Guru Gobind Singh Indraprastha University

Bachelor in Prosthetics & Orthotics

FIRST YEAR

Life Science-Anatomy

Anatomy Theory
General: Introduction and definition, Anatomical terms, Regions of body, cavities and their contents. Cell structure, arrangement into organs and systems.

Osteology: Structure and function of bones and joints, Skull, Vertebrae, Upper extremity and Lower extremity.

Systemic: Outline and Gross Anatomy of cardiovascular system, respiratory system, integumentary system, Genito-urinary System, Gastro-intestinal system.

Lower Extremity: Survey of structure and function of Lower Limb, detailed structure and function of bones and joints of lower limb, blood supply to lower limb, main nerves to lower limb, cutaneous nerve supply, origins, insertions, actions and nerve supply of muscles of lower limb and surface anatomy.

Upper Extremity: Survey of structure and function of upper limb, detailed structure and function of bones and joints of Upper Limb, blood supply to limb, brachial plexus, major nerves to upper limb, cutaneous nerve supply, origins, insertions, actions and nerve supply of muscles of Upper Limb and surface anatomy.
Spine: Outline of structure and function of vertebral column, detailed structure of vertebrae throughout vertebral column, structure and function of atlanto-occipital, atlanto-axial and all other intervertebral joints, origins, insertions, actions and nerve supply of major muscles of vertebral column.

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.

Life Science-Physiology, Pathology

Physiology Theory

General: Introduction and definition of various terms, cell structure and function including cell division, Body water and body fluid, oedema.

Musculo-skeletal: Voluntary and involuntary muscles and their function. Various types of joints, skeletal system, weight bearing and Gait analysis.

Nervous System: Reflex action, the regulation of posture, General survey of voluntary movement, Pain, Reflex action, Autonomic Nervous System.

The Blood: Outline of Coagulation of the blood, red blood corpuscles, white blood corpuscles, Immunity reactions and inflammation.

Cardio- Vascular: General considerations, Heart rate, Regulation of blood pressure, peripheral circulation, Capillaries vascular responses of the skin.

Respiratory System: General considerations, Carriage of oxygen by the blood, Carbon dioxide transparent in the body, Cyanosis, Dyspnoea, Regulation of body temperature.

Physiology Practical
Demonstration: Muscle testing, sensations testing, blood pressure and pulse recording etc.

Pathology

General: General aims and objectives of study of pathology, common terminology. An outline of the basic mechanism of disease processes. Inflammation - Outline of Various changes in acute and chronic inflammation, & infections: Repair of tissues. Outline of Viral, bacterial and fungal infections.

Degeneration: Outline of Ischemia, necrosis, gangrene, thrombosis, embolism and infraction, Thromboangiitis oblitrans.

Neoplasia: Outline of Benign and malignant neoplasms, principles of their spread.

Pathology: Outline of pathology of Bones infection, trauma, growth disturbances, Diseases of bones, muscles and Joint Malformations. Healing of fractures.

Neuro-vascular: Outline of Cerebro-vascular disorders, trauma to brain and spinal cord. Disorders of peripheral nerves.

MATERIALS, TOOLS, EQUIPMENT & P&O WORKSHOP TECHNOLOGY -

Materials:

Metal work: Mechanical working of metals especially steel and aluminum. Fundamentals of riveting, soldering, brazing and welding. Powder metallurgy, Surface coating of metals.

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

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

Fabric: Fabric types, properties, utilization, selection and quality control.

Plastics: 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: 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. 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: 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, poluthelene and other kind of rigid/semi rigid/ flexible foams.

TOOLS, EQUIPMENT & P&O WORKSHOP TECHNOLOGY:

General: Introduction to bench work, hand tools, measuring tools and instruments. Equipment for mass production, introduction to lathe machine and its operation, milling machine and its operations, tooling, attachment. Shaping machine and its uses. Grinding machine. Abrasive machine. Special tools and equipment use in fabrication of orthoses and prostheses.

Workshop Technology PracticalPractice: 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.

MECHANICS, APPLIED MECHANICS AND STRENGTH OF MATERIALS

Mechanics and Applied Mechanics:

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.

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. Methods of dimensioning & tolerancing. Cone methods of indicating Surface textureon. Technical Drawings for structural Metal Work. 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.

BIOMECHANICS-I

General: Introduction to terminology, Definitions, Planes and directions., Regions and landmarks of the body, Centre of Gravity – Line of Gravity, Types of levers, lever arms. Body Mass, forces, equilibrium. Floor reaction. Axes of rotation, Speed, acceleration, velocity, (scalar and vector), Kinetics and Kinematics, Human weight bearing system – weight bearing line, Normal human locomotiondefinition, characteristics of normal gait, Characteristics of pathological gait.

Biomechanics of normal foot, pathological foot, foot arches, normal and surgical foot wear.

Tissue Mechanics: Introduction to relevant biological tissues and their mechanical properties.

Human Movements: Range of movement of lower/upper limbs and spine. Normal and Pathological gait - introduction to EMG studies.

Biomechanics of Symes prosthesis, partial foot prosthesis, below knee (trans tibial) prosthesis.

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

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.

Below Knee: Various types of below knee (trans-tibial) prosthesis with a focus on endoskeletal prostheses. All types of Below knee Prosthetics Components – both conventional and modular. Below knee Prescription Criteria and principles. Materials used for Below Knee Prosthesis. Measurement and Casting techniques for PTB prosthesis. Cast modification. Fabrication Techniques for PTB prosthesis. Fabrication Technique for BK Conventional Prosthesis – both Open and close ended socket, Different types of socket designs – PTB, PTS, PTBSC, PTB-SCSP, Different types of suspension.

Different Technology: Conventional below knee prosthesis with local components, ALIMCO components, Jaipur limb (using HDPE), ICRC technology, Endoskeleton/modular - all common types.

Gait Deviations and Analysis: Person with Chopart, Symes, Below knee prosthesis. Check-Out Procedures for Person with Chopart, Symes, Below knee prosthesis. Prosthetics Practical: Fabrication of Partial foot prosthesis, Chopart Prosthesis, Symes and various types of Below knee prosthesis using different technology.

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.Vrious types of Foot Orthoses for diabetic feet and other sensory deficiencies.

AFO (Ankle foot orthosis)-Conventional AFO-Limited /Foot drop (using ALIMCO Components), Plastic AFO (custom moulded), Using metal hinges, plastic hinges, different trim lines, Plastic AFO for Calcaneal deformity, AFO with soft insert, Prefabricated AFO, AFO with inside/outside posting, AFO with built in compensation.

Club foot orthosis (CTEV): Denis brown splint (night splint), Ankle support, Prefabricated CTEV splint, Custom moulded FO/AFO/KAFO, POP splint, Shoes modification.

Fracture: Tibial guard and other kinds of foot and ankle fracture orthoses.

Practical: Different types of foot orthoses, Shoe modifications, and all types of Ankle foot orthoses (A.F.O.) especially Plastic A.F.O. and fracture orthoses.

SECOND YEAR:-

PHYSICAL MEDICINE & REHABILITATION-I

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, 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. PWD Act.

Psychology: Introduction to Psychology, Outline of Psychology and the individual, Behaviour, 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.

Sociology: 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 Removing, Environment Barriers, Recreation for the Disabled Community Welfare organizations, Social welfare programmes. Professional and social work in medical setup. M.S.W. in rehabilitation, Practical and environment difficulties of patient in use of appliances. Outline of Educational aspects, Job analysis, Job placement.
Rehabilitation therapy: Introduction to Physiotherapy and Occupational Therapy, Child development in brief – milestone and delayed milestone, Assessment procedure, Evaluation of muscle power, range of motion, Checking of joint stability Checking of Pelvic tilt, Use of Goniometer, Checking of muscular atrophy/dystrophy, Functional Assessment which includes ADL, Stretching, strengthening, breathing exercise Therapy at post-surgical stage (re-educating the muscles, maintaining ROM, preventing.

Stump care 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, Physical Medicine and Rehabilitation.

PHYSICAL MEDICINE & REHABILITATION-II

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.

General: 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 disorders e.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.

Specific disorders: Peripheral nerve injuries. Poliomyelitis, Cerebral Palsy, Muscular Dystrophy, Club foot (CTEV), Spina Bifida, Hemiplegia, Spinal Cord injuries (paraplegia/ Quadriplegia), Tuberculosis & Perthes Disease, Leprosy , Burns, Erb's Palsy, Tumours - malignant and benign.

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.

ORTHOPAEDICS & AMPUTATION SURGERY

Orthopaedics
General: Introduction, Principles of Orthopaedics. Fracture, types and management.
Inflammation: Outline of Inflammation, Osteomyelitis, Inflammation of Joints, Rheumatoid Arthritis, infective arthritis, tuberculosis arthritis, Osteoarthritis, Ankylosing spondylitis, arthritis of hemophilic joints, Neuropathic joints. Inflammation of Tendon sheath and bursae, Contructures, Posture etc. Metabolic diseases of bones, e.g. rickets, osteomalacia, gout, scurvy etc. Poliomyelitis and all its effect.

Spine: Outline of Tortocolis, cervical rib, spina bifida, spondylolisthesis, scoliosis – all types, kyphosis, Lordosis, spondylosis, prolapse of intervertebral disc.

Hip: Outline of Dislocation (congenital, traumatic, pathological, paralytic and spastic), Coxa-vara, coxa-valga.
Knee: Outline of Meniscal tears, dislocation of patella, genu valgus, genu varum, genu recurvatum,
Ligamentous injuries.
Ankle & foot: Outline of Sprain (acute and chronic), C.T.E.V., Calcaneo varus and Pes Valgus, Hallux Valgus and varus, calcaneal spur, Metatarsalgia, plantar fascitiis, Anesthetic feet, Bunion
Shoulder: Outline of Recurrent dislocation, Bicipital tendinitis and periarthritis.
Elbow: Outline of Cubitus varus and valgus, Madelung's deformity, Tennis elbow, Volkmann's contracture, Dupuytren's disease, claw hand, De Quervain's disease and claw hand.
Wrist & Hand: Tenosynovitis, mallet finger, carpal tunnel syndrome

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.

Amputation in special circumstances, like in infants and children, Congenital limb deficiencies and its universal classification, ischemic limbs, elderly persons and malignancy.

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, its simple assessment and P&O management technique.

****

BASIC 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, truns 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. The cathode ray oscilloscope. 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.

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

---

COMPUTER STUDIES – I

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 also 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 softwares, 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.

Practical: 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.

Biomechanics – II

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. Common types of pathological gait. Above knee Amputee gait analysis and deviations, gait variations due to alignment or pathological conditions.
Through knee Biomechanics: Through knee Prescription Principles, socket biomechanics and alignment techniques.

Above Knee Prosthetics Biomechanics: General Socket biomechanics, above knee socket biomechanics and analysis of socket forces. Analysis of Above knee Prosthetics components. Biomechanics of AK prosthesis alignment.

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 – variations due to alignment or pathological conditions. Gait analysis of KAFOs and HAKAFOs with various types of crutches.

Prosthetic Science-II

Knee Joints: All 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.

Above Knee Prosthesis: Types of Above knee Prosthesis. Above Knee Prosthetic Components. Above Knee Socket Shape and Clinical Considerations. Casting and measurement techniques, Cast modification, Fabrication techniques of Above knee socket. Various tyoes of suspension systems especially suction and silicon type.

Different Technology: Conventional above knee prosthesis with local components, ALIMCO components, Jaipur limb (using HDPE), ICRC technology, Endoskeleton/modular - all common types. Above Knee Gait Analysis. Above Knee Check-out Procedures.

Hip Disarticulation Prosthesis: Various types of Through hip Prosthesis. Different types, 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 Practical: Fabrication of all types of Above Knee prosthesis and through knee prosthesis and one Hip disarticulation prosthesis.

Orthotic Science-II

Above knee Orthotics: All types of K.A.F.O., H.K.A.F.O. and also orthoses for C.D.H., C.P., Paraplegics, Legg Calve perthes diseases. Spina Bifida, Leprosy and Hemiplegia.

Orthotics Components: Prescription principles of various types of Knee Ankle foot Orthoses (KAFO), Knee Orthoses (KO) and Hip Knee Ankle foot Orthoses (HKAFO).

Fabrication: Cast and measurement techniques, choosing right kind of materials and components, cast modification, fabrication and alignment technique, using of different technologies – its advantages and disadvantages, Accommodation of climb 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

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.

Man management: Introduction, Discipline, Security, distribution of work, Work sheet, Time sheet and staff Welfare.

Store purchase: 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.

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.

COMPUTER STUDIES – II

To bring the course to the international level, it is envisaged that the facilities to train the students in CAD CAM should be made available at all centres immediately but latest within the next five years. After that practical training consisting of 144 hours in this subject would be compulsory. The practical examination of 100 marks would be added after the facilities are available. This is done keeping in view that most centres would not have CAD CAM facility at present.

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 2002: 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.

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.

Practical: 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/

BIOMECHANICS – III,

Tissue Mechanics: Study of mechanical characteristics and function of Bones, skin, ligaments, cartilage and muscles.

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 and especially using Spinal orthosis.

Upper Limb: Grasp patterns, grasp forces, mechanical replacement of hand function, augmentation of deficient hand function, upper limb prosthetic socket biomechanics – all types, Orthosis biomechanics, application of external power, myoelectic control of external power and usage of devices.

Control systems: Introduction to control theory. Application in Prosthetics and Orthotics of functional electrical stimulation (FES), hybrid orthosis, myoelectrics and bio-feedback.

Design concept part-I: Buckling, theories in failure/ fatigue/stress concentrations, connections, fluid mechanics and beam deflection.

Design concept part-II: 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, beam deflection. Design test standards/materials/Philadelphia Loads/ISO. Design calculations for P&O devices.
Practical: Different ways of design tests, use of FES and myoelectric control system in P&O devices.

Mobility and Rehabilitation Aids (Basics)

Mobility and Walking aids: Canes, walking sticks, Crutches - axillary, elbow and forearm support. Different types of Walking Frame, Walker and their attachments. Parapodium and David Hart Walker.

Developmental aids: Biomechanics of various kinds of developmental aids, Normal milestone and delayed milestone, 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.

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

Mobility and Rehabilitation Aids (Advance)

Wheelchair: Different types, prescription criteria, measurement techniques, wheelchair modification and maintenance according to individual's needs. Various attachments of a wheelchair. Motorized wheel
chair, tricycle and motorized tricycle, Scootys. Different types of cushions and its fabrication technique. Gait Training with crutches: Training with various walking aids and that too different ways. Installation/fabrication of Parallel bars and transition from Parallel bars to walkers then to crutches or sticks.

Self help devices: Special gadgets for prehension and to assist in activities of daily living (A.D.L.)

Prosthetic Science-III

UPPER LIMB PROSTHETICS
Upper limb prosthetics: Historical development in Upper Limb Prostheses – India and abroad, UpperExtremity 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 Through wrist 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.

Below Elbow: Prescription Criteria, Types of Below Elbow 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.

Above Elbow: Prescription Criteria, Types of Above Elbow 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 Shoulder disarticulation prosthesis both cosmetics and functional, Components, Different types of Elbow and Shoulder Mechanisms. Types of Socket, flexible/rigid socket or combination of both, 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

Orthotics Science-III

Upper Limb orthotics: Objectives of splinting and principles. Biomechanical principles of all types of upper limb Orthotics. Material used and its advantages and disadvantages. Basic opponens splints, all types of hand/finger orthosis, Wrist Hand orthosis which includes - Flexor hinge splint finger driven, Flexor hinge splint wrist driven, Flexor hinge splint shoulder driven. Measurement/casting and Fabrication of Elbow Orthoses, Elbow Wrist and Hand Orthoses, Elbow braces appliances to allow 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.

FOURTH YEAR

Prosthetics Clinical Practice-I & II

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 "Total Rehabilitation".

Orthotics Clinical Practice-I& II

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 "Total Rehabilitation".

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 to be chosen within four weeks from the day of admission to the fourth year.

Study Tour

It is a compulsory event for final year students who has to visit at three or four other major P&O Training Institutes and Artificial Limbs Manufacturing Corporation of India (ALIMCO). Trainee has to submit a report certified by the tour guide at the end of the tour latest by four weeks after completion of the study tour.

Prosthetic Science-IV

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.

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

Orthotic Science -IV

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 – 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 Immobiliser. 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 use.

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, P.T.B. orthoses, Silicone Cosmetic prosthesis.

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

INTERNSHIP PROGRAMME FOR B.P.O. STUDENTS

This internship programme will be for 6 months after the successful completion of the final year exams by the candidates.
During this internship programme the students will be involved in the day-to-day activities in the Institute mainly concerned with prosthetics and orthotics. They will be participating in the treatment and service programmes which consist of measurement technique of appliances, fabrication of P & O appliances, fitting of appliances, gait training activities, clinical presentation and follow up. They will be connected with production technology of these devices, which comprises of material selection, processing, planning and control prosthetic and orthotics workshop (management technique) and research methodology in order to develop independent thinking in overall management.

They will be working 3 months each in prosthetic and orthotic field respectively. The type of work that they will have to attend is indicated in the adjoining table.

Regular muster will be maintained to keep attendance record and regularity and punctuality will be observed during this programme.

Weekly assessment should be done. If the performance is unsatisfactory, repetition of the postings should be recommended by the supervisor. The work record of the internship program is mandatory to be kept in a work book.

The student will maintain “Critique book” Giving Account of all work done during internship which will be certified by the Institute authorities.

INTERNSHIP PROGRAMME: ORTHOTICS

Types of Orthoses	No. needed to be fabricated
Lower Extremity Orthoses	10
Upper Extremity Orthoses	2
Spinal Orthoses	
Cervical	2
TLSO (incl. one for scoliosis)	2
Lumbo-sacral	2

PROSTHETICS	
BK Prosthesis:	2, (all socket variants)
Partial Foot/and symes Prostheses:	2
AK Prsothesis:	2
Hip disarticulation Prosthesis:	1 (if available)
BE Prosthesis:	2
AE Prosthesis:	2 (1 Cosmetics & 1 Functional)
Congenital limb length deficiency Prosthesis:	1 type

DISTRIBUTION OF TEACHING HOURS FOR THE COURSE OF STUDY

First Year:

H O U R S

S.No.	Subjects	Theory	Practical	Total
1.	Life Science-Anatomy	108	18	126
2.	Life Science Physiology, Pathology	108	18	126
3.	Materials, Tools, Equipments & P &O Workshop Technology	72	36	108
4.	Mechanic, Applied Mechanics & Strength of Materials	72	36	108
5.	Engineering Drawing	72	36	108
6.	Bio-Mechanics-I	72	36	108
7.	Prosthetics Science-I	48	222	270
8.	Orthotic Science-I	48	222	270
	Total	**600**	**624**	**1224 hours**

DISTRIBUTION OF TEACHING HOURS FOR THE COURSE OF STUDY

SECOND YEAR:

H O U R S

Sl No	Subject	Theory	Practical	Total
1.	Physical Medicine & Rehabilitation-I	96	36	132
2.	Physical Medicine &Rehabilitation-II	96	36	132
3.	Orthopaedics & Amputation Surgery	96	---	96
4	Basic Electronics & Electro Technology	96	---	96
5.	Computer Studies-I	36	72	108
6	Bio-Mechanics-II	72	36	108
7.	Prosthetics Science-II	54	222	276
8.	Orthotic Science-II	54	222	276
	Total	**600**	**624**	**1224 hours**

DISTRIBUTION OF TEACHING HOURS FOR THE COURSE OF STUDY

THIRD YEAR:

H O U R S

Sl No	Subject	Theory	Practical	Total
1	P & O Workshop Management	72	24	96
2.	Computer Studies-II(Theory)	72	-----	72
3.	*Computer Studies-II Practical	-----	144	144
4.	Bio-Mechanics-III	72	36	108
5.	Mobility & Rehabilitation Aids(Basic)	38	88	126
6.	Mobility & Rehabilitation Aids(Advanced)	38	88	126
7.	Prosthetics Science-III	54	222	276
8.	Orthotics Science-III	54	222	276
	Total	**400**	**824**	**1224 hours**

*

Note: Delhi University does not have CAD-CAM Training facilities while P.M.R. Department, Safdarjang Hospital & V.M.M.C have got the same available hence we will be following R.C.I guidelines in toto.

DISTRIBUTION OF TEACHING HOURS FOR THE COURSE OF STUDY

FOURTH YEAR:

H O U R S

Sl.No..	Subjects	Theory	Practical	Total
1.	Prosthetics Clinical Practice I	---	112	112
2.	Prosthetics Clinical Practice II	---	112	112
3.	Orthotics Clinical Practice-I	---	112	112
4	Orthotics Clinical Practice-II	---	112	112
5.	Project Work	---	104	104
6.	Study Tour	---	120	120
7.	Prosthetics Science-IV	54	222	276
8.	Orthotics Science - IV	54	222	276
	Total	**108**	**1116**	**1224 hours**

SCHEME OF EXAMINATION

Scheme of Examination for the course shall be as follows.

First year – Bachelor of Prosthetics and Orthotics (BPO)

Subject	Theory		Total (Theory)	Practical		(Total) Practical	Duration (Hrs)
	M.M Annual	M. M. Internal		M.M Annual	M.M Internal		
1.Life Science Anatomy	75	25	100	---	---	---	3 hrs
2. Life Science Physiology & Pathology	75	25	100	---	---	---	3 hrs
3. Materials, Tools Equipment & P &O Workshop Technology	75	25	100	---	---	---	3 hrs
4. Mechanic Applied Mechanic& Strength of Materials	75	25	100	---	---	---	3 hrs
5.Engineering Drawing	75	25	100	---	---	---	3 hrs
6.Bio-Mechanics-I	75	25	100	---	---	---	3 hrs
7..Prosthetic Science-I	75	25	100	75	25	100	3 hrs
8.Orthotic Science	75	25	100	75	25	100	3 hrs

TOTAL MARKS: 800 (Theory) + 200 (Practical) = 1000

SECOND YEAR: Bachelor of Prosthetics & Orthotics

Subject	Theory		Total	Practical		Total	Duration
	M.M. Annual	M.M. Internal	(Theory)	M.M Annual	M.M. Internal.	(Practical)	(Hrs)
1.Physical Medicine & Rehab Ilitation-I	75	25	100	---	---	---	3 hrs
2.Physical Medicine & Rehabi Litation-II	75	25	100	---	---	---	3 hrs
3.Orthopaedics & Amputation Surgery	75	25	100	---	---	---	3 hrs
4.Bacis Ele-tronics & Electro Technology	75	25	100	---	---	---	3 hrs
5.Computer Studies-I	75	25	100	---	---	---	3 hrs
6. Bio Mechanics-II	75	25	100	---	---	---	3 hrs
7.Prosthetic Science-II	75	25	100	75	25	100	3 hrs
8.Orthotic Science-II	75	25	100	75	25	100	3 hrs

TOTAL MARKS: 800 (Theory) + 200 (Practical) = 1000

THIRD YEAR: Bachelor of Prosthetics and Orthotics

Subject	Theory		Total	Practical		Total	Duration
	M.M. Annual	M.M Internal	(Theory)	M.M. Annual	M.M. Internal	(Practical)	(Hrs)
P.& O Workshop Management	75	25	100	---	---	---	3 hrs
Computer Studies-II (Advanced)	75	25	100	---	---	---	3 hrs
Computer Studies-II (Pracical)	----	----	----	75	25	100	3 hrs
Bio – Mechanics -III	75	25	100	---	---	---	3 hrs
Mobility & Rehabilitation Aids (Basic)	75	25	100	---	---	---	3 hrs
Mobility & Rehabilitation Aids (Advanced)	75	25	100	----	---	---	3 hrs
Prosthetics Science-III	75	25	100	75	25	100	3 hrs
Orthotics Science- III	75	25	100	75	25	100	3 hrs

TOTAL MARKS: **700 (Theory) + 300 (Practical) = 1000**

FOURTH YEAR: Bachelor of Prosthetics & Orthotics

Subject	Theory		Total (Theory)	Practical		Total (Practical)	Duration (Hrs)
	M.M. Annual	M.M. Internal		M.M Annual	M.M. Internal		
Prosthetics Clinical Practice- I	-----	------	-----	75	25	100	3 hrs
Prosthetics Clinical Practice-II	----	-------	-----	75	25	100	3 hrs
Orthotics Clinical Practice-I	------	--------	----	75	25	100	3 hrs
Orthotics Clinical Practice-II	-------	----	----	75	25	100	3 hrs
Project Work	----	-----	----	75	25	100	3 hrs
Study Tour	----	-----	-----	75	25	100	3 hrs
Prosthetics Science- IV	75	25	100	75	25	100	3 hrs
Orthotics Science- IV	75	25	100	75	25	100	3 hrs

TOTAL MARKS: **200 (Theory) + 800 (Practical) = 1000**
