ISHWAR Institute of Prosthetics and Orthotics

Education for Evidence Based Practice

SYLLABUS AND SCHEME OF EXAMINATION

BACHELOR OF PROSTHETICS & ORTHOTICS (BPO)*

W.E.F 2012-13

*provisional

BACHELOR OF PROSTHETICS & ORTHOTICS
FOUR YEARS (NON-SEMESTER PATTERN)
SCHEME OF EXAMINATIONS

YEAR	SUBJECT	Duration of Examination	E/NE	Internal Assessment Marks	University Theory Marks	University Practical Marks	Oral Marks	Total Marks
0ne	Anatomy	3	E	25	75	----	----	100
0ne	Physiology	3	E	25	75	----	----	100
0ne	Material and workshop Technology	3	E	25	75	----	----	100
0ne	Applied Mechanics & Strength of Materials	3	E	25	75	----	----	100
0ne	Engineering Drawing	3	E	25	75	----	----	100
0ne	Biomechanics I	3	E	25	75	----	----	100
0ne	Prosthetics –I	3	E	25	75	75	25	200
0ne	Orthotics-I	3	E	25	75	75	25	200
Two	Pathology	3	E	25	75	----	----	100
Two	Orthopaedics & Amputation Surgery	3	E	25	75	----	----	100
Two	Physical Medicine &Rehabilitation	3	E	25	75	75	25	100
Two	Fundamentals of Electricity & Electronics	3	E	25	75	----	----	100
Two	Bio-Mechanics-II	3	E	25	75	----	----	100
Two	Prosthetics Science-II	3	E	25	75	75	25	200
Two	Orthotics Science- II	3	E	25	75	75	25	200
Three	Computer Science	3	E	25	75	75	25	200
Three	P&O Workshop	3	E	25	75	---	---	100

	Management							
Three	Mobility & Rehabilitation Aids	3	E	25	75	75	25	200
Three	Prosthetics Science-III	3	E	25	75	75	25	200
Three	Orthotics Science-III	3	E	25	75	75	25	200
Three	Research Methodology /Project development	3	E	25	75	---	---	100
Four	Prosthetics Science-IV	3	E	25	75	75	25	200
Four	Orthotic Science- IV	3	E	25	75	75	25	200
Four	Prosthetics Clinical Practice	3	E	25	75	75	25	200
Four	Orthotics Clinical Practice	3	E	25	75	75	25	200
	Project Work	---	E	25	75	75	25	200

RECOMMENDED CLOCK HOURS OF INSTRUCTION FOR EACH SUBJECT*

Sl.No	Subject	Theory Hours	Clinical / Practical Hours	Total Hours
	1st YEAR			
1	Anatomy	120	40	160
2	Physiology	90	30	120
3	Material and workshop Technology	90	60	150
4	Applied Mechanics & Strength of Materials	90	50	140
5	Engineering Drawing	30	30	60
6	Biomechanics I	70	40	110
7	Prosthetics –I	80	160	240
8	Orthotics-I	80	160	240
	Grand Total hours	**650**	**570**	**1220**
	2nd YEAR			
`1	Pathology	80	20	100
2	Orthopaedics & Amputation Surgery	70	50	120
3	Physical Medicine &Rehabilitation	70	30	100
4	Fundamentals of Electricity & Electronics	80	20	100
5	Bio-Mechanics-II	80	40	120
6	Prosthetics Science-II	80	260	340
7	Orthotics Science-II	80	260	340
	Grand Total hours	**540**	**680**	**1220**
	3rd YEAR			
1	Computer Science	60	100	160
2	P & O Workshop Management	100	0	100
3	Mobility & Rehabilitation Aids	80	140	220
4	Prosthetics Science-III	80	260	340

5	Orthotics Science-III	80	260	340
6	Research Methodology /Project development	133	-----	133
	Grand Total hours	**460**	**760**	**1220**
4th YEAR				
1	Prosthetics Science-IV	60	120	268
2	Orthotic Science-IV	60	120	268
3	Prosthetics Clinical Practice	----	360	448
4	Orthotics Clinical Practice	----	360	448
	Project Work	---	140	228
	Grand Total hours	**120**	**1100**	**1220**

Recommended clock Hours per year (Miscellaneous)*

1	Library Hours	200
2	Physical education	40
3	Seminars / Case Discussion (Except 1st year)	50
4	Internal Assessment	130
5	Guest Lecture / CME/ Conference (Except 1st year)	20
		440

Recommended Hours for Clinical work*

Clinicals (1st year to 4th year)	2320

STUDY TOUR

Study tour can be conducted after 2nd year as per the convenience of the institute**.**

SCHEDULE*

Course Duration: 4 Years

No. of working days in an academic year: 270 Days (Including Examination Period)

Total Hours Per academic year: 1660 Hours

Non- Working Days: 95

Sundays: 52

Saturdays (Half Day): 26

Government Holidays: 17

Vacations: 21

First Year

Subjects

1. Anatomy
2. Physiology
3. Material and Workshop Technology
4. Applied Mechanics & Strength of Materials
5. Engineering Drawing
6. Biomechanics
7. Prosthetics-1
8. Orthotics-1

ANATOMY

EXAMINATION AT END OF-Ist YEAR INSTRUCTION HOURS- 120 HOURS

Course Description:

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.

Course Objectives:

• 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. (Student should know origin, insertion, nerve connection and blood supply of each muscle).
• Describe and relate the structure and function of the upper and lower limbs to clinical pathologies.

Course Content:

Histology: General Histology, study of the basic tissues of the body; Microscope, Cell, Epithelium, Connective Tissue, Cartilage, Bone, Muscular tissue, Nerve.

Embryology:
Development of bones, axial and appendicular skeleton and muscles Regional anatomy

Thorax:

a) Cardio – Vascular System
• Mediastinum: Divisions and contents.
• Pericardium: Thoracic Wall: position, shape and parts of the heart; conducting System; blood Supply and nerve supply of the heart.

b) Respiratory system

• Outline of respiratory passages.
• Pleura and lungs: position, parts, relations, blood supply and nerve supply
• Diaphragm: Origin, insertion, nerve supply and action, openings in the diaphragm.
• Intercostal muscles and Accessory muscles of respiration: Origin, insertion, nerve supply and action.

c) Abdomen:

• Peritoneum: Parietal peritoneum, visceral peritoneum, functions of peritoneum.
• Location, size, shape, features, blood supply, nerve supply and functions of the following: stomach, liver, spleen, pancreas, kidney, urinary bladder, intestines, gall bladder.

d) Musculo Skeletal Anatomy

• Anatomical positions of body, axes, planes, common anatomical terminologies.
• Connective tissue classification.
• Bones- Composition & functions, classification and types according to morphology and development.
• Joints-definition-classification, structure of fibrous, cartilaginous joints, blood supply and nerve supply of joints.

Upper Extremity:

a) Osteology: Clavicles, Scapula, Humerus, Radius, Ulna, Carpals, Metacarpals, Phalanges.

b) Soft parts: pectoral region, axilla, cubital fossa, palm, dorsum of hand, muscles, nerves, blood vessels.

c) Joints: Shoulder girdle, shoulder joint, elbow joints, radio ulnar joint, wrist joint and joints of the hand.

d). Arches of hand, skin of the palm and dorsum of hand.

Lower Extremity:

a) Osteology: Hip bone, femur, tibia, fibula, patella, tarsals, metartarsals and phalanges.

b) Soft parts: Gluteal region, front and back of the thigh (Femoral triangle, femoral canal and inguinal canal), medial side of the thigh (Adductor canal), lateral side of the thigh, popliteal fossa, anterior and posterior compartment of leg, sole of the foot, lymphatic drainage of lower limb, venous drainage of the lower limb, arterialsupply of the lower limb, arches of foot, skin of foot.

c) Joints: Hip Joint, Knee joint, Ankle joint, joints of the foot.

Trunk & Pelvis:

a)Osteology: Cervical, thoracic, lumbar, sacral and coccygeal vertebrae and ribs.

b) Soft tissue: Pre and Para vertebral muscles, intercostals muscles, anterior abdominal wall muscles, Inter-vertebral disc.

c) Pelvic girdle and muscles of the pelvic floor.

Head and Neck:

Osteology: Mandible and bones of the skull
Applied Anatomy: Surface anatomy, locomotion and movements. Anthropometry.

Anatomy Practical (40 Hrs.)

Demonstration of various tissues and cells and Dissection - Demonstration of Lower limbs, upper limbs, spine, surface anatomy and marking.

PHYSIOLOGY

EXAMINATION AT END OF-I st YEAR INSTRUCTION HOURS- 90 HOURS

Course Description:

The course is designed to assess the students to acquire the knowledge of the normal physiology of human body and understand the alteration in the physiology for the fabrication of the prosthesis and orthosis.

Course Objectives:

- 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.

Course Content:

General Physiology

- Cell: Organelles: their structure and functions
- Transport Mechanisms across the cell membrane
- Body fluids: Distribution, composition.

Blood

- Introduction: Composition and functions of blood.
- Plasma: Composition, functions Plasma proteins.
- RBC: count and its variations, Haemoglobin - Anemia. Blood indices, PCV, ESR.
- WBC: Classification. Functions, count, its variation of each. Immunity
- Platelets: functions, count, its variations
- Blood coagulation. (Brief)
- Lymph: Composition, and functions.

Nerve Muscle Physiology

- Introduction: Resting membrane potential. Action potential
- Nerve: Structure and functions of neurons. Properties and impulse transmission of nerve fibres.
- Neuroglia: Types and functions.

• Muscle: Classification. Skeletal muscle: Structure. Neuromuscular junction, Motor Unit.
• Fatigue.

Cardiovascular System

• Introduction: Physiological anatomy and nerve supply of the heart and blood vessels.
• Conducting system: Components. Impulse conduction Cardiac Cycle: Definition. Phases of cardiac cycle. Pressure and volume curves.. ECG: Definition.
• Cardiac Output: Definition.
• Functional anatomy of vascular and lymphatic system.
• Arterial Blood Pressure: Definition. Normal values and its variations.
• Hypertension.

Respiratory System

• Introduction: Physiological anatomy – Pleura, tracheo-bronchial tree, alveolus, respiratory membrane and their nerve supply. Functions of respiratory system. Respiratory muscles.
• Mechanics of breathing: – Inspiration; Expiration; Intrapleural pressure, Recoil tendency and lung volumes.
• Hypoxia
• Disorders of Respiration: Dyspnoea. Orthopnoea. Hyperpnoea, hyperventilation, apnoea, tachypnoea: define.

Nervous System

• Introduction: Organization of CNS – central and peripheral nervous system. Functions of nervous system.
• Synapse: Functional anatomy, classification, Synaptic transmission.
• Sensory Mechanism: Sensory receptors: function, classification and properties.
• Sensory pathway: The ascending tracts – Posterior column tracts, lateral spinothalamic tract and the anterior spinothalamic tract – their origin, course, termination and functions.
• Pain sensation: mechanism of pain. Cutaneous pain –slow and fast pain, hyperalgesia.
Deep pain. Visceral pain – referred pain.
• Sensory cortex. Somatic sensations: crude touch, fine touch, tactile localization, tactile discrimination, stereognosis, vibration sense, kinesthetic sensations.
• Motor Mechanism: Motor Cortex. Motor pathway: The descending tracts – pyramidal tracts, extrapyramidal tracts – origin, course, termination and functions.
• Reflex Action: Monosynaptic and polysynaptic reflexes, superficial reflexes, deep reflexes. Muscle tone –definition, and properties hypotonia, atonia and hypertonia.

UMNL and LMNL

• Spinal cord Lesions: Complete transection and Hemisection of the spinal cord.
• Cerebellum: Functions
• Posture and Equilibrium:
• Thalamus and Hypothalamus: Nuclei. Functions.
• Basal Ganglia: Structures, functions.
• Cerebral Cortex: Lobes. Brodmann's areas and their functions. Higher functions of cerebral cortex – learning, memory and speech.

Kidney and micturition

• Introduction and functional anatomy of kidney, innervation, renal circulation and care of any appliances fitting fir dysfunction.
• Micturition – Physiological anatomy and nervous connection of the bladder, cystometrogram micturiton reflex.

Integumentary system: Structure of skin, function of skin: Protection, heat regulation, sensation and elasticity.

Endocrinology: Endocrine Pancreas: Secretory cells, action, regulation of secretion of insulin and glucagon. Glucose metabolism and its regulation. Disorder: Diabetes mellitus.

Nutrition & Metabolism

• An Introduction to Nutrition and Metabolism
• Factors influencing energy expenditure

Practical: (30 Hrs.)

1. Clinical examination of nervous system.
2. Clinical examination of sensory system.
3**.** To study the phenomenon of fatigue in human by Dynamometer

Materials and Workshop Technology

EXAMINATION AT END OF-I st YEAR **INSTRUCTION HOURS- 90 HOURS**

Course Description:

Students would have competence in practicing effectively and safely within a workshop environment.

Course Objectives:

• 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 behaviour 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.
• 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.

Course Content:

MATERIAL SCIENCE

Metal & Alloys: Fundamentals of metals and alloys both ferrous and nonferrous. Properties, testing and inspection of metals and alloys, heat treatment of metals. Powder metallurgy, surface coating of metals.

Wood: Wood, types, seasoning, preservation, lamination properties and adhesives for wood. Wood work: Introduction to Wood, wood work and wood working tools. Pattern making and making of various kinds of joints.

Leather: Leather, types, tanning, preservation, lamination, properties and adhesives for leather.

Fabric: Fabric types, properties, utilization, selection and quality control. Polymers & composite materials: Introduction to Plastics, type of plastics and molecular structures. Relationship of properties to structures. Monomers, Polymers, additives, Mechanical properties, effect on properties of method of production. Fabrication processes, Effects of fabrication, process, micro structural changes, shrinkage and other degradation during processing, environmental effects. Thermoforming plastics, their fabrication process, thermosetting plastics and fabrication process Composite materials and their uses-Resin: Acralyic and Polyster. Elastomers, H.D.P.E. PP, PP-CP, Visoelastic behaviour of plastics. Introduction to fiber reinforced plastics. Introduction to and their processing especially various techniques of moulding and lamination. Joining of plastics, welding, adhesives and their effect on structure and plastics properties.

Foams: Different types of foams used in P&O especially Latex, Polyurethane, polyethylene and other kind of rigid/semi rigid/ flexible foams. Plaster of Paris & Silicon and its application procedure in Prosthetic & Orthotic techniques

WORKSHOP TECHNOLOGY

Equipment for mass production, introduction to lathe machine and it's operation, milling machine and its operations, tooling, attachment, Shaping machine and its uses. Grinding machine, Drilling Machine Abrasive machine etc. Special tools and equipment used in fabrication of orthoses and prostheses. Compressors, Vacuum Pumps and Dust Collection Equipments Cutting Tools (Chisels, Saws and Metal Cutters) Pneumatic Tools Power Cutting tools Workshop Safety & Hazards and Care Mechanical working of metals such as steel and aluminum. Fundamental of riveting, soldering, brazing and welding.

Workshop Technology Practical Practice: (60 Hrs.)

Practical work on workshop practices. Practical training on lathes, Drilling Machine (Bench and Pedestal), Grinding Machine, Router, hot air oven, sanding machine, heat gun, pneumatic machines and Other machines. Practical work on various materials and tools and its use in prosthetics & Orthotics.

APPLIED MECHANICS AND STRENGTH OF MATERIALS

EXAMINATION AT END OF-I st YEAR **INSTRUCTION HOURS- 90 HOURS**

Course Objectives:

• 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.

Course Content:

General Mechanics: Definition of Mechanics, Foundation material on Units, dimensional homogeneity, scalar and vector quantities, Co-ordinate systems, Newton's laws. Resolution and summation of forces and moments in two and three Dimensions, equivalent force systems, free body diagrams, equations of Equilibrium, plans and space frame analysis. Parallel and non- parallel Forces, torque. Linear and angular motion, uniform acceleration, friction, inertia, moment of inertia, dynamic equilibrium (translation/rotation), Energy, momentum.

Simple stress & Strain: Definition of stress and strains, factor of safety stress, modulus of elasticity, longitudinal strain and internal strains. Possion's ratio etc. stress and strain curve, statement of formulae relating between different modules, simple problems to understand the above principles of composite bars-formula relating to loads and strains in individual members simple to understand the above relations. Mechanics Practical (25 hours)

General: Practices on parallel and non-parallel forces, torque. Linear and angular motion, uniform acceleration, friction, inertia.

Design concept: Buckling, theories in failure, fatigue and stress concentrations, connections, Shear force and bending moment diagrams, centroids, 2nd moment of area and mass, theorem of parallel axes, bending stress, torsional stress of circular shafts, combined axial and bending stresses. Combined and torsional stresses, combined axial bending torsional stresses. Open and closed helical springs and beam deflection.

Control systems: Introduction to control theory and its applications in Prosthetics and Orthotics.

Ecogonomics with applied mechanics

General: Introduction to definition and scope in modern industrial social studies on Machine or man oriented topics. Displays devices for transmitting information from machine to man. Controls in information from man to machine. Safety factors, Pollution, noise, fumes, atmospheric pollution if motion study in relation to Ergonomics principles.

Practicals : 50 Hrs.

ENGINEERING DRAWING

EXAMINATION AT END OF-I st YEAR INSTRUCTION HOURS- 30 HOURS

Course Description:

The course is designed to assist the students to acquire an introduction to concepts of drawing instruments and their uses, general principles and the basic elements of technical drawing.

Course Objectives:

- Describe about the drawing instruments and their uses.
- Describe the general principles of drawing and technical drawing.
- To draw isometric sketching and 3D visualizing.
- Explain use of drawing standard.
- Draw 1st and 3rd angle projection, auxiliary views and simple assembly drawings.
- Explain the application of machine tolerances.
- Describe about the general sketching.

Course Content:

Introduction: Drawing instruments and their uses. Sizes and layout of drawing sheets. Item references on drawings and item lists. Planning on assembly.

General Principles: Folding of Drawing prints Scales. Plain and diagonal, Lines, Letterings. General principles of presentations. Section and other conventions Conventional representations circle, Tangent Ellipse. Cycloised Involute of circle.

Fundamentals: Dimensions on technical drawings. Indications of linear and angular tolerance on technical drawings. Orthographic projections of points, lines, simple objects and combinations. Isometric views, Auxillary view, Drawing of screw thread form Bolts Screws and Screw joints, weld and welded joint dimentioning and sketching of P&O components/ parts, pulley shaft, coupling, etc.

Design: Design calculations and its applications for Prosthetics & calculation Orthotics devices.

General Sketching: Sketching for preparing assembly, workshop drawing. Various parts and Components used in prosthetics and orthotics, Basic idea of design analysis,

itemisation empiricism, approximation and synthesis. Detail diagrams of all kind orthoses, prostheses and mobility aids.

Practical: (30 Hrs.) All kinds of engineering drawing practice.

Biomechanics

Course Description:

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

Course Objectives:

• 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 temporospatial, kinematic and kinetic information to distinguish between normal and abnormal function of the upper limbs, lower limbs & Spine.
• Analyse the forces at a skeletal joint for various static and dynamic activities.
• Demonstrate the ability to analyzer 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.

BIOMECHANICS-I

EXAMINATION AT END OF-I st YEAR **INSTRUCTION HOURS- 70 HOURS**

Course Content:

Basic Concepts in Biomechanics: Kinematics and Kinetics

a) Types of Motion
b) Location of Motion
c) Direction of Motion
d) Magnitude of Motion
e) Definition of Forces
f) Force of Gravity
g) Reaction forces
i) Objects in Motion
j) Force of friction
k) Concurrent force systems
l) Parallel force systems
m) Work
n) Moment arm of force
o) Force components
p) Equilibrium of levers

Joint structure and Function

a) Joint design
b) Materials used in human joints
c) General properties of connective tissues
d) Human joint design
e) Joint function
f) Joint motion
Biomechanics of normal foot, pathological foot, foot arches, normal and surgical foot wear.

Human Movements: Normal gait: general features of gait, gait initiation, kinematics and

kinetics of gait, energy requirements, Pathological gait Introduction to EMG studies and recording EMG.

Joint Force Analysis: Body segment parameters, joint forces during swing and stance phase, force analysis on foot and ankle joint, knee joint and Hip joint.

Human locomotion and Gait analysis: Introduction to different ways to do gait analysis by using force plate/TV analysis/ electromyography studies, energy studies, gait repeatability, variation due to age, variation due to footwear, Orthoses/Prostheses.. Trans Femoral Amputee, gait analysis and deviations, gait variations due to alignment or pathological conditions. Biomechanics of Symes prosthesis, partial foot prosthesis, below knee (trans tibial) prosthesis.

Practicals (40 Hrs.)

Prosthetic Science

i. Theory:

Course Description:

This subject is delivered in a coordinated manner with the Practical part of the 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.

Course Objectives:

• 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 prosthetic solutions including, etiology, clinical presentation, prognosis and appropriate device management.
• Demonstrate empathy between Prosthetics 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 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 components.
• Formulate appropriate prosthetic and orthotic prescriptions for wide range clinical situations.
• Understand and describe the roles of key members of the rehabilitation team and identify how they interrelate with the prosthetist.

ii. Practical:

Course Description:

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.

Course Objectives:

• 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 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 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.
• 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 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 identification, problem solving in a process that includes all stake holders, with the client at the centre.

PROSTHETIC SCIENCE-I

EXAMINATION AT END OF-I st YEAR INSTRUCTION HOURS- 80 HOURS

Introduction: Introduction to Prosthetics, definitions of various terminologies, Historical development in Lower Extremity Prosthetics in India and abroad.

Prosthetic Feet: Various types of Prosthetic feet. Conventional foot. Rocker, SACH foot, modified SACH Foot. Jaipur Foot, Seattle foot, Flex foot, Quantum foot, Peg Roelite foot, Carbon copy foot, Comparatives studies of prosthetic feet. Single axis, Double axis, Multi-axial foot, other kinds of feet etc. Heel Height adjustment, Adjustable ankle, various kinds of ankle mechanisms.

Partial Foot: Various types of Partial foot prosthesis. Biomechanics of Partial foot prosthesis, Prescription Principles, Materials used for partial foot prosthesis, various cast techniques of Partial foot prosthesis, Fabrication Technique for partial foot prosthesis.

Syme's: Various types of Symes Prosthesis, Prosthetic components, Prescription criteria, Principles. Materials used for Symes prosthesis, casting techniques. Cast modification. Fabrication Technique for Symes (P.T.B. type) prosthesis. Fabrication Technique for conventional symes prosthesis.

Trans Tibial: Various types of trans-tibial prostheses including Jaipur limb & ICRC technology, Prosthetics Components – both conventional and modular. Trans-tibial Prosthetic Prescription Criteria and Principles. Materials used in Trans-tibial Prosthesis. Measurement and casting techniques for Trans-tibial prosthesis. Cast modification. Fabrication techniques for trans-tibial prosthesis. Fabrication Technique for trans-tibial Conventional Prosthesis – both Open and close ended socket, Different types of socket designs – PTB, PTS, PTBSC, PTB-SCSP, Different types of suspension.

Gait Deviations and Analysis: Person with Chopart, Symes, Trans-tibial prosthesis. Check-Out Procedures with Chopart, Symes & Trans-tibial prosthesis.

Prosthetics Practical (160 Hrs.) Fabrication of Partial foot prosthesis, Chopart Prosthesis, Symes and various types of Trans tibial prosthesis using different technology.

ORTHOTIC SCIENCE

i. Theory:

Course Description:

This subject is delivered in a coordinated manner with the Practical part of the Orthotic 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.

Course Objectives:

• 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 solutions including, etiology, clinical presentation, prognosis and appropriate device management.
• Demonstrate empathy between Orthotic 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 kinematics 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 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 orthotic components.
• Formulate appropriate orthotic prescriptions for wide range clinical situations.
• Understand and describe the roles of key members of the rehabilitation team and identify how they interrelate with the orthotist.

ii. Practical

Course Description:

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.

Course Objectives:

• Assess the medical condition of a patient related to their orthotic management using appropriate investigative techniques which include patient history taking and clinical testing.
• Formulate an optimal orthotic 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 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 identification, problem solving in a process that includes all stake holders, with the client at the centre.

ORTHOTIC SCIENCE-I

EXAMINATION AT END OF-I st YEAR **INSTRUCTION HOURS- 80 HOURS**

General: Introduction to Orthotics, definitions of various terminologies, History of Orthoses in India and abroad. Various materials used in Orthotics.

Different types of Orthoses: Users/Client's assessment and prescription criteria, Measuring and casting, cast modification, three point force system, fabrication, fitting, aligning, checking out and finishing of the following devices:

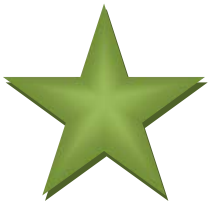
Shoe Modification: Medial/Lateral raise (Inside /outside shoe), M.T. Bar (Inside/ Outside shoe), Arch support, Meta tarsal pad, Calcaneal heel wedge, Heel raise, Thomas Heel, Heel pad for Calcaneal spur, 'T' strap (Medial and lateral), Fixation of stirrup plate in shoes/ Sandal, Various types of Arch Supports – flexible/semi rigid/rigid/custom moulded, SMO-Custom moulded Supra malleolar orthosis. Various types of Foot Orthoses for diabetic feet and other sensory deficiencies.

AFO (Ankle foot orthosis): Conventional AFO-, Plastic AFO (custom moulded), Articulated A.F.O & various types of ankle joints

Club foot Orthosis: Orthotic management of CTEV, Ankle support Orthotic management of Anesthetic Foot. Orthosis for the management of fracture below knee.

Practical (160 Hrs.) Different types of foot Orthoses, Shoe modifications, and all types of Mechanical Ankle Joint, conventional & Custom molded (A.F.O.) and fracture Orthosis for below knee.

SECOND YEAR



Subject

1. Pathology
2. Orthopaedics & Amputation Surgery
3. Physical Medicine & rehabilitation
4. Fundamentals of Electricity & Electronics
5. Bio-Mechanics-II
6. Prosthetics Science-II
7. Orthotics Science-II

PATHOLOGY

EXAMINATION AT END OF-2nd YEAR INSTRUCTION HOURS- 80 HOURS

Course Description:

The student should be able to describe and contrast the etiology and progression of diseases and to identify early signs and symptoms of conditions that are commonly encountered by prosthetists/orthotists. In addition, she/he should be able to advise on care and appropriate treatment options.

Course Objectives:

• Describe the basic pathological processes that underlie disease (eg: 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 (musculoskeletal system and nervous system, vascular system).

Course Content:

a. General:

i. Introduction to pathology, basic mechanism of health and disease, clarification of disease.

Inflammation –

Acute inflammation: features, causes, vascular and cellular events. Chronic inflammation: Causes, Types, Classification, Repair, Wound healing by primary and secondary union, factors promoting and delaying the process.

b. Hemodynamic disorders, thrombo embolic disease & shock.

i. Ischemic, necrosis, thrombosis, embolism, Infarcation, shock.
ii. Gangrene.
iii. Thromboangitis obliterans.

Neoplasia – Definition, classification, Biological behaviour: Benign and Malignant, Carcinoma and Sarcoma, principles of their spread.

c. Hypersensitivity diseases and immunity- Brief overview of hypersensitivity reaction allergies & auto immune diseases.

d. Genetic disorders – Brief over view of genetic disease.

e. Nerurovascular diseases
i. Outline of Cerebro-vascular disorders
ii. Trauma to brain and spinal cord.
iii. Demyelinating diseases like multiple sclerosis.
iv. Degenerative diseases like parkinsons disease.
v. Peripheral vascular disease
vi. Poliomyelitis.

f. Metabolic disorders – Diabetic mellitus- Types, Pathogenesis, Pathology, Laboratory diagnosis.

g. Disorders of blood-Constituents of blood and bone marrow, Regulation of hematopoiesis. Anemia: Classification, clinical features & lab diagnosis.

Practicals (20 Hrs.)

ORTHOPAEDICS & AMPUTATION SURGERY

EXAMINATION AT END OF-2nd YEAR INSTRUCTION HOURS- 70 HOURS

Course Description:

In this unit the students learns about the various orthopedic conditions in detail with review of the disabling conditions. It also covers the various common surgical techniques and its influences in the orthotics and prosthetics fit and design.

Course Objectives:

• Have an understanding of different clinical conditions that may indirectly impact on the clients' ability to successfully rehabilitate using the device.
• Explain the management of different disabling conditions.
• Explain the principles of amputations and revision amputation, types and techniques.
• Explain the post operative care of the stump and stump hygiene
• Describe the stump dermatology and the common skin diseases and management.
• Describe and fabricate the post operative fitting in the lower extremity.
• Describe common surgical technique and how they may influence prosthetics and Orthotics fit and design.

Course Content:

Orthopaedics

General: Introduction, Principles of Orthopaedics. Common Investigative Procedures.

Traumatology

Fracture, definition, types, signs and symptoms and management. Subluxation/ dislocations – definition, signs and symptoms, management.

Inflammatory and Degenerative Conditions

Osteomyelitis, arthritis and arthroses, eg - Inflammation of Joints, Rheumatoid Arthritis,infective arthritis, tuberculosis arthritis, Osteoarthritis, Ankolysing spondylitis, arthritis of hemophilic joints, Neuropathic joints. Inflammation of tendon sheath and bursa.

Disease of Bones and Joints

Metabolic diseases of bones, e.g. rickets, Osteomalacia, Osteopenia, Osteoporosis.gout, scurvy etc.

Congenital Deformities: Outline of Torticolis, spina bifida, spinal anamolies scoliosis C.T.E.V.

Acquired Deformities: Scoliosis – all types, kyphosis, Lordosis, spondylosis Coxa-vara, coxa-valga and coxa magna, Otto pelvis, genu valgus, genu varum, genu recurvatum.

Cervical and Lumbar Pathology: Prolapse of intervertebral disc, Spinal cord injury.

Regional Conditions: Definition, Clinical features and management of the following regional conditions.

Hip: Outline of Dislocations and subluxations & dysplasia (congenital, traumatic, pathological, paralytic, spastic and central),

Knee: Outline of Meniscal tears, dislocation of patella, Ligamentous injuries.

Ankle & foot: Outline of partial and total ligamentous injuries Sprain Heel and foot deformities (Calcaneo varus, Pes Valgus, varus, Metatarsalgia, plantar fascitiis, Anesthetic feet, Bunion toe Hallux Valgus).

Shoulder: Outline of Recurrent dislocation, bicipital tendinitis and periarthritis.

Elbow and forearm: Outline of Cubitus varus and valgus, Madelung's deformity, Tennis elbow, Volkmann's contracture, Dupuytren's disease, De Quervain's disease, entrapment neuropathies.

Wrist & Hand: wrist drop, Tenosynovitis, mallet finger, carpal tunnel syndrome, claw hand.

Specific Disorders: Leprosy, Burns, Tumors – Benign & malignant, Tuberculosis & Perthes Disease, AVN (Full) Peripheral Nerve Injuries, Congenital anomalies Muscular Dystrophy etc. Sports injuries and their management.

Amputation Surgery

General: Indications/causes, General Principles, Types of amputation, i.e. Guillotine, Flap, Osteoplastic Myoplastic, Osteo-myoplastic. Individual's Preparation for prosthesis. Ideal stump. Preoperative, operative and postoperative prosthetic management techniques in general. Amputation: Amputation surgery in lower and upper limbs, stump refashioning and amputation revision Amputation in special circumstances, like in infants and children, Congenital limb deficiencies and its universal classification, ischemic limbs, elderly persons, malignancy and Diabetes. Osteointegration and Osteogenesis imperfecta. Conginetal anomalies, podiatery, burns.

Orthopaedics Practical: (50 Hrs.)

General: Demonstration of different conditions & relevant x-ray films, how to read from x-ray, how to measure the deformity from x-ray, Cobb's & Rib angle measurement etc. its simple assessment and P&O management technique.

PHYSICAL MEDICINE AND REHABILITATION

EXAMINATION AT END OF-2nd YEAR INSTRUCTION HOURS- 70 HOURS

Course Description:

The course is designed to assist the students to develop understanding of the health and socio-economic context of people with disabilities in the community and their role and the role of CBR and introduce different members of the clinic team and theoretical principles of rehabilitation.

Course Objectives:

- 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.
- Discuss the social causes of disability in India and the link between poverty and disability.
- Reflect and analyse on their attitude/values and attitudes towards persons with disabilities, their families and the community (Socio-cultural and religious).
- Explain the UN convention rights and role as prosthetist and orthotist.
- Explain the different approaches to rehabilitation.
- Explain different component of CBR and the guiding principles of CBR implementation.
- Explain P & O role in a CBR programme.

A. Psychology & Social work:

Introduction to Psychology, Outline of Psychology and behavior, Intelligence and abilities, Learning and Remembering, Psychological Development, Cognitive Processes, Personality, Moral Development, Psychological aspect of disability. The Role of the Family, Child with the disability, parents of the disabled child. Acceptance of Severely disabled persons. Social-Sexual Relationships. Independent Living. Introduction to Sociology and outline of Society, definitions, outline of Social works, Nature of Social organization, types of organizations. Non governmental organisations

and its role in prosthetics & orthotics. Structure and functions of Social Institutions. Village as a community. Social Changes.Social Problems, Social Welfare, Vocational Rehabilitation, Employment, Self-Employment Job analysis, Job placement.

Disability & Development:

Background to social, political and economic issues in India and other Low Income countries. Affect on poor who live in rural and urban areas. Disability and women Introduction to community based rehabilitation as compared to the existing medical model and its function. Introduction to impairment, disability and handicap. Introduction to disability issues, Government schemes and initiatives, legislation and UNCRPD Local resources available and referral. Income generation schemes, Purpose of Sangha/group of PWDs. Access, adaptations and change of environment where people live or work. Removing Environmental Barriers, Recreation for the Disabled Community Welfare organizations, Social welfare programmes. Professional and social work in medical & rehabilitation set up. Practical and environmental difficulties of patients in use of appliances. Outline of Educational aspects, PWD act.

B. Physiotherapy and Occupational Therapy

Introduction to Physiotherapy: Aims and scope of various biomechanical modalities – shoulder wheel, shoulder ladder, shoulder pulleys, pronator - supinator instrument, static cycle, rowing machine, ankle exerciser, balancing board, springs, weights.

Normal Posture: definition & description, static and dynamic, alignments of various joints, centre of gravity, planes & muscular moments, and Analysis of posture

Movements: Anatomical definition and description, Movements and exercise as therapeutic modality and their effects, Physiological reaction of exercise.

Traction: Rational, Technique, indications & contra indications. Brief description of Short wave Diathermy-continuous and pulsed, Microwave Diathermy, Ultrasound, Infrared, UVR and Lasers & other electrotherapy modalities.

Muscle Testing: Concept, introduction, significance and limitations. Grade systems, techniques of muscle testing, goniometry. Brief description of Hydrotherapy. Therapy at post-surgical stage (re-educating the muscles, maintaining ROM, preventing stump contracture and care of non amputated limb, Exercise through games involving parents or guardians, POP bandage application for temporary splinting and correction of simple deformity, Stump bandaging application etc).

Introduction to Occupational Therapy

Aims and scope of various biomechanical modalities used in Occupational Therapy Child development in brief - milestone and delayed milestone, Assessment procedure, Evaluation of muscle power, range of motion, checking of joint stability Functional Assessment which includes ADL, stretching, strengthening, breathing exercise, therapy at post-surgical stage (re-educating the muscles, maintaining ROM, preventing stump contracture and care of non amputated limb, Exercise through games involving parents or guardians, POP bandage application for temporary splinting and correction of simple deformity, Stump bandaging application etc.

Practical: Practical aspects of physiotherapy, occupational therapy.

C. Physical Medicine and Rehabilitation:

Concept of Total Rehabilitation, Rehabilitation team and role of each member of theteam. Introduction to Physical Medicine, Principles of clinical examinations, diagnosis and treatment. Different aspects of physical medicine and rehabilitation. Rehabilitationaspects of visually handicapped, hearing handicapped and mentally retarded and disability evaluation. Introduction to Health care System, Rehabilitation in Health care, rehabilitation under various ministries, introduction to Institute based rehabilitation (IBR) and Community Based Rehabilitation (CBR). Prosthetics & Orthotics in CBR and Role of CBR Workers in P&O. Introduction to general medicine and diseases. Chemical and physical agents causing diseases. Outline of metabolic disorderse.g. Diabetes Mellitus, deficiency diseases e.g. Vit. D deficiency and Vit. C deficiency.

Community Based Rehabilitation: What is CBR and its need – what way it is different than IBR, Simple knowledge about other disabilities, its prevention and its management, To understand the role of Key Players in CBR, Referral facilities where to refer when to refer, Role of other professionals in CBR, Role of P&O Professionals in CBR, Early identification and early Intervention, How to work as a team in CBR/IBR structure, Simple techniques to make CBR activities more purposeful, Telemedicine.

Specific disorders: Peripheral nerve injuries. Poliomyelitis, Cerebral Palsy, Muscular Dystrophy, Club foot (CTEV), Spina Bifida, Hemiplegia, Spinal Cord injuries (paraplegia/ Quadriplegia), Infections – Prevention & control.

- Pyogenic infection.
- Tubular and fungal in infections.
- Leprosy & STD.
- Parasitic & Protozoal disease.
- Viral, Rickets diseases, AIDS. Out lines of pathology of bone diseases, infections, trauma, & growth disturbances.

• Rickets, osteomalacia & osteoporosis.
• Fracture of bone & its healing
• Skeletal tuberculosis.
• Osteo myelities – Pyogenic & tubucular.
• Bone neoplasm.
• Avascular necrosis [osteo necrosis]
• Overview of osteogenesis imperfecta, pagets etc. Disease of joints.
• Osteoarthritis, Rheumatoid arthritis re-active arthritis, ankylosing spondyloarthritis & re-active arthritis.
• Infectious arthritis.
• Gouty arthritis and pseudo gout
• Brief overview of tumors of joints. Diseases of soft tissue and skin.
• Soft tissue tumors
• Ligamentous and meniscal disease and injuries with special emphasis on sports injuries.
• Skin – protection, heat, regulation, sensation, elasticity, wound repair, response to irritants, response to pressure & ischemia brief.
• Overview of skin disease – Eczema, contact dermatitis both etc. Neuromuscular diseases: normal peripheral nerve and skeletal muscle.
• General re-actions of motor unit.
• Disease of peripheral nerves – inflammatory neuropathies, immune mediated infections, polyneuropathies [leprosy, etc, hereditary neuropathies, acquired metabolic & toxic neuropathies, nutritional neuropathies. Traumatic neuropathies.
• Disease of skeletal muscle.
• Muscular dystrophies.
• Myotonic dystrophy.
• Inflammatory & toxic neuropathies.
• Neurovascular diseases.

Sports Injuries: Introduction to sports injuries, common sports injuries and their management, Mechanism of injury to hip, knee, ankle, shoulder, elbow, wrist and hand in various sports and outline of their Orthotics management.

Practicals: (30 Hrs.)

FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

EXAMINATION AT END OF-2nd YEAR **INSTRUCTION HOURS- 80 HOURS**

Course Description:

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

Course Objectives:

- Explain basic concept of electricity and electronics covering following: DC circuits, inductance and capacitance, AC circuits, power, supplies, amplifiers, feedback, interference rejection techniques, myoelectrodes and bioelectrictiy.
- Explain eelectronics measuring system
- Explain safety practice of electricity

Course Content:

Electricity

Basic Concepts: Introduction to SI System of units, charge, current, resistance, potential differences, electromotive force, Energy power, Voltage and current Relationship, energy storage, DC circuits, AC circuits, sine wave, Frequency, Period, phase, RMS value, inductive and capacitive reactance.

Resistors: Resistors sensitive to temperature, strain and light, Resistors in series and in parallel.

Transformers: Principle of the transformer, voltage, turns and current ratios.

Semi Conductors: Outline Concepts of semiconductors and insulators. Conduction in intrinsic and extrinsic semi conductors.

Amplifiers: Amplifiers as a system element. Operational amplifiers and their ideal characteristics. The small single equivalent circuit having a controlled source. Voltage and current gain, the decibel power gain, Noise and drift voltages, Source in amplifiers and bio-systems.

Feed Back: The general Feedback equation, Feedback Voltage series, negative feedback and loop gain, loop gain Accuracy, input resistance, output resistance, band width of noise. Feedback as a control mechanism in the wider sense, Positive feedback –instability and self-oscilation in amplifiers and oscillatiors.

Measurements: Electronics measuring instruments.Summary of recording instruments. Concepts of resolution and accuracy applied to digital and analogue instruments. Transducers for temperature, light, pressure, sounds, description, specification and use in circuit.

Myoelectrodes: Technology of metal and metal paste electrodes, the equivalent circuit between electrodes, stability, source of unwanted voltage electrode systems. Other types of myoelectrodes micro electrodes, implanted electrodes, comparison with surface electrodes. Sensors, microprocessors etc.

Electrical Safety: Description of single phase and three phase supply system and voltage involved. Function of line, natural and earth in single phase system. Current practice in pin connection and colour codes. Simple safety procedure to be taken when servicing equipment. Effect on safety of fault conditions. Fuses, Conductors and earth leakage detectors – miniature circuit breakers (MCB). Voltage regulators integrated circuits.

Bio-Electricity: Biological Potentials, Muscle action potentials, Electro-myography and Myo-electricity.

Practicals: 20 Hrs.

BIOMECHANICS – II

EXAMINATION AT END OF-2nd YEAR INSTRUCTION HOURS- 80HOURS

Course Content:

Through knee Biomechanics: Through knee Prescription Principles, socket biomechanics and alignment techniques.

Trans Femoral Prosthetics Biomechanics: General Socket biomechanics, Trans Femoral socket biomechanics and analysis of socket forces. Analysis of Trans Femoral Prosthetic components.

Gait deviation: Gait deviation while using while using Foot Orthoses (FO), Ankle Foot Orthoses (AFO) and trans-tibial prostheses.

Above knee Orthotics Biomechanics: Biomechanical principals of various kinds of above knee Orthosis especially Knee Ankle Foot Orthosis and Floor Reaction Orthosis. Biomechanics of HKAFO especially to prevent scissoring. Three/ four/five point force system. KAFO and HKAFO gait deviations due to alignments or pathological conditions. Gait analysis of KAFOs and HKAFOs with various types of crutches. Combined and torsional stresses, combined axial bending torsional stresses. Open and closed helical springs, beam deflection. Design test standards/materials/Philadelphia Loads/ISO. Design calculations for P&O devices/BIS.

Practicals: 40 Hrs.

PROSTHETICS SCIENCE- II

EXAMINATION AT END OF-2nd YEAR INSTRUCTION HOURS- 80 HOURS

Course Content:

Knee Joints: Different types of Endoskeletal and exoskeletal knee joints - Single axis knee joints, Polycentric knee joints, Free knee, Constant friction knee joints, Variable friction Knee joint, microchip control knee, hydraulic knee joint, swing Phase control knee joints, Stance Phase control knee joints etc.

Hip Joints: For above knee as well as for hip disarticulation/ hemi- pelvictomy – all types of hip joints especially single axis and Swivel type.

Through Knee Prosthesis: Various types of through knee prosthesis - Through knee prosthetic Components. Materials used for through knee prosthesis. Casting techniques for through knee prosthesis, Cast modification, Fabrication Techniques of through hip prosthesis, through knee Gait analysis and deviations, Through knee Check-out Procedures.

Trans Femoral Prosthesis: Types of Trans Femoral Prosthesis. Trans femoral Prosthetic Components. Trans Femoral Socket designs. Casting and measurement techniques, Cast modification, Fabrication techniques of Trans Femoral socket. Various types of suspension used in Trans Femoral Prosthesis.
Endoskeleton/modular: all common types, Trans Femoral Gait Analysis, Trans Femoral Check-out Procedures.
Prosthetics Practical: (260 Hrs.) Fabrication of all types of above Knee prosthesis and through knee prosthesis.

ORTHOTICS SCIENCE-II

EXAMINATION AT END OF-2nd YEAR INSTRUCTION HOURS- 80 HOURS

Course Content:

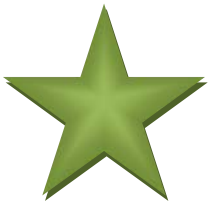
Above knee Orthotics: Types of knee & Hip joints

Orthotics Components: Prescription principles of various types of Knee Orthoses (KO), Knee Ankle foot Orthoses (KAFO), Hip Knee Ankle foot Orthoses (HKAFO). RGO & ARGO Orthoses. All types of K.A.F.O., H.K.A.F.O. FRO, RGO & ARGO etc. and also Orthoses for management of C.D.H., C.P., Paraplegics, Legg Calve perthes diseases, Spina Bifida, Leprosy and Hemiplegia etc.

Fabrication: Cast and measurement techniques, appropriate selection of materials and components, cast modification, fabrication and alignment technique, using of different technologies – its advantages and disadvantages, Accommodation of limb length discrepancy while designing orthosis, Gait analysis and check out procedures.

Practical: (260 Hrs.) Orthoses in Lower Motor Neuron Disorders, Orthoses in Upper Motor Neuron Disorders, various types of knee Orthoses, Weight relieving orthosis, Floor reaction orthosis, Toronto Brace, Low cost Orthoses, Bilateral H.K.A.F.O, Orthoses in Arthritis, Orthoses in Fractures, Orthoses in Hemophilia, Orthoses in Progressive Muscular Dystrophy, Orthoses in Juvenile Disorders etc.

Third Year



Subject

1. Computer Science
2. P&O Workshop Management
3. Mobility&Rehabilitation Aid
4. Prosthetics Science-III
5. Orthotics Science-III
6. Research Methodology/Project development

COMPUTER SCIENCE

EXAMINATION AT END OF-3rd YEAR INSTRUCTION HOURS- 60 HOURS

Course description

Student will acquire computer knowledge to design the prosthetics and orthotics components and apply in research and development in prosthetics and orthotics field.

Course Objectives:

- Describe the advanced application of computer in prosthetics and orthotics field.
- Design various components for prosthetics and orthotics use.
- Make use of computer knowledge in the statistics data analysis and documentation.
- Describe the principles of computer aided design(CAD) & computer aided manufacture(CAM).

Course Content:

Introduction: Computers and Components of computers: Physical Composition, Central Processing Unit, Main Memory, Input and Output units and also all kinds of common types of computer peripherals.

Hardware: Various Configurations, Specification of peripherals and computer system. Various types of storage facilities and its advantages and disadvantages.

Computing environments: Introduction to types of computers- Personal computers, Main frame and super computers, Networks, E-Mail, Internet. Introduction to operating systems, e.g. DOS, Windows, Linux, Unix, commands and introduction to General file systems.

Software: The current operating software's, Word Processor, spreadsheet, database and presentation software, e.g. Windows XP or Windows 2000 Professional, Microsoft Office XP or 2000 Professional etc., upgraded as used currently, Anti Virus.

Computer Aided Design & Manufacturing (CAD & CAM)

Basics of CAD: Introduction, Definition, History, Current status, Product Cycle, Automation, Designing, Application and Benefits. Computer Graphics: Introduction of software, Function of graphic package, Application Software. AutoCad 2010 and updated version: Introduction, Foundation of AutoCad Commands, Execution of Simple 2D Drawings, Understanding 3D commands, Executing3D Commands, Creating 3D objects Rendering and Image attach to an object Starting New Projects, Creating, Editing, Saving Drawing, Annotation, Dimension, Plotting, Customisation, Auto Lisp.
Introduction to CNC, History of CNC, Advantages and disadvantages of N/C, CNC, DNC, Major part of CNC. Basics of CAM: Introduction of CNC machine, basics of Computer Aided Designing and Manufacturing (CADCAM) and its use in P&O. Other kinds of Computer use in Prosthetics and Orthotics. CADCAM Technology in socket making and also making of different kinds of orthosis and prosthesis. CAD/CAM in Prosthetics & Orthotics: types of digitizers used, concept of different types of modifying software, CNC carver and its specification, step wise fabrication procedure of sockets, shells and spinal orthoses, its advantages and disadvantages.

Practical(100 Hrs.)

1. Trainees has to be thorough in all branches of MS Office especially WORD and POWERPOINT. In addition to that it would be better if trainee also learn one additional drawing and imaging software among e.g. Corel Draw, PageMaker, Photoshop or similar kind of softwares.

2.Trainees has to be thorough in all branches CADCAM especially AUTOCAD. Trainees should make design of all common types of P&O components which are regularly in use by using AutoCAD software.

P&O WORKSHOP MANAGEMENT

EXAMINATION AT END OF-3rd YEAR INSTRUCTION HOURS- 100 HOURS

Course description:

Students would have an understanding of the planning, construction, human management, store management and safety of the workshop.

Course Objectives:

• Explain techniques related to the design, planning, control and improvement of service and manufacturing operations.
• Demonstrate basic knowledge of financial 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.

Course Content:

Introduction: Principles of Administrative and Management structure, Industrial Management, Definition of Organization. Principles of good organisation, type of Organisational setup Workshop Administration and management. Management: Introduction, Discipline, Security, distribution of work, Work sheet, Time sheet and staff Welfare. Material Management: Store and store organization. Inventory Control. Purchase organization. Introduction to cost accounting. Use of computer for effective store management.

Safety: Industrial accidents, safety and hazards.

Planning: Planning of Prosthetics and Orthotics Workshop all types of various scales. Workshop layout, plant Layout. Costing, billing, documentation especially development of recording system to manage individual's records.

Construction: Construction, ventilation, electrification, colour scheme, lighting, Sanitary convenience, Further expansion and accessibility of Prosthetic and Orthotic Workshop and fittings. Human resource management & Environmental Science:

Economics:

Business management practices such as cost calculations, accounting process and budgeting address issues related to clinic management including, appointment systems and record keeping, Quality control and the use of quality assurance system Appropriate code of ethical behaviour of P & O Professional responsible for the treatment of patients

Practical:

Either to design and develop a workshop or to carry out a project for layout of a workshop for prosthetics and orthotics work or workshop of similar nature.

MOBILITY AND REHABILITATION AIDS

EXAMINATION AT END OF-3rd YEAR INSTRUCTION HOURS- 80 HOURS

Course description:

Students would learn about the use of various types of mobility aids required by PWDs and related analysis of the gait pattern.

Course Objectives:

• Explain the prescription of commonly used mobility aids like crutches, walking stick, and walkers.
• Assess and prescribe the best possible mobility solution for a wheelchair user.
• Carry out repair and maintenance of wheelchair.
• Describe the correct use of the wheelchairs, transfers and various modifications of wheel chairs.
• Train users to make the best use of their wheelchair.
• Assess, prescribe and fabricate different types of developmental aids.
• Describe the analysis of gait with the related mobility aids.

Course Content:

Mobility and Walking aids: Canes, walking sticks, Crutches - auxiliary, elbow and forearm support. Different types of Walking Frame, Walker and their attachments. Para podium etc

Developmental aids: Biomechanics of various kinds of developmental aids, Normal milestone and delayed milestone, prescription, design and materials used, measurement techniques, fabrication of Box seat, Special Chair with or without table/tray, Standing/ tilting frame, Low-level cart, Prone board and various

developmental and educational toys. Maximum use of Appropriate Technology while making developmental aids.

Molded seats: Biomechanics of various kinds of molded seats, prescription criteria, cast and measurement techniques, Cast modifications, fabrication of molded seats with inside or outside posting, use of different materials and technologies to fabricate the same, suspension or right kinds of strapping.

Wheelchair: Manual wheelchair: Benefits of appropriate wheelchair for a wheelchair user, Features and benefits of 'sitting upright' in wheelchair,, Types of wheelchair, cushion and its components and its safe handling, pressure relief techniques, user assessment, prescription, measurement, fitting, Transfer techniques, Wheelchair mobility skills, Care & Maintenance of Wheelchairs and importance of wheelchair user instructions. Cushions and its fabrication technique & wheelchair modification.

Other types: Introduction: Motorized wheelchair, tricycle and motorized tricycle, modified two wheeler for mobility. Gait Training with various walking aids, Installation/ fabrication of Parallel bars. Self help devices: Special gadgets to assist in activities of daily living (A.D.L.) – assistive device for SCI patients, stroke patients etc.

Practicals: 140 Hrs.

PROSTHETIC SCIENCE-III

EXAMINATION AT END OF-3rd YEAR INSTRUCTION HOURS- 80 HOURS

Course Content:

Upper Limb: Grasp patterns, grasp forces, mechanical replacement of hand function, augmentation of deficient hand function, upper limb prosthetic socket biomechanics – all types.

Control systems: Introduction to control theory, application in Prosthetics of functional electrical stimulation (FES), myoelectric and bio-feedback.

Upper limb prosthetics: Historical development in Upper Limb Prostheses – India and abroad, Upper Extremity Prosthetics Components - Terminal devices, Wrist units, Elbow units, Shoulder units, Harnessing systems in Upper extremity prosthesis.

Partial Hand: Both cosmetics and functional types which also includes silicon prostheses. Cosmetic hand gloves and fingers. Devices for augmentation of function and cosmesis for partial hand amputation and finger amputation.

Wrist Disarticulation: Prescription Criteria, Types of prosthesis – Components, Socket Shape, Clinical Considerations, Casting and measurement techniques, Cast modifications, Fabrication techniques, alignment techniques, Harnessing and suspension mechanisms, Fitting, donning and doffing techniques. Check out procedures, Testing and Training. Trans Radial: Prescription Criteria, Types of Trans Radial prosthesis – Components, Types of Socket which includes Self suspending, flexible/rigid socket or combination of both, Clinical Considerations, Casting and measurement techniques, Cast modifications, Fabrication techniques – single wall and double wall, alignment techniques, Harnessing and suspension mechanisms, Control system – body powered and externally powered, Fitting, donning and doffing techniques. Check out procedures, Testing and Training.

Trans Humerus: Prescription Criteria, Types of Trans Humeral prosthesis which also includes Elbow Disarticulation prostheses – Components, Different types of Elbow Mechanisms. Types of Socket which includes Self suspending, flexible/rigid socket or combination of both, Clinical Considerations, Casting and measurement techniques, Cast modifications, Fabrication techniques – single wall and double wall, alignment techniques, Harnessing and suspension mechanisms, Control system – body powered and externally powered, Fitting, donning and doffing techniques. Check out procedures, Testing and Training. Shoulder Disarticulation: Prescription Criteria, Types of prosthesis both cosmetics and functional, Components, Different types of Elbow and Shoulder Mechanisms. Types of Socket, Clinical Considerations, Casting and measurement techniques, Cast modifications, Fabrication techniques, alignment techniques, Harnessing and suspension mechanisms, Control system – body powered and externally powered, Fitting, donning and doffing techniques. Check out procedures, Testing and Training.

Prosthetics Practical: Fabrication of prosthesis for partial hand amputation or congenital absence, through wrist prosthesis, Below Elbow prosthesis, Above Elbow prosthesis, Shoulder Disarticulation prosthesis, Elbow Disarticulation prosthesis – preferably using various available technologies.

Practical (260 Hrs.) Different ways of design tests, use of FES and myoelectric control system in P&O devices.

ORTHOTIC SCIENCE –III

EXAMINATION AT END OF-3rd YEAR INSTRUCTION HOURS- 80 HOURS

Course content:

Upper Limb: Orthosis biomechanics, application of external power, myoelectric control of external power and usage of devices.

Control systems: Introduction to control theory, application in Orthotics of functional electrical stimulation (FES), hybrid Orthosis.

Upper Limb Orthotics: Objectives of splinting and principles. Types & classification of Orthoses. Biomechanical principal of all types of upper limb Orthotics. Material used and its advantages and disadvantages. All types of Hand Orthoses, Wrist Hand Orthoses, Elbow Orthoses, Shoulder Elbow Wrist Hand Orthoses & Pelvic Shoulder Elbow Wrist Hand Orthosis. Measurement/casting and Fabrication of P.S.E.W.H.O, S.E.W.H.O, Elbow Orthoses, Elbow Wrist and Hand Orthoses, Elbow braces etc. Immobilization/ mobilization, Appliances for flail elbows: Measurement/casting and Fabrication of Shoulder Orthoses, The shoulder joint braces and splints, Abduction splints and braces, Traction splint of Humerus, All types of Shoulder Elbow Wrist and Hand Orthoses which also includes both body powered and externally powered. All types of fracture Orthoses, Temporary splinting, Feeder and other assistive appliances.

Orthotics Practical (260 Hrs.) Fabrication of at least 5 types of splints belonging to each group.

RESEARCH METHODOLOGY

EXAMINATION AT END OF-3rd YEAR INSTRUCTION HOURS- 60 HOURS

Course description:

The student would acquire the knowledge of the research problem, design, Sampling, data collection, analysis of data, Testing hypotheses, interpretation and report writing to prosthetics and Orthotics.

Course Objectives:

- Explain the process, types, design, needs, principles of research.
- Formulate an appropriate research plan in order to solve a clinical problem.
- Examine the concepts of estimation and hypothesis testing with applications to population proportions, means, variances.
- Describe the sampling, data collection and processing of data.
- Examine the data by using different measures.
- Perform effective descriptive statistical analysis as well as statistical inference for a variety of mainstream applications.
- Use appropriate empirical and probability distributions to model data.
- Conduct a basic research study in order to solve a clinical problem.

Course content:

Introduction to Biostastistics

1. Definition – Statistics, Biostatistics
2. Applications of Biostatistics
3. Data collection from experiments & surveys.
4. Variable – Qualitative & Quantitative, Discrete and continuous.
5. Presentation of Data: -

a) Tabular Presentation of Data – Statistical Table, Format of a Table.
b) Frequency Distribution – construction of Frequency Distribution, cumulative and relative frequency distribution, Exclusive and inclusive method of classification of Data.
c) Diagrammatic Presentation of Data: - Bar diagrams, Pie Diagram, Line Diagram, Pictogram, Cartogram or Statistical map.
d) Graphical representation of a Frequency distribution – Histogram, Frequency Polygon, Frequency curve, ogives or cumulative frequency curves.

Research methodology:

1. Introduction to Research methodology: Meaning of research, objectives of research, Types of research & research approaches.
2. Research problem: Statement of research problem Statement of purpose and objectives of research problem, Necessity of defining the problem.
3. Research design: Meaning of research design, Need for research design.
4. Sampling Design: Criteria for selecting sampling procedure.
5. Measurement & scaling techniques: Measurement in research- Measurement scales, sources of error in measurement.
6. Methods of data collection: collection of primary data.
7. Sampling fundamentals, need for sampling.
8. Analysis of data:, Types of analysis.
9. Testing of hypothesis: What is hypothesis? Basic concepts concerning testing of hypothesis.

FOURTH YEAR

Subject

1. Prosthetics Science-IV
2. Orthotic Science-IV
3. Prosthetics Clinical Practice
4. Orthotics Clinical Practice
5. Project Work

PROSTHETIC SCIENCE-IV

EXAMINATION AT END OF-4th YEAR INSTRUCTION HOURS- 60 HOURS

Course Content:

Hip Disarticulation Prosthesis: Various types of through hip Prosthesis. Prescription principles, Materials and components to be used, Casting and measurement techniques, Cast modification, alignment, suspension, Fitting, donning and doffing techniques. Check out procedures, Testing and Training. Through hip Gait analysis and deviations.

Prosthetics: Bilateral Stubbies. Bilateral Prosthesis. Trans Lumber Prosthesis (Sitting and Standing), Prosthesis for Child Amputee, Prosthesis for Congenital anomalies, Prosthesis adaptation for sports and recreation, immediate post surgical fittings, Check-out Procedures.

Practical: (120 Hrs.) Fabrication of Prosthesis for through hip, double or multiple amputees, Fitting of Prosthesis in cases and developing and/or adapting new designs.

ORTHOTIC SCIENCE –IV

EXAMINATION AT END OF-4th YEAR INSTRUCTION HOURS- 60 HOURS

Course content

Spinal Biomechanics: Motions of the spine, Biomechanics of different region in spinal column, Biomechanics Inter vertebral disk, Lumbar Spine loading during normal activities and effects of Orthosis on this loads, Biomechanical Principles of spinal orthosis, Biomechanics of Corsets, Cervical/thoraco/lumbar/sacral spinal orthosis. Biomechanics of scoliosis correction using different technologies especially using Spinal orthosis.

Spinal Orthoses: Historical development of spinal orthoses. Anatomical and Physiological Principles of construction and fitting of spinal Orthoses. Biomechanical principle and Functions of spinal Orthoses.

Cervical Orthoses: Principle, material, measurement/ casting, fabrication of all types of Cervical Orthoses especially different types of cervical collar, semi-rigid/rigid cervical orthoses both temporary and permanent. Cervical Traction, HALO traction and various types.

Thoraco Lumbo Sacral Orthoses: Flexible spinal Orthoses. Rigid spinal orthoses. Principle, material, measurement/ casting, fabrication of all types of Thoraco Lumbo sacral orthoses (TLSO) especially all types of orthoses for scoliosis. All types of under arm orthoses and variants. Various types of Immobilisers, Fitting, donning and doffing techniques. Check out procedures, Testing and Training.

Lumbo sacral Orthoses: Principle, material, measurement/ casting, fabrication of all types of Lumbo sacral orthoses (LSO) especially Corsets and all types of orthoses for Lordosis and scoliosis. Pelvic traction and its uses.

Orthotics: Orthoses for sports injury, Reciprocating Gait Orthoses (RGO), Hip Guidance Orthoses(HGO), Fracture Cast Bracing, Swivel walker, orthopodium/ Parapodium. Weight relieving orthoses, Extension orthoses or Ortho-prostheses, PTB. orthoses, Silicone Cosmetic prosthesis.

Practical:((120 Hrs.) Fabrication of orthoses for children with Cerebral palsy as in para above and adapting according to the individual needs.

PROJECT WORK

EXAMINATION AT END OF-4th YEAR INSTRUCTION HOURS- 140 HOURS

Each Trainee shall take a project work under supervision of a guide. Project work has to be well documented and presented in essay form. The major focus will be trainee's original work which she or he has to present prior to final examination. The subject and the guide should be chosen within four weeks from the day of admission to the fourth year.

CLINICAL PRACTICE

EXAMINATION AT END OF-4th YEAR INSTRUCTION HOURS- 360 HOURS each

Course description:

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.

Course Objectives:

They will develop skills in the:

- communication.
- assessment and prescription.
- clinical provision of prostheses and orthoses.
- manufacture of prostheses and orthoses.
- interpersonal relationships.
- organisation and management.
- Clinical research.
- Contributing too and learning from the clinic team.

PROSTHETICS CLINICAL PRACTICE

Direct Service: In this period each trainee will be in touch directly with the persons withdisabilities under supervision of the Instructor/Demonstrator. She/he would do all the necessary work from start to the finish for fittings of suitable prostheses. Each personfitted with prostheses has to be documented/ recorded well and to be presented in the clinics in front of Rehabilitation team and other trainees. Besides fitting, trainee would also work with other rehabilitation team members to understand “Total Rehabilitation”.

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