

SCHEME OF EXAMINATION

&

SYLLABI

OF

**Msc. IN PROSTHETICS & ORTHOTICS
(First Year and Second Year)**

**Guru Gobind Singh Indraprastha University
KASHMERI GATE, DELHI.**

Msc. IN PROSTHETICS & ORTHOTICS

FIRST YEAR

COURSE CODE	COURSE NAME	NUMBER OF HOURS	MARKS IN THEORY	MARKS PRACTICAL	TOTAL MARKS
MPO 101	Biomechanics & Kinesiology	15	100		100
MPO 102	Advanced material in P & O	15	100		100
MPO 103	Advanced Lower Extremity Orthotics	10	100		200
MPO 104	Advanced Lower Extremity Prosthetics	10	100		200
MPO 105	Information Technology and Management Skill	60	100		100
MPO 106	Clinical Gait Analysis**	100			
MPO 107	CAD-CAM in P & O and Electronics**	20			
PRACTICALS					
MPO 151	Practical – Clinical Gait Analysis	400		100	
MPO 152	Practical – CAD/CAM in P & O	400		100	
MPO 153	Clinical Practice in Lower Extremity Orthotics	100		–	
MPO 154	Clinical Practical in Lower Extremity Prosthetics	20		–	
MPO 155	Seminar in P & O**				
	TOTAL		500	200	700

** Grades will be allotted for CAD-CAM and Clinical Gait Analysis

Every student will be required to register themselves for all courses of the programme and will also be required to take up examination to all courses.

Msc. IN PROSTHETICS & ORTHOTICS

SECOND YEAR

COURSE CODE	COURSE NAME	NUMBER OF HOURS	MARKS IN THEORY	MARKS PRACTICAL	TOTAL MARKS
MPO 201	Mobility Aids in Rehabilitation	15	100		100
MPO 202	Advanced Upper Extremity Orthotics	15	100		200
MPO 203	Advanced Upper Extremity Prosthetics	15	100		200
MPO 204	Advanced Spinal Orthotics	15	100		200
MPO 205	Research Methodology & Data Analysis	20	100		100
PRACTICALS					
MPO 251	Clinical Practice in Upper Extremity Orthotics	200		100	
MPO 252	Clinical Practice in Upper Extremity Prosthetics	200		100	
MPO 253	Clinical Practice in Spinal Orthotics	200		100	
MPO 254	Project Work	500	–	200	200
	TOTAL		500	500	1000

** Grades will be allotted for field visits.

Every student will be required to register themselves for all courses of the programme and will also be required to take up examination to all courses.

BIOMECHANICS & KINESIOLOGY

COURSE CODE – MPO 101

Number of Hours: 15 hrs

- ◆ Internal force system – body segment parameters, joint force during swing & stance phase, force analysis on foot & ankle joint, knee joint & hip joint. External force system
- ◆ Biomechanics of foot – Biomechanics of normal foot, pathological foot, foot arches, normal & surgical foot wear, strength of bone, ligament & tissue, friction & friction
- ◆ Biomechanics of ankle – Motion in different plane, loading, joint reaction forces, Strength of Bone, Ligament & Tissue, Friction & Friction
- ◆ Biomechanics of Knee – Motion in different plane, Loading, Joint reaction forces, Strength of Bone, Ligament & Tissue, Friction & Friction
- ◆ Biomechanics of Hip – Motion in different plane, Loading, Joint reaction forces, Strength of Bone, Ligament & Tissue, Friction & Friction
- ◆ Biomechanics of Hand
- ◆ Biomechanics of Spine – Spinal Biomechanics: motion of the spine, biomechanics of different region in spinal column, bio mechanics inter vertebral disc, lumbar spine loading, during normal activities & effects of orthoses on this load, bio mechanical principle of spinal orthosis, Biomechanics of corsets, cervical / thoracic / lumbar / sacral spinal orthoses. Biomechanics of scoliosis correction using different technologies & especially using spinal orthoses.

ADVANCED MATERIALS IN P & O

COURSE CODE – MPO 102

Number of Hours: 15 hrs

- ◆ Thermoplastics – Metal and Alloys: fundamental of metal & alloys both ferrous & non – ferrous, properties, testing and inspection of metals & alloys, heat treatment of metals.
Metal work: mechanical working of metal especially steel and aluminum, fundamental of riveting, soldering, brazing and welding, power metallurgy, surface coating of metal.
- Covering Materials – Wood utilization: wood types, seasoning, preservation, lamination properties and adhesive for wood.
Wood work: introduction to wood, wood works & wood working tools. Pattern making & making of various kinds of joints.
- Material used to manufacture the post of the Orthotics
- Material used to manufacture the shells of Orthotics – Leather utilization: leather, types, tanning, preservation, lamination, properties and adhesive for the leather.
Fabric: fabric types, properties, utilization, selection and quality control.
Plastics: introduction to plastics, types of plastics & molecular structure. Relationship of properties to structure, monomers, polymers, additives, mechanical properties, effect of properties on method of production.
- Fabrication: fabrication process, effect of fabrication process, micro structural changes, shrinkage & other degradation during processing, environmental effect, thermoforming plastics, their fabrication process.
Thermosetting and fabrication process, composite material and their uses, elastomers. H.D.P.E, PP, PP-CP, viscoelastic behavior of plastics, introduction to fiber reinforcement plastics, introduction to and their processing especially various types of moulding and lamination.
Joining: joining of plastics and welding, adhesives and their effect on their structure and plastics properties
Foam: different types of foams used in P & O especially latex, polyurethane, polyethylene & other kind of rigid / semi rigid / flexible foams.

ADVANCED LOWER EXTREMITY ORTHOTICS

COURSE CODE – MPO 103

Number of Hours: 10 hrs

- Floor reaction Orthotics – Partial foot: various types of partial foot prosthesis, its bio mechanics, prescription principles, material used in partial foot prosthesis, various cast techniques of partial foot prosthesis & fabrication techniques.
- ◆ Weight Relieving Orthotics – Fabrication
- ◆ Orthotic training procedure
- ◆ Gait analysis & check out procedure – Human locomotion & gait analysis: introduction to different ways to do gait analysis by using force plate / TV analysis / electromyography studies, energy studies, gait repeatability, variations due to age, variation due to foot ware, orthosis / prosthesis, common type of pathological gait, above knee amputee gait analysis & deviation, gait variations due to alignment or pathological conditions.
- ◆ General Principles of Manufacturing, Orthotics Material & tools & Handling of tools - orthotic component prescription principles of various types of KAFO, knee orthosis, HKAFO.
- ◆ Fabrication: casting & measurement techniques, choosing right kind of material & component, cast modification, fabrication & alignment techniques using different technologies - its advantages & disadvantages, accommodation of limb length discrepancy while designing orthosis, gait analysis & check-out procedure.
- ◆ Fabrication of AFO, KAFO, HKAFO – Shoe modification: medial / lateral rise (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 & lateral), fixation of stirrup plate in shoe / sandal. Various types of arch support – flexible / semi rigid / rigid / custom molded, SMO – custom molded supra malleolar orthosis. Various types of foot orthoses for diabetic feet & other sensory deficiencies.
- ◆ Fabrication of Bilateral HKAFO

ADVANCED LOWER EXTREMITY PROSTHETICS

COURSE CODE – MPO 104

Number of Hours: 10 hrs

- General Principles of Manufacturing, Prosthetics Material & tools & Handling of tools. Knee joints: all types of endoskeletal & exoskeletal knee joints – single axis, polycentric, free, constant friction, variable friction, microchip control, hydraulic, swing phase control, stance phase control knee joints etc. Hip joints: for AK as well as for hip disarticulation / hemipelvectomy - all types of hip joint especially single axis & swivel type.
- Handling of tools, safety, precaution
- Prosthetics training procedure
- Gait analysis & check out procedure
- Selection of components, assembly, alignment. Check up of different types of prosthesis

INFORMATION TECHNOLOGY & MANAGEMENT SKILLS

COURSE CODE – MPO 105

Number of Hours: 60 hrs

Lecturers from guest faculty on any one elective subject from the following:

- Biomechanics related to Prosthetics / Orthotics
- P & O in CBR
- Hydraulics and Pneumatics
- Robotics
- Ergonomics design of Prosthesis and Orthosis – introduction to definition & scope in modern industrial social studies on machine or man oriented topics, display 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 principle.

CAD / CAM IN P & O

COURSE CODE – MPO 107

Number of Hours: 20 hrs

Designing of Orthotic & Prosthetics devices – Basic of CAD: introduction, definition, history, current status, product cycle, automation, designing, application & benefits.

Computer Graphics: introduction of software, function of graphic package, application software.

Auto CAD 2002: Introduction, foundation of Auto CAD commands, execution of simple 2D drawing, understanding 3D commands, executing 3D commands, creating 3D.

Rendering & image attach to an object starting new project, creating, editing, saving drawing, annotation, dimension, plotting, customization, AutoLisp.

1. Basic of CAD: introduction of CNC machine, basics of computer aided designing & manufacturing (CAD/CAM) & its use in P & O, other kinds of computer use in Prosthetics & Orthotics.
- Biomechanical Principle

CLINICAL PRACTICE IN LOWER EXTREMITY ORTHOTICS

COURSE CODE – MPO 151

Number of Hours: 400 hrs

- Fabrication of lower extremity orthotics system & testing their efficacy on the subject with experiments.

Orthosis in lower motor neuron disorders, orthosis in upper motor neuron disorders various types of KO, weight reliving orthosis, FRO, Toronto brace, low cost orthosis, bilateral HKAFO, orthoses in arthritis, orthoses in fracture, orthoses in hemophilia, orthoses in progressive muscular dystrophy, orthoses in juvenile disorders etc.

CLINICAL PRACTICE IN LOWER EXTREMITY PROSTHETICS

COURSE CODE – MPO 152

Number of Hours: 400 hrs

- Fabrication of lower extremity Prosthetics system & testing their efficacy on the subject with experiments. Fabrication of partial foot prosthesis, chopart prosthesis, Symes & various types of B.K prosthesis using different technology.

PRACTICAL – CLINICAL GAIT ANALYSIS

COURSE CODE – MPO 153

Number of Hours: 100 hrs

Clinical Gait Analysis

- Transtibial amputee (TT)
-
- Transfermoral (TF)

- Through Hip (TH) – various types of through hip prosthesis, different types prescription principles, material & component to be used, casting & measurement techniques, cast modification, alignment, suspension fitting, donning & doffing techniques, check-out procedure, testing & training, gait analysis & gait deviation

- Moulded AFQs

- Articulated AFQs

- KAFO's (with lock)

- HKAFO

- Bilateral Involvement

- Pathological Gait Analysis

PRACTICAL – CAD / CAM IN P & O

COURSE CODE – MPO 154

Number of Hours: 20 hrs

CAD / CAM in P & O

Fabrication & designing of various gadgets with the help of CAD / CAM

- Transtibial Amputation
- Transfemoral Amputation
- Through Knee
- Through Hip
- Moulded AFO's
- Quadrilateral sockets for KAFO
- Under arm Braces
- DLSO – AP
- Moulded Cervical Orthotics

Trainees has to be through in all branches CAD/CAM especially AutoCAD, trainees should make design of all common types of P & O component which are regularly in use by using AutoCAD software.

Grades will be allotted for the subject.

SECOND YEAR

MOBILITY AID IN REHABILITATION

COURSE CODE – MPO 201

Number of Hours: 15 hrs

- Wheel chair & tricycle - types, design, strength & Special purpose wheelchair / Tricycle Dimensions, Modifications – different types, prescription criteria, measurements techniques, wheel chair modification & maintenance according to individual's need, various attachment of the wheel chair, motorized wheel chair, tricycle & motorized tricycle, scooty, different types of cushion & its fabrication techniques.
- Crutches, canes & sticks : Measurements, Strength, Types etc. - Gait Training with crutches: training with various walking aides & that to different ways, installation / fabrication of parallel bars & transition from parallel bars to walker then to crutches or sticks.
- Walker / other mobility aid: Measurement, Types, Design strength – Developmental aids: bio mechanics of different kind of developmental aids, normal mile stone & delayed mile stone, measurement techniques, fabrication of box seat, special chair with or without table / tray, standing / tilting frame, low level cart, prone board & various developmental & educational toys, maximum use of appropriate technology while making developmental aids.
- Moulded seats: bio-mechanics, prescription criteria, cast & measurement techniques, cast modification & fabrication of moulded seats with inside or outside posting, use of different materials & technologies to fabricate the same, suspension or right kind of strapping.

ADVANCED UPPER EXTREMITY ORTHOTICS

COURSE CODE – MPO 202

Number of Hours: 15 hrs

- Measurement – casting – impression
- Nomenclature & Knowledge of different type of Orthotic, their purpose of giving & check up
- Selection of components, assembly, alignment, check-up of different types of Orthotics- Upper limb orthotics: objective of splinting & principles, biomechanical principle of all type of Upper Limb Orthotics, material used & its advantage & disadvantage, basic component splinting, all type of hand / finger orthoses, wrist hand orthoses which includes – flexor hinge splint finger driven, - flexor hinge splint wrist driven, flexor hinge splint shoulder driven, casting / measurement & fabrication of EO elbow wrist & hand orthoses, elbow brace appliances to allow mobilization . Immobilization, appliances for flail elbows, casting / measurement & fabrication of shoulder orthoses, the shoulder joint braces & splints, abduction splint & braces, traction splint of humerus, all types of shoulder elbow wrist & hand orthoses which also includes both body powered & externally powered, all types of fracture orthoses, temporary splinting, feeder & other assistive appliances.

ADVANCED UPPER EXTREMITY PROSTHETICS

COURSE CODE – MPO 203

Number of Hours: 15 hrs

- Measurement – casting – impression
- Nomenclature & Knowledge of different type of Orthotic, their purpose of giving & check up
- Selection of components, assembly, alignment, check-up of different types of Orthotics-

Partial hand: both cosmetic & functional types which also includes silicon prostheses, cosmetic hand glove & finger, device for augmentation of function & cosmetic for partial hand amputation & finger amputation.

Wrist disarticulation: prescription criteria, types of through wrist prostheses – component, socket shape, clinical consideration, casting & measurement techniques, cast modification, fabrication techniques, alignment techniques, harnessing & suspension mechanism, fitting, donning & doffing techniques, check out procedure, testing, & training.

Below elbow: prescription criteria, types of B.E prostheses – component, type of socket which include self-suspending, flexible / rigid socket or combination of both, clinical consideration, casting & measurement techniques. Cast modification, fabrication techniques – single wall / double wall, alignment techniques, harnessing & suspension mechanism, control system – body powered & externally powered, fitting donning & doffing techniques, check out procedure, testing & training.

Above elbow: prescription criteria, types of AE prostheses which also included elbow disarticulation prostheses – components, different types of elbow mechanism, types of socket which includes self suspension, flexible / rigid socket or combination of both, clinical consideration, casting & measurement techniques. Cast modification, fabrication techniques – single wall / double wall, alignment techniques, harnessing & suspension mechanism, control system – body powered & externally powered, fitting donning & doffing techniques, check out procedure, testing & training.

Shoulder disarticulation: prescription criteria, types of shoulder disarticulation prostheses both cosmetic & functional – components, different types of elbow & shoulder mechanism, types of socket, flexible / rigid socket or combination of both, clinical consideration, casting & measurement technique. Cast modification, fabrication techniques – single wall / double wall, alignment techniques, harnessing & suspension mechanism, control system – body powered & externally powered, fitting donning & doffing techniques, check out procedure, testing & training.

ADVANCED SPINAL ORTHOTICS

COURSE CODE – MPO 204

Number of Hours: 15 hrs

Spinal Orthotics -

- Measurement – casting – impression
- Nomenclature & Knowledge of different type of Orthotic, their purpose of giving & check up
- Selection of components, assembly, alignment, check-up of different types of Orthotics-

Spinal orthoses: historical development of spinal orthotics, anatomical & physiological principles of construction & fitting of spinal orthoses, biomechanical principle & function of spinal orthoses.

Cervical orthoses: principle, material, measurement / casting, fabrication of all types of Cervical orthoses especially different type of cervical collar, semi – rigid / rigid cervical orthoses both temporary & permanent, cervical traction – various types.

Thoraco lumbar sacral orthoses: flexible spinal orthoses, rigid spinal orthoses, principal, material, measurement / casting, fabrication of all types of Thoraco lumbar sacral orthoses (TLSO) especially all types of orthoses for scoliosis. All type of under arm orthoses & variants, various types of immobilizer, fitting, donning & doffing techniques, check out procedure, testing & training.

Lumbo sacral orthoses: principle, material, measurement / casting, fabrication of all type of lumbo sacral orthoses (LSO), especially corset & all types of orthoses for loardosis & scoliosis, pelvic traction & its use.

- Identification of objectives and research planning-
 - Principle of research designing
 - Design, instrumentation & analysis for qualitative research
 - Design, instrumentation & analysis for quantitative research
 - Design, instrumentation & analysis for quasi-experimental research
 - Design models utilized in P & O
- Management of personal motivation establishing priorities and achieving objectives
- Time management
- Stimulation of creativity
- Search and critical appraisal of literature
- Role of supervisor
- How to write a paper and get it published-
 - Define measurement
 - Measurement framework
 - Scales of measurement
 - Pilot study
 - Types of variables
 - Reliability & validity
 - Drawing tables, graphs, master charts etc.
- Thesis writing
 - Review of Literature
 - Formulating a question, operational definition
 - Inclusion & Exclusion criteria
 - Forming groups
 - Data collection & analysis
 - Result, interpretation, conclusion, discussion
 - Informed consent
 - Limitations
 - Presenting papers at scientific meeting

CLINICAL PRACTICE IN UPPER EXTREMITY ORTHOTICS

COURSE CODE – MPO 251

Number of Hours: 200 hrs

- Fabrication of at least one B/E and A/E Myoelectric hand and at least one externally powered band.
- At least one shoulder disarticulation / Forequarter amputee should be fitted and presented in clinic.

COURSE CODE – MPO 252

Number of Hours: 200 hrs

- Fabrication of at least one B/E and A/E Myoelectric hand and at least one externally powered band.
- At least one shoulder disarticulation / Forequarter amputee should be fitted and presented in clinic.

CLINICAL PRACTICE IN SPINAL ORTHOTICS

COURSE CODE – MPO 253

Number of Hours: 200 hrs

- Fabrication and fitting of at least 2 different halo-pelvic systems
 1. With Molded DLSO
 2. With Milwaukee brace

- At least 3 various types of underarms orthosis

- At least 3 various types of advanced cervical / cervico-thoracic/cervico-thoracic lumbar Sacral orthosis etc.

- Fabrication and fitting at least 3 different advanced upper extremity orthosis system
 1. Externally powered functional arms orthotics
 2. Various arm attachment with low temperature thermoplastics.

PROJECT WORK

COURSE CODE – MPO 254

Number of Hours: 500 hrs

The candidate is advised to collect a topic for dissertation in especially of his choice in P & O, perform related studies as regards materials, fabrications, designs, and analysis of performance and prepare a complete project to be submitted to the university with the help of the allotted guide.

Required numbers of copies of the project work are to be submitted by the student three months before the scheduled date of examination. The evaluation will be done by the external examiner.

Any one-elective subject.

- 1. Molding design & concept**
- 2. Mass production technology**
- 3. Cosmetic prosthesis**

FIELD VISITS

Field visit to be arranged by the Institute / affiliated University in specialized area related to P & O application.

Grade will be given for the same.