics and Biomechanics
- Clinical Studies
- Materials Technology

**SECONDARY SUBJECTS**

- Clinic, Workshop and Business Management
- Workshop Technology
- Electro Technology
- Research Methods in Health
CORE SUBJECTS

Core Practical Subjects

1.1 Prosthetic and Orthotic Science – Practical

The basis of “Prosthetics and Orthotics Science – Practical” is the closely supervised practical instruction of students in the manufacturing and fitting of devices and in the clinical and technical aspects of prosthetic and orthotics. Upon conclusion of the subject students should be able to demonstrate basic skills necessary to deliver devices to patients. S/he will understand and appreciate the choice of treatment/rehab planning, device design, component selection and broader prescription methodology. S/he will have an appreciation of the client centred approach, understanding the clients role and the role of or her health care professional’s role in making these choices. This should include the supervised manufacture and fitting of all common devices and at least exposure to the range of devices not routinely seen in clinical practice.

Upon completion of this subject the student will be able to:

- Assess the medical condition of a patient related to their orthotic or prosthetic management using appropriate investigative techniques which include patient history taking and clinical testing.
- Formulate an optimal orthotic or prosthetic solution using information from the patient assessment, other members of the rehabilitation team, medical charts, etc.
- Communicate and discuss patient goals and expectations and discuss and debate the orthotic or prosthetic management with the patient, co-workers and other members of the rehabilitation team.
- Reliably measure and capture a positive cast or image of clients’ appendage while correctly positioning the body part and if appropriate apply the necessary corrective force system.
- Create the final design of the orthosis through modification of the positive cast and/or tracing of the body part or, when indicated, measure and fit prefabricated devices.
- Identify, prescribe and justify selection of appropriate materials and componentry in the construction of the device.
- Construct the device using appropriate fabrication techniques in preparation for the initial fitting.
- Fit the device to the patient using static and dynamic functional criteria established from the original assessment.
- Evaluate the quality of the device fit to ensure the appropriate interface contouring, force application and trimlines.
- Identify problems related to device fit and/or alignment and be able to suggest and implement appropriate correction.
- Assess and solve orthotic and prosthetic problems as part of long term patient care.
- Maintain accurate records of patient treatment and follow up as well as confidentiality of such information.
- Communicate effectively with patient, co-workers, and other health care professionals in such a manner that will ensure the highest quality of service and reflect a professional attitude on the part of the student.
- Educate the client and/or caregiver on use, care and function of the device.
- Understand the methodology of problem idebtification, problem solving in a
process that includes all stakeholders, with the client at the centre.

The following areas of practice should be addressed:

- partial foot prosthetics;
- ankle disarticulation prosthetics;
- trans-tibial prosthetics;
- knee disarticulation prosthetics;
- trans-femoral prosthetics;
- hip disarticulation and hemipelvectomy prosthetics;
- partial hand prosthetics;
- wrist disarticulation prosthetics;
- trans-radial prosthetics;
- elbow disarticulation prosthetics;
- trans-humeral prosthetics;
- shoulder disarticulation and forequarter prosthetics;
- foot orthotics;
- ankle-foot orthotics;
- knee orthotics;
- knee-ankle-foot orthotics;
- hip orthotics;
- hip-knee-ankle-foot orthotics;
- hand orthotics;
- wrist-hand orthotics;
- elbow orthotics;
- elbow-wrist-hand orthotics;
- shoulder orthotics;
- shoulder-elbow-wrist-hand orthotics;
- sacro-iliac orthotics;
- lumbo-sacral orthotics;
- thoraco-lumbar orthotics;
- thoraco-lumbo-sacral orthotics;
- cervical orthotics;
- cervico-thoraco-lumbo-sacral orthotics;
- orthopaedic footwear and shoe modifications;
- fracture bracing.

1.2 Clinical Practice

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 a Category I professional who is accountable to the school.

Core Theoretical Subjects

1.3 Prosthetic and Orthotic Science – Theory

This subject is delivered in a coordinated manner with the Practical part of the Orthotic and Prosthetic Science course. The student will be required to acquire and comprehend the necessary theoretical knowledge and to be able to integrate this effectively in clinical practice.

Learning Objectives:

Upon completion of this subject the student will be able to:

• Compare and contrast strategies for clinical assessment of patients and describe appropriate investigative techniques including patient history taking and physical examination.
• Recognize and describe the signs and symptoms of the most common pathologies which require orthotic and prosthetic solutions including, aetiology, clinical presentation, prognosis and appropriate device management.
• Have an understanding of clinical conditions that may indirectly impact on the clients ability to successfully rehabilitate using the device.
• Demonstrate empathy between P&O theory and the environment in which the client is situated.
• Distinguish between the physical characteristics of the limbs and discuss the relative implication for device design.
• Describe and compare temporospatial and kinematic characteristics of normal and pathological gait and use this information to justify the selection and design of appropriate devices.
• Discuss biomechanical force systems and use these principles in generating an appropriate orthotic or prosthetic prescription.
• Describe the mechanics of materials and be able to apply these concepts to the design and construction of devices.
• Compare and contrast the functional characteristics of prosthetic and orthotic components.
• Formulate appropriate prosthetic and orthotic prescriptions for a wide range clinical situations.
• Understand and describe the roles of key members of the rehabilitation team and identify how they interrelate with the orthotist/prosthetist.
• Identify and describe common surgical techniques and how they may influence prosthetic and orthotic fit and design.

1.4  Anatomy and physiology

Upon completion of a category one course in prosthetics and orthotics, student should be able to

• describe and explain cell biology;
• explain and give examples of basic tissues, their properties and structure;
• compare and contrast the structure and properties of biological substances (ie: blood, lymphatic fluids, serum);
• describe parts and organs of the body by systems including:
  - integumentary system
  - skeletal system
  - articular system
  - muscular system
  - nervous system
  - circulatory system
  - respiratory system
  - urinary system
  - reproductive system
  - endocrine system
  - digestive system
• explain the process of human growth and development;
• demonstrate competence in identifying and differentiating between surface anatomical structures of the lower limb, upper limb spine and trunk;
• Understand the inter-relations between the systems described. (I mean, they should know origin, insertion, nerve connection and blood supply of each muscle, that’s just one example)
• describe and relate the structure and function of the upper and lower limbs to clinical pathologies;
• Synthesise and apply the principles of anatomy and physiology to describe the human locomotor system.

The student should understand the function of individual joints and muscles and be proficient in explaining their interaction. He/she should be knowledgeable in the area of clinical conditions 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.

1.5  Pathology

The student should be able to meet the following learning objectives.
• describe the basic pathological processes that underlie disease (e.g., cell injury and necrosis, inflammation and healing, ischemia, infarction and neoplasia);
• apply knowledge of basic pathological processes to explain the etiology, pathogenesis, structural and functional manifestations of diseases commonly encountered in clinical practice, including relevant conditions affecting locomotion and body systems (circulatory system, respiratory systems, musculoskeletal system and nervous system).
• discuss the pathophysiology of abnormalities present at birth (congenital deficiencies).

The student should be able to describe and contrast the aetiology and progression of diseases and to identify early signs and symptoms of conditions that are commonly encountered by prosthetists/orthotists. In addition, s/he should be able to advise on care and appropriate treatment options. Specific conditions covered should include:
• demyelination disorders;
• skin disorders;
• upper motor neurone disorders;
• lower motor neurone disorders;
• diabetes mellitus
• Hansen disease
• peripheral vascular disease;
• age related disabilities;
• spinal injuries;
• joint and skeletal disorders;
• trauma and post traumatic conditions
• overuse syndromes

Have a basic understanding of surgical techniques commonly encountered by the clinical team. Students should be encouraged to witness relevant surgeries and have a baseline understanding of post surgical care.

1.6 Mechanics and biomechanics

Students should be able to;

Mechanics

• Demonstrate an ability to utilize appropriate terminology and units to describe mechanical principles.
• Derive free body diagrams in order to describe clinical problems and generate treatment solutions.
• Apply the mechanical principles of statics and dynamics to quantify and explain linear and angular motion of the human body
• Apply the concepts of stress and strain in the analysis of basic structural elements.
• Determine and draw diagrams for internal forces and bending moments (axial forces, shear forces, moments and torques) in a structural member.
• Explain the principles of composition and resolution of forces and use these principles to solve clinical problems
• Discuss the concepts of work energy and power
• Explain the principles of fluid mechanics and describe how the principles can be applied in clinical situations.
• Explain mechanisms underlying failure of structures under deformation.

Biomechanics

The understanding of Bio-mechanical principles of Prosthetics and Orthotics will be the foundation of the work of the graduate P&O practitioner. It is essential they have a sound theoretical knowledge of the subject and are able to demonstrate the rigorous application of these principles to practical P&O situations and in the analysis of those situations

• Demonstrate an ability to apply principles of tissue mechanics to explain the principles of P&O treatment, (involving various force systems) and the practical problems encountered in prosthetics and orthotics
• Use biomechanical terminology to describe position and motion of the human body
• Discuss mechanical principles governing human motion
• Utilise temporo spatial, kinematic and kinetic information to distinguish between normal and abnormal function of the upper limbs, lower limbs and spine.
• Analyse the forces at a skeletal joint for various static and dynamic activities
• Demonstrate the ability to analyse forces and moments applied to the body by prosthetic and orthotic devices.
• Apply biomechanical principles to generate optimal solutions to clinical problems in prosthetics and orthotics.
• understand the concepts of differentiation and integration and evaluate derivatives and integrals of a function

1.7 Clinical Studies

students should be able to perform the following tasks related to clinical practice.

• describe and discuss the principles underlying evidence based practice
• compare, contrast and criticise relevant literature in order to determine the best available evidence regarding treatment modalities for specific clinical problems.
• recognise members of the clinic team and identify benefits associated with a team approach;
• describe and discuss theoretical principles of rehabilitation;
• describe theories related to the psychology of loss and disability;
• demonstrate safe methods for handling and moving patients;
• describe and discuss issues related to medical ethics
• Demonstrate and appreciation of emotional intelligence
• Apply client centered service delivery
• Manage gender and cultural awareness
• Comply with cross infection and hygiene standards
• Understanding of the mechanism for “care in the community” and to comprehend how post rehab is synthesized.

1.8 Materials technology

Upon completion of a prosthetics and orthotics program students should be able to;

• Explain the important properties of various types of materials: metals, ceramics, polymers, and composites.
• Describe the relationships that exist between the structural elements of these materials and their characteristics.
• Explain mechanical and failure behavior of these materials, along with techniques used to improve the mechanical and failure properties in terms of alteration of structural elements.
• Describe the basis for the selection of different materials for specific prosthetic and orthotic applications.

Demonstrate knowledge of toxicity and safety issues associated with the use of specific materials.
SECONDARY SUBJECTS

2.1 Clinic, workshop and business management

Students should
• possess knowledge and understanding of techniques related to the design, planning, control and improvement of service and manufacturing operations.
• demonstrate basic knowledge of business management practices such as cost calculations and accounting processes.
• address issues related to clinic management including, appointment systems and record keeping.
• discuss the importance of quality control and workflow management.
• Apply appropriate inventory management protocols
• Understand and discuss the benefits associate with the use of quality assurance systems
• Understand the organization of the workplace environment.

2.2 Workshop technology

Students should have competence in practising effectively and safely within a workshop environment. Students should;

• be familiar with the occupational health and safety policy and procedures in the workplace.
• demonstrate proficiency in the use of hand tools and machine tools commonly used in the fabrication of orthopaedic devices.
• describe the principles of computer aided design computer aided manufacture

2.3 Electrotechnology

The student will have knowledge of basic principles of electricity with particular reference to applications in prosthetics, orthotics and workshop practice. This should include;

• DC circuits;
• inductance and capacitance;
• AC circuits;
• power supplies;
• amplifiers;
• feedback;
• interference rejection techniques;
• myoelectrodes;

2.4 Research methods in health

The student will have a knowledge of the following areas of mathematics and their application to mechanics, biomechanics and prosthetics and orthotics:
• Analyse, describe, interpret and present information contained in various data sets
• To examine the concepts of estimation and hypothesis testing with applications to population proportions, means, variances
• perform effective descriptive statistical analysis as well as statistical inference for a variety of mainstream applications
• Understand probabilistic reasoning and compute probabilities for simple problems.
• Use appropriate empirical and probability distributions to model data.
• interpret the output from regression analysis and be aware of limitations of standard interpretations
• determine the appropriate statistical tests to use for a variety of research questions
• Formulate an appropriate research plan in order to solve a clinical problem
• Conduct a basic research study in order to solve a clinical problem
• Synthesise results of a research study and communicate them in written and oral form.