THE TAMIL NADU Dr. M.G.R. MEDICAL
UNIVERSITY, CHENNAI-600 032.

REGULATIONS FOR BACHELOR OF PROSTHETICS & ORTHOTICS DEGREE COURSE

In exercise of the powers conferred by Section 44 of The Tamil Nadu Dr. M.G.R. Medical University, Chennai , Act, 1987 (Tamil Nadu Act 37 of 1987), the Standing Academic Board of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, hereby makes the following regulations.

SHORT TITLE AND COMMENCEMENT:-

These regulations shall be called "THE REGULATIONS FOR THE BACHELOR OF PROSTHETICS & ORTHOTICS (B.P.O) DEGREE COURSE OF THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY, CHENNAI".

They shall come into force from the academic year 2012-2013 session onwards.

The regulations and syllabus are subject to modification by the standing Academic Board from time to time.

REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

    1. A pass in Higher Secondary Course with PCM / PCB / PCBZ under Science Stream with a Minimum of 50% in aggregate in PCM / PCB / PCBZ and a pass in English subject.
    2. Minimum Age limit is 17 years as on 31st December of the academic year.

(The Rehabilitation Council of India, New Delhi, has increased the percentage of marks and Minimum Eligibility Criteria to 50% and as per the rules of the Government of Tamilnadu, for SC/ST/OBC Candidates the percentage of marks and Minimum Eligibility Criteria is 40% in aggregate for admission in to Bachelor of Prosthetics & Orthotics from the Academic Year 2015-16 onwards)

Lateral entry for Diploma students to BPO course

1. Candidates who have passed Diploma in Prosthetics & Orthotics from a RCI recognized institute shall be eligible for admission directly in to 3rd Year BPO course.
2. Candidates should have passed 10+2 with PCM/PCB/PCBZ.
3. Minimum 50% of pass of in aggregate and pass in English subject.
4. Admissions will be subject to the availability of vacant seats in 3rd Year pertaining to the Year of Admission.

2. ELIGIBILITY CERTIFICATE:-

The Candidates who have passed any qualifying examination other than the Higher Secondary Course Examination conducted by the Government of Tamil Nadu shall obtain an Eligibility certificate from the University by remitting the prescribed fees along with the filled in Application Form which s h a l l downloaded from the University website (web.tnmgrmu.ac.in).

3. REGISTRATION;-

A candidate admitted to the Bachelor of Prosthetics & Orthotics (B.P.O) Degree course in any one of the affiliated Institutions of this University shall register his/her name in the prescribed application form for registration dully filled along with the prescribed fee and a declaration in the format, to the University through the affiliated Institutions within 30 days from the Cut-off date prescribed for Bachelor of Prosthetics & Orthotics (B.P.O) Degree course for admission.

4. DURATION OF THE COURSE:-

The duration of the Bachelor of Prosthetics and Orthotics Course shall be four academic years.(3 ½ Year Study Period and 6 Months Internship) (Approved in the 48th SAB held on 02.07.2014).

The admitted candidates should complete the course within double the duration (8 Years) from the date of joining the course.

5. COMMENCEMENT OF THE COURSE:-

The course shall commence from 1st August of the Academic Year.

6. COMMENCEMENT OF EXAMINATIONS:-

1st August / 1st February

If the date of commencement of Examination falls on Saturdays, Sundays or declared Public holidays, the examination shall begin on the next working day.

7. CUT-OFF DATES FOR ADMISSION TO EXAMINATIONS:-

The Candidates admitted upto 30th September shall be registered to take up their 1st year examination during August of the next year. All kinds of admissions shall be completed on or before 30th September of the academic year. There shall not be any admissions after 30th September even if seats are vacant

8. MEDIUM OF INSTRUCTION:-

English shall be the medium of instruction for all the subjects of study and examinations for the Bachelor of Prosthetics & Orthotics Course.

9. CURRICULUM:-

The curriculum and the syllabi for the course shall be as prescribed in these regulations are subject to modifications by the Standing Academic Board from time to time.

10. WORKING DAYS IN AN ACADEMIC YEAR:-

Each academic year shall have a total of 240 working days.

11. ATTENDANCE REQUIRED FOR ADMISSION TO EXAMINATIONS:

No candidate shall be permitted to appear for the University examinations,unless he/she attends the course for the prescribed period and produces the necessary certificate of study attendance and satisfactory conduct from the Head of the Institution.

Every candidate is required to put in a minimum of 85% of attendance both in theory and practical separately in each subject for admission to the examination.

A candidate lacking in the prescribed attendance in any subject in theory and /or practical shall not be admitted to the entire examination.

12. CONDONATION OF LACK OF ATTENDANCE:

There shall be no condonation of lack of attendance.

13. MARKS QUALIFYING FOR A PASS:-

A candidate shall be declared to have passed the examination if he/she obtains the following qualifying marks:

- 50% of Marks in the University Theory Examination.
- 50% of Marks in the University Practical Examination.
- 50% of Marks in aggregate in Theory, Practical & I.A..

14. RE-ADMISSION AFTER BREAK OF STUDY:-

The regulation for Re-admission are as per University common regulation for Re-admission after break of study.

15. MIGRATION / TRANSFER OF CANDIDATES:-

Migration / Transfer of Candidates from one recognized institution to another recognized institution of this University shall be granted on the following conditions:-

1. All migrations / transfers are subject to the approval of the Vice- Chancellor.
2. Transfer shall be effected only at the beginning of the academic year.
3. Transfers shall be effected during any year of study after fulfillment of the regulations of this University.

16. COMPULSORY INTERNSHIP:-

Every candidate admitted to Bachelor of Prosthetics and Orthotics Degree Course shall undergo Six Months compulsory internship in the institution he has studied after successful completion of the final examination

17. REVALUATION / RETOTALLING

Revaluation / Re-totalling of Answer Paper is not permitted.

18. SCHEME OF EXAMINATION:-

FIRST YEAR:

Sl. No.	Subjects	IA		Theory		Practical		Total Marks
		Max	Min	Max	Min	Max	Min	
1.	Anatomy	50	25	100	50	-	-	150
2.	Physiology	50	25	100	50	-	-	150
3.	Material and workshop	50	25	100	50	-	-	150
4.	Applied Mechanics & Strength of Materials	50	25	100	50	-	-	150
5.	Engineering Drawing	50	25	100	50	-	-	150
6.	Biomechanics I	50	25	100	50	-	-	150
7..	Prosthetics –I	50	25	100	50	100	50	250
8.	Orthotics-I	50	25	100	50	100	50	250

Second Year

Sl. No.	Subjects	IA		Theory		Practical		Total Marks
		Max	Min	Max	Min	Max	Min	
1.	Pathology	50	25	100	50	-	-	150
2.	Orthopaedics & Amputation	50	25	100	50	-	-	150
3.	Physical Medicine &Rehabilitation	50	25	100	50	100	50	250
4.	Fundamentals of Electricity &	50	25	100	50	-	-	150
5.	Bio-Mechanics-II	50	25	100	50	-	-	150
6.	Prosthetics Science-II	50	25	100	50	100	50	250
7.	Orthotics Science-II	50	25	100	50	100	50	250

Third Year

Sl. No.	Subjects	IA		Theory		Practical		Total Marks
		Max	Min	Max	Min	Max	Min	
1.	Computer Science**	50	25	100	50	100	50	250
2.	P & O Workshop Management	50	25	100	50	-	-	150
3.	Mobility & Rehabilitation Aids	50	25	100	50	100	50	250
4.	Prosthetics Science- III	50	25	100	50	100	50	250
5.	Orthotics Science-III	50	25	100	50	100	50	250
6.	Research Methodology / Project development	50	25	100	50	-	-	150

**Computer Science will be the internal paper, institution will send the marks to the university

Fourth year:

Sl. No.	Subjects	IA		Theory		Practical		Total Marks
		Max	Min	Max	Min	Max	Min	
1.	Prosthetics Science-IV	50	25	100	50	100	50	250
2.	Orthotic Science-IV	50	25	100	50	100	50	250
3.	*Prosthetics Clinical Practice	50	25	-	-	200	100	250
4.	*Orthotics Clinical Practice	50	25	-	-	200	100	250
5.	Project Work	50	25	-	-	200	100	250
*** Internal Paper**								

In first year the main emphasis is on Anatomy, Physiology, basic engineering, Prosthetics and Orthotics workshop technology and part of lower limb Prosthetics and Orthotics.

In the second year, besides remaining part of lower limb Prosthetics and Orthotics, major emphasis was given to Pathology, Orthopaedics & Amputation Surgery, Physical Medicine and Rehabilitation

In third year, major components would be Rehabilitation/ mobility aid, upper limb Prosthetics and Orthotics, Research Methodology besides computer science etc.

In fourth year major focus is on Spinal Orthotics, Prosthetics and Orthotics management of bilateral amputees especially of higher level and other complicated ones. Three months clinical practice in orthotics and three months in prosthetics has been allotted besides project work.

SYLLABUS OF BACHELOR IN PROSTHETICS & ORTHOTICS

FIRST YEAR

PAPER – I ANATOMY

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.

LowerExtremity:

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 occygeal 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:

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

PAPER – II PHYSIOLOGY

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:

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

Note: for above practical – physiology practical manual for B.Sc. [Hons.], OT, PT, B.Sc. Nursing and allied sciences Edition first reprint 2006 by CBS publishers Author: Raj Kapoor

PAPER - III MATERIAL AND WORKSHOP TECHNOLOGY

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

WORKSHOPTECHNOLOGY

General: Introduction to bench work, hand tools, measuring tools and instruments. 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: 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.

PAPER - IV APPLIED MECHANICS AND STRENGTH OF MATERIALS

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.

PAPER - V ENGINEERING DRAWING:

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: All kinds of engineering drawing practice.

PAPER - VI BIOMECHANICS-I

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 h) Equilibrium 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.

PAPER - VII PROSTHETIC SCIENCE-I

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: Fabrication of Partial foot prosthesis, Chopart Prosthesis, Symes and various types of Trans tibial prosthesis using different technology.

PAPER - VIII ORTHOTIC SCIENCE-I

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: 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

PAPER - I PATHOLOGY

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.

PAPER - II ORTHOPAEDICS & AMPUTATION SURGERY

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

InfIammatory 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, podiatry, burns.

Orthopaedics

Practical:

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.

PAPER - III PHYSICAL MEDICINE AND REHABILITATION

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 the team. Introduction to Physical Medicine, Principles of clinical examinations, diagnosis and treatment. Different aspects of physical medicine and rehabilitation. Rehabilitation aspects 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.

*Examination has to be conducted of A, B, C section with separate answer sheet for the evaluation by the concerned faculty /professionals.

PAPER - IV FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

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

PAPER - V BIOMECHANICS – II

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.

PAPER – VI PROSTHETICS SCIENCE- II

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: Fabrication of all types of above Knee prosthesis and through knee prosthesis.

PAPER – VII ORTHOTICS SCIENCE-II

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: 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

PAPER – I

COMPUTER

SCIENCE

Introduction to 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:

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.

PAPER – II P&O WORKSHOP MANAGEMENT

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.

PAPER – III MOBILITY AND REHABILITATION AIDS

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 developmentalaids.

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.

PAPER - IV PROSTHETIC SCIENCE-III

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: Different ways of design tests, use of FES and myoelectric control system in P&O devices.

PAPER – V ORTHOTIC SCIENCE -III

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: Fabrication of at least 5 types of splints belonging to each group.

PAPER VI - RESEARCH METHODOLOGY

Introduction to Biostatistics

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, cumulativeand 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, gives 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

PAPER – I PROSTHETIC SCIENCE-IV

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

PAPER – II ORTHOTIC SCIENCE -IV

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

3. PROSTHETICS CLINICAL PRACTICE

Direct Service: In this period each trainee will be in touch directly with the persons with disabilities 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 person fitted 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 otal Rehabilitation .

4. ORTHOTICS CLINICAL PRACTICE

Direct Service: In this period each trainee will be in touch directly with the persons with disabilities 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 person fitted 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 otal Rehabilitation .

5. PROJECT WORK

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.

RECOMMENDED BOOKS &

JOURNALS ANATOMY

Sl.No.	Title	Author	Publisher	Year/Vol.
1.	Human Anatomy: Regional and	Chaurasia, B D	CBS, New Delhi	2004 3V
2.	Human Osteology	Chaurasia, B D	CBS, New Delhi	1991
3.	Anatomy: Palpation and Surface Markings	Field, Derek	Butterworth, London	1997
4	Human Osteology	A.K.Dutta		
5.	Grant's Method of Anatomy	John V. Basmajian		
6	Gray's Anatomy for Students	Richard L. Drake, Wayne Vogl & Adam W.M. Mitchell		

PHYSIOLOGY

Sl. No.	Title	Author	Publisher	Year/Vol.
1	Human Physiology	Chatterji, C. C.	Medical Allied	1997 2V
2.	Human Physiology for B.D.S and PT/OT	Dr. A. K. Jain		1 st Edition 1998
3.	Text Book of Medical	Guyton, A.C. and Hall, J. E.	W.B.Saunders, Singapore	1998
4.	Essentials of Medical Physiology	K.Sembulingam & Prema Sembulingam		

PATHOLOGY

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Basics of Pathology	By Robins		
2.	Test Book of Pathology	By Dr. Harsh Mohan	Jaypee Publisher New Delhi	

PROSTHETICS & ORTHOTICS

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Prosthetics & Orthotics	Shurr. G. Donald & J.W.Michel		2nd ed.
2.	Prosthetics & Orthotics Lower Limb	Seymour, Ron		
3.	Amputations & Prosthetics	May Bella J.	Jaypee Publisher New Delhi	
4.	Orthotics in functional rehabilitation of the	Nowoczenski, Deborah A.		

5.	Atlas for prosthetic rehabilitation, Surgery and limb deficiency.	American Academy of Orthopaedic Surgeons	Mosby publications/ or N.Y.U. St.Louice, London, Chickago	3rd
6.	Orthotics	Edestein, Joan E.	Jaypee Publisher New Delhi	
7.	Wheel chair selection & configuration	Cooper, Cynthia ed.		
8.	Orthotics in rehabilitation	Mckee, Pat		
9.	Hydraulics and	Parr, Andrew		
10.	Foot and ankle in sports	Bates, Andrea		
11.	Functional fracture bracing	Sarmiento, A.		
12.	AAOS atlas of Orthosis and assistive devices,	Hsu, John D.	Mosby publications/ or N.Y.U. St.Louice, London, Chickago	4th ed.
13.	Maintenance and care of the prosthesis	C.A. Hannesseg		
14.	Manual for lower Extremity prosthetics Publisher : Mosby		Mosby publications/ or N.Y.U. Louice, London, Chickago	
15.	Manual for Upper Extremity Prosthesis	William R.SANTASHI Edn		
16.	Hip disarticulation	C.A. Melancik		

17.	The Management of Spinal deformities	Kenton D.Leather man Rober A. Dickson	Butter worth-Heineman n Ltd. Linacre House, Jordon Hill,Oxford OX2 8DP	
18.	FOOT ORTHOSIS	Kent, Wu		
19.	Principal in Prosthetic management for	E.F.Murphy		
20.	Orthotics: Individual: A Comprehensive Interactive Tutorial CD- ROM	Jan Bruckner and Joan Edelstein		
21.	An Atlas of Lower Limb Orthotic Practice	D.N. Condie and S. Turner		
22.	Orthotics and Prosthetics in Rehabilitation	Michelle M. Lusardi PhD PT and Caroline C. Nielsen PhD		
23.	Guidelines for Prescribing Foot Orthotics	Mark A. Reiley		
26.	Orthotics in Functional Rehabilitation of the	Deborah A. Nawocze		
27.	Hand and Upper	Fess,Gettle,Philips	Elsevier	
	Extremity Splinting :	Elaine	Mosby St.	
	principles and methods	Ewing,Karan	Luis B. I.	
		S,Cynthia A	Publications	
28.	Control of the Foot/Ankle Complex: Orthotic Recommendations	American Academy of Prosthetists & Orthotists	American Academy of Prosthetists & Orthotists	

29.	Orthology: Pathomechanics of Lower-Limb Orthotic Design	Academy of Prosthetists & Orthotists		
30	Powered upper limb prosthesis	American Academy of Prosthetists & Orthotists		
31	Introduction to microprocesso r	Mathur U.N.Dhur A.P	Mac-Graw Hill Inc. New Delhi	
32.	Orthotics Etcetera	John B Redford		
33.	Upper Extremity Orthotics	Anderson, Miles H.	Jaypee Publisher New Delhi	
34.	New Advances in Prosthetics and Orthotics	Mark H Bussell		
35.	Extremity Orthotics	AAOS	Spring field	
36.	Prosthetic & patient	Kevin Croll		Ist
37.	Orthotic & Prosthetic	Michel M.Lusardi		
38.	Clinical Practical & rehabilitation Technology	Johan B		
39.	The Immediate post-operative Prosthesis in	Andrew C. Ruoff & Others		
40.	Congenital Limb	Charles A Frank		
41.	Above Knee Amputation-Prosthetic Principles	Zems Grim		
42.	Hemipelvictom y Prosthesis	Fred Hampton		

43	Hip Disarticulation	C. A. Mclaucik		
44.	Powered Lower Limb Orthotics in	J. Hughes		
45.	Bio-mechanical basis of	P.Bowker, D.N.	Butter	
	Orthotics Management	Conde D.L.Bader,	worth-	
		D.J.PRATT	Heinemann	
			Ltd. Linacre	
			House,	
			Jordon	
			Hill,Oxford	
			OX2 BDP	

PSYCHOLOGY & SOCIOLOGY

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Sociology	Vidya Bhusan & Mazumdar	Kitab Mahal New Delhi	
2.	Introduction to sociology	Devis		
3.	Child Development	By Hurlock (ED)		
4.	Intro. To Psychology ED.7	By Morgan	Tata Mcg. Hill, Delhi	
5.	Abnormal Psychology	BY Mohanty		
6.	Text Book of Sociology	Wallis,Willey Wilson D,Malcom		

BIOMECHANICS

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Bio-mechanical basis of Orthotics Management	P. Bowker, D.N. Conde, D.L. Bader, D.J.PRATT	Butter worth-Heinemann Ltd. Linacre House, Jordon Hill, Oxford OX2 BDP	
2.	to biomechanics	Humphrey , Jay D.		
3.	Biomechanical Basis of human	Hamill ,		2nd ed.
4.	Human walking	Rose, Jessicaed.		
5.	Kinesiology	Soderberg, L.ed.		
6.	of Kinesiology	Hoffoman shirt J.		2nd ed.
7.	Muscles, nerves & movement	Tyldesley, Barbara		3rd ed.
8.	Gait analysis	Perry, Jacuelin		
9.	Human body dynamics	Tozeren , Aydin		
10.	Human motion	, G.F.ed		
11.	Clinical biomechanics	Dvir, Zeevi		
12.	Basic Biomechanics	Hall Susan J	McGraw-Hill	
13.	Gait disorders	Hausdorff, Alexander Jeffrey M, Neil B	B. I. Publications P	
14.	Fundamentals of Bio- Mechanics	Duane Knudson		2nd ed.

15.	mechanics and biomechanics	Stanley Bell P Frank	B. I. Publications uk	
16.	Clinical Biomechanics	Black Jonathan		
17.	Biomechanics of the Foot and Ankle	Donatelli, R.A.	Davis, Philadelphia	
18.	Physiology of Joints	Kapandgi, I.A.	Churchill-Livingstone	Vol. I, II & III

COMPUTER SCIENCE

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	CAD, CAM	McMohan , Chris		
2.	CAD/CAM theory and practice	Zeid Ibrahim	B. I. Publications P New Delhi	
3.	Computer course	Satish Jain	Pub: BPB New Delhi	
4.	Computer Organisation & system Software	Satish Jain	Pub: BPB New Delhi	
6.	Computer graphics	Hammandlu	Pub: BPB New Delhi	
7.	Operating systems	BPB	Pub: BPB New Delhi	
8.	Auto CAD 2007 for engineers &	C.D		
9.	Sensor technology hand	C.D		

MATERIAL SCIENCE

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Material science & engineering	Calin, Andrea		6th ed.
2.	Physics of plastics	Biller, Jose		
3.	Carbon materials for advanced	Bulson, P.S. ed		
4.	Fundamentals of polymer	Ram, Arie		
5.	Plastics technology	Chan, Karence K. ed.		2nd ed.
6.	Polymer Foams	Nigel Mills		
7.	Text book of Material Science &	O.P.Khanna		
8.	Introduction to Composite	S.W.Tasi		
9.	Composite Materials	L.J.Broutman & R.H.Kroch		
10.	Material Science & Process	M.K.Murlidhar		

ENGINEERING DRAWING

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Technical/ Engineering Drawing	N.D. Bhatt	Chroper Publications	
2.	Technical/ Engineering Drawing	P.S. Gill		
3.	Textbook of machine drawing	Dhawan, R.K.		3rd rev. ed..

APPLIED MECHANICS & STRENGTH OF MATERIAL

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Applied Mechanics	R.S.Khurmi		
2.	Strength of Materials	Jagdish Lal		

WORKSHOPTECHNOLOGY

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Workshop Technology Vol. I &	B.S. Raghuvanshi	Dhanpat Rai & Co. Delhi	
2.	Basics Mechanics	John Lord & Ann Reed	Butter North, Oxford	
3.	Workshop Technology	Chapman		Vol.I,II & III

ORTHOPEDICS & AMPUTATION SURGERY

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Outline of orthopaedics	Adam,s		
2.	Apley's Systems of Orthopedics and Fracture	Solomon , Louis	Arnold, London	
3.	Essential Orthopedics	Maheshwari, J		
4.	Orthopedics: principles and their	Terke, Samual	Lippencott, New York	
5.	Amputation & Prosthesis	Miroslow Vitali		

FUNDAMENTALS OF ELECTRICITY & ELECTRONICS

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Basic electronics	Thereja, B.L.		
2.	Sensor technology hand	C.D.		
3.	Fundamentals of digital electronics & microprocessors	Singh, Anokh		
4.	Biological & Medical Electronics	Ralph. W. Stach, Ph.D.	London.	
5.	Bio-electricity	by E.E. Svek / Ling D.E.E.		

PHYSICAL MEDICINE & REHABILITATION

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Physical Medicine & Rehabilitation	Bredamm,s		
2.	Physical Medicine & Rehabilitation	Deliza		
3.	Neurological Rehabilitation	Carr, J.H. and Shepherd,	Butterworth, Oxford	
4.	Handbook of Physical Medicine and Rehabilitation	Kottke, F.J. and Lehman	W B Saunders, London	
5.	Tetraplegia and Paraplegia	Bromley, Ida	Churchill-Livingston, London	

RESEARCH METHADOLOGY

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Critical Moments in Quantitative Research	Armstrong H.B.	Butter worth-Heine Oxford	
2.	Orthotic system&	R.M. Scot		

PHYSIOTHERAPY/OCCUPATIONAL THERAPY

Sl. No.	Title	Author	Publisher	Year/Vol.
1.	Occupational Therapy	Pedartery		
2.	Occupational Therapy	Specsman		
3.	Hand Splinting	Win & Parry		
4.	Movement Therapy in hemipleagia	Brunn Stones		
5.	Introduction to Physical	Pagliarulo, M.A.	Mosby, London	
6.	Human Movement	Jones,	Butterworth Heine	
7.	Principles of Exercise Therapy	Gardiner, Dena	CBS, New Delhi	
8.	Clayton's Electrotherapy: Theory and Practice	Froster, A. and Palastanga, N.	AITBS, Delhi	
9.	Electrotherapy Explained	Jhon, Low and A Reed	Butterworth Heine Oxford	
10.	Daniels and Worthingham's Muscle Testing: Techniques of Manual Examination	Hislop, H.J. and Montgomery, J.	W.B.Saunders Philadelphia	2002

11.	Tidy's Physiotherapy	Thomson, A	Varghese, Mumbai	
12.	Muscles Testing and Function	Kendal, F.P.	Lippi cott, New York	1993