



All India Institute of Medical Sciences, Jodhpur

Indicative Syllabus for the Post of Technician Prosthetics or Orthotics

(Syllabus is only indicative. The questions can assess any aspect of knowledge, aptitude, attitude and practical skills, which is expected from a trained person to work efficiently at the advertised post)

Section A

40% Questions covering the following topics:-

General Intelligence & Reasoning: It would include questions of non-verbal type.

The test will include questions on:-

- Similarities and differences,
- Space visualization,
- Problem solving,
- Analysis,
- Judgment,
- Decision making,
- Visual memory,
- Discriminating observation,
- Relationship concepts,
- Figure classification,
- Arithmetical number series,
- Non-verbal series etc.

The test will also include questions designed to test the candidate's abilities to deal with abstract ideas and symbols and their relationship, arithmetical computation and other analytical functions.

Quantitative Aptitude: This paper will include questions on problems relating to:-

- Number Systems,
- Computation of Whole Numbers,
- Decimals
- Fractions
- Relationship between Numbers,
- Fundamental arithmetical operations,
- Percentages,
- Ratio and Proportion,
- Averages,
- Interest,
- Profit and Loss,
- Discount,
- Use of Tables and Graphs,
- Mensuration,
- Time and Distance,
- Ratio and Time,
- Time and Work, etc.

Computer Knowledge: Candidates' understanding of the Basics of Computer Knowledge, its parts, functions, emails, MS office, etc.



Section B (SUBJECT KNOWLEDGE)

60% Questions to be based on the subject specific to the post with following topics:-

PROSTHETICS AND ORTHOTICS (BPO)

1. 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



- 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. UMN and LMN
- 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 for dysfunction.
- Micturition – Physiological anatomy and nervous connection of the bladder, cystometrogram micturition 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

3. 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 : Acrylic And Polyster. Elastomers, H.D.P.E. PP, PP-CP, Visoelastic behaviour of plastics. Introduction to fiber reinforced plastics. Introduction to and their processing especially various techniques of moulding and lamination. Joining of plastics, welding, adhesives and their effect on structure and plastics properties.

Foams: Different types of foams used in P&O especially Latex, Polyurethane, polyethylene and other kind of rigid/semi rigid/ flexible foams.

Plaster of Paris & Silicon and its application procedure in Prosthetic & Orthotic techniques

WORKSHOP TECHNOLOGY



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, 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.

4. 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. Poisson'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.

5. 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.

6. 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.

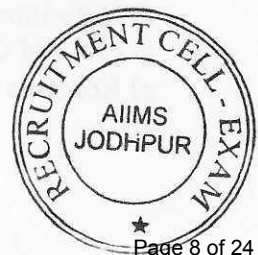
Human locomotion and Gait analysis: Introduction to different ways to do gait analysis by using force plate/TV analysis/ electromyography studies, energy studies, gait repeatability, variation due to age, variation due to footwear, Orthoses/Prostheses.. Trans Femoral Amputee, gait analysis and deviations, gait variations due to alignment or pathological conditions.

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

7. 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.

8. 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:

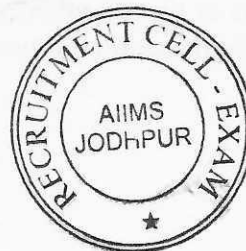
Shoe Modification: Medial/Lateral raise (Inside /outside shoe), M.T. Bar (Inside / Outside shoe), Arch support, Meta tarsal pad, Calcaneal heel wedge, Heel raise, Thomas Heel, Heel pad for Calcaneal spur, 'T' strap (Medial and lateral), Fixation of stirrup plate in shoes/ Sandal, Various types of Arch Supports – flexible/semi rigid/rigid/custommoulded, 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.



1. 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, Infarction, 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.



2. 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

Inflammatory and Degenerative Conditions

Osteomyelitis, arthritis and arthroses, eg - Inflammation of Joints, Rheumatoid Arthritis, infective arthritis, tuberculosis arthritis, Osteoarthritis, Ankylosing 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 Torticollis, spina bifida, spinal anomalies 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

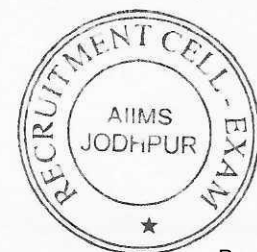
Hip: Outline of Dislocations and subluxations & dysplasia (congenital, traumatic, pathological, paralytic, spastic and central),

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 fasciitis, Anesthetic feet, Bunion toe Hallux Valgus)

Shoulder: Outline of Recurrent dislocation, Bicipital tendinitis and peri-arthritis.

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. Congenital anomalies, podiatry, burns.

3. 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.

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 disorder 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, 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, Ricketts diseases, AIDS.

Out lines of pathology of bone diseases, infections, trauma, & growth disturbances.

- Ricketts, osteomalacia & osteoporosis.
- Fracture of bone & its healing
- Skeletal tuberculosis.
- Osteo myelitis – Pyogenic & tubucular.
- Bone neoplasm.



- Avascular necrosis [osteonecrosis]
- Overview of osteogenesis imperfecta, Paget's 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.

4. 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-oscillation in amplifiers and oscillators.

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.

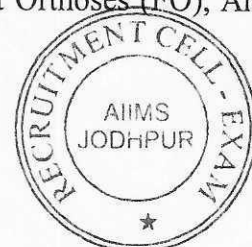
Bio-Electricity: Biological Potentials, Muscle action potentials, Electro-myography and Myo-electricity

5. 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.

6. 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- pelvectomy – 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.

7. 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.

1. 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, Executing 3D 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 (CAD/CAM) and its use in P&O. Other kinds of Computer use in Prosthetics and Orthotics. CAD/CAM 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

2. 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

3. 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 developmental aids.

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

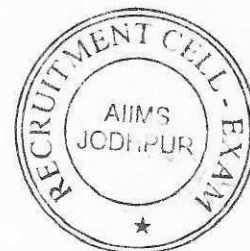
Wheelchair: Manual wheelchair: Benefits of appropriate wheelchair for a wheelchair user, Features and benefits of 'sitting upright' in wheelchair,, Types of wheelchair,cushion and its components and its safe handling, pressure relief techniques, , userassessment, prescription, measurement, fitting, Transfer 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.



4. 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.

5. 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.

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

Research methodology:



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

1. 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.

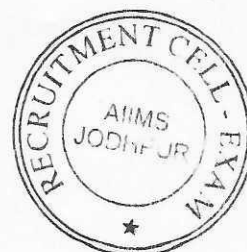
Prosthetics: Bilateral Stubbies. Bilateral Prosthesis. Trans Lumbar Prosthesis (Sitting and Standing), Prosthesis for Child Amputee, Prosthesis for Congenital anomalies, Prosthesis adaptation for sports and recreation, Immediate post surgical fittings, Check-out Procedures.

2. 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.

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 "Total 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 "Total Rehabilitation".

