

**Syllabus for**  
**First Year M. Sc (P &O)**

**Subjects**

1. Biomechanics & Kinesiology
2. Advances in Materials for prosthetics & Orthotics
3. Advances in Lower Extremity Orthotics
4. Advances in Lower Extremity Prosthetics
5. Information Technology & Management Skills.

# **1.1 Biomechanics & Kinesiology**

**Number of Hours ( Theory ) : 50 hrs  
( Demo ) : 10 hrs**

**Marks :-100**

- Basic Mechanics
- **Biomechanics**
  1. Fatigue of bone under repetitive loading
  2. Degenerative changes in bone associated with ageing.
  3. Behaviour of articular cartilage in pure shear.
  4. Lubrication of articular cartilage.
  5. Composition & Structure of Tendons & Ligaments.
  6. Factors that affect the biomechanical properties of tendons & ligaments.
  7. Compression injuries of peripheral nerves.
  8. Force production in muscle. (Length-Tension Relationship)
  9. Biomechanics of the knee.
  10. Biomechanics of the hip.
  11. Biomechanics of the ankle.
  12. Biomechanics of the foot.
  13. Biomechanics of the lumbar spine.
  14. Biomechanics of the cervical spine.
- **Biomechanics of aids & appliances.**
- **Gait & Motion Analysis.**
- **Force plate / Pressure studies.**

# **1.2 Advances in Materials in Prosthetics & Orthotics**

Number of Hours : 60 hrs

Marks: 100

## **1. Polymers**

- ✓ Definition
- ✓ Types of Polymers.
- ✓ Processing of polymers
- ✓ Conversion of polymers
- ✓ Polymer additives & Reinforcements

## **2. Alloy steel**

- ✓ Definition
- ✓ Properties, effect of heat treatment
- ✓ Applications
- ✓ Ti, Ta, Cr, Mo, V, Ni & Si

## **3. Ceramic**

- ✓ Definition
- ✓ properties
- ✓ Manufacturing process & Applications.

4. Non-ferrous Metals

5. Surface coating/treatment process

6. Design concepts & Principles of designing.

7. Rubbers.

8. Testing of Materials.

# **1.3 Advances in Lower Extremity Orthotics**

**Number of Hours Theory: 60 Hrs- Practical 400 hrs- Seminars 20 Hrs**

**Marks:- 100 Theory + 100 Practical (50 term work + 50 Practical exams)**

Variety of Modern hip, Knee and Ankle joints.

1. Modern Ankle & Foot attachments.
2. Principles influencing Orthotic design concepts
3. Orthoses for sports Injuries with advanced designs.
4. Advances in Orthotic Management of,
  - a) Spina Bifida/ Myelomeningocele
  - b) Legg Calves perthe's Disease
  - c) Paralytic disorders.
  - d) Trauma & Functional Fracture Bracing.
  - e) Neuropathic & Dysvascular patient.
  - f) Foot
  - g) Pain
5. Advances in Pediatric Orthotics for lower limbs.
6. Reciprocating gait Orthosis.
  - a) Design
  - b) Construction & Clinical applications.

## **7. Clinical Gait Analysis (Theory)**

To learn the significance of differences in the magnitude of internal Joint reaction forces & force moments. To collect & interpret normal & pathological 3-D Kinetic & Kinematic Gait data

## **Clinical Practice in Lower Extremity Orthotics (400 hrs)** **(50 Mks Term Work & 50 Mks Practical Exams)**

**A. Candidate has to conduct a clinical gait analysis of the subjects  
Mentioned below**

- |  |   |
|--|---|
| • Subjects fitted with molded AFO's        | 2 |
| • Subjects fitted with articulated AFO's   | 2 |
| • Subjects Fitted with KAFO's (Functional) | 1 |
| • Subjects fitted with KAFO's (Locked)     | 1 |
| • Subjects fitted with HKAFO's.            | 1 |
| • Subjects with bilateral involvement.     | 1 |
| • Pathological gait analysis.              | 2 |

**Total** **10**

**B. Each candidate has to fit the appliances mentioned below, study their efficacy and maintain a journal detailing the results.**

<b>Practical Assignments</b>		
<b><u>Category</u></b>	<b><u>Description</u></b>	<b><u>Nos</u></b>
<b>Foot Orthosis</b>	Moulded Inserts, a) Rigid Plastic Type b) Soft Foam type Foot Orthoses for, a) Hallux Valgus b) Claw Toes c) C.T.E.V etc.	2 Nos
<b>Ankle.Foot.Orthosis.</b>	a) Conventional (Ankle Joint Type with different actions) b) Total-Contact – Plastic c) Spiral Orthosis d) Posterior Leaf Spring	2 Nos
<b>Knee.Orthosis</b>	Different types of K.O for a) Sports Injuries b) Osteoarthritis	2 Nos
<b>Knee. Ankle. Foot. Orthosis.</b>	Conventional with Boots Modular – Shoe Less Trilateral Orthosis Weight. Relieving Orthosis	3 Nos
<b>Hip.Knee.Ankle.Foot.Orthosis</b>	1. Reciprocating Gait Orthosis 2. Conventional & Modular (H.K.A.F.O)	1 Nos
<b><u>CAD-CAM AIDED DESIGNS</u></b>		
Fabrication & designing of various gadgets with the help of CAD/CAM		
<b>Knee. Ankle. Foot. Orthosis</b>	#Shaft Femur or Flail Limb	2 Nos
<b>Ankle. Foot. Orthosis.</b>	Unstable ankles / Flail ankles	2 Nos

**Seminar in Orthotics**

**20 hrs**

**Student will have to make a presentation on the subjects assigned to him/her by his/her Guide.**

- Biomechanics related to Orthotics
- Role of Orthotics in CBR
- Robotics
- Ergonomics designs of Orthosis.

# 1.4 Advances in Lower Extremity Prosthetics

**Numbers of Hours Theory: 60 Hrs – Practicals : 400 Hrs- Seminar: 20 Hrs**

Marks: - 100 Theory + 100 Practicals [50 term work + 50 Practical exams]

- **Modern Prosthetic Feet :**

Evolution in Prosthetic Feet Technology,  
Prosthetic feet for partial foot amputations, Pirogoff foot, Symes foot  
Feet for trans tibial, through knee, trans-femoral & through hip  
Prosthesis.

- **Modern Prosthetic Knees :**

Evolution of Prosthetic Knees  
Constant Friction knee, Stabilised Knee, Manual Lock Knee,  
Polycentric Four Bar Knee Joints, Uniaxial Knee Joints, Hydraulic  
and Pnuematic Controls In Prosthetic knees, Microprocessor Controls  
In Prosthetic Knees (IP+), C-LEG Adaptive Knee etc.

- **Recent Advances in Prosthetic Socket Technology:**

- ✓ **Trans Tibial** : Evolution in Socket Design Technology, Pelite,  
Pedilin, Silicon, Polyurethane Foam,
- ✓ **Trans Femoral** : Evolution in Socket Design Technology,
- ✓ **Through Knee**
- ✓ **Through Hip**

- **Prosthesis for Persons with high level and bilateral amputations**
- **Prosthetic management of children with limb deficiencies.**
- **Advances in Prosthetic management of hip disarticulation, trans-pelvic amputation & trans-lumbar amputations.**
- **Research in lower limb prosthetics**
- **Clinical Gait Analysis (Theory)**

To learn the significance of differences in the magnitude of internal  
Joint reaction forces & force moments. To collect & interpret normal  
& pathological 3 - D Kinetic & Kinematic gait data.

**Clinical Practice in Lower Extremity Prosthetics (400 hrs)**  
**(50 Mks Term Work & 50 Mks Practical Exams)**

**A. Candidate has to conduct a clinical gait analysis of the subjects mentioned below**

➤ Transtibial amputee.	3
➤ Transfemoral amputee.	2
➤ Through Hip amputee	1
Total	<u>6</u>

B. Each candidate has to fit the appliances mentioned below, study their efficacy and maintain a journal detailing the results.

<b>Practical Assignments</b>		
Prosthetic Feet	a) S.A.C.H Foot b) Jaipur Foot c) Flex Foot d) Energy Storing Feet	To study the designs, actions and constructions of various feet.
Extension Prosthesis	Congenital Anomalies	3 Nos
Trans-Tibial (Symes & Below – Knee)	a) Exoskeletal b) Endoskeletal Type	3 Nos (Study of different types of Sockets)
Prosthetic Knee Units	a) Constant Friction Knee b) Stabilised Knee c) Polycentric Knee d) Hydraulic & Pneumatic e) Micro-Processor Controlled Knee	To study the designs, functions and constructions of various Knee Units.
Trans-Femoral (Above – Knee)	a) Exoskeletal Type b) Endoskeletal Type	3 Nos
Hip Disarticulation	Canadian type (Exoskeletal)	1 Nos
<b>CAD-CAM AIDED DESIGNS</b>		
Fabrication & designing of various gadgets with the help of CAD/CAM		
Trans-Tibial (Below – Knee)	K.B.M/ PTB (Classical)	2 Nos.
Trans-Femoral (Above – Knee)	Quadrilateral/Narrow M-L type	2 Nos.
Through Knee (Knee Disarticulation)	BOTTA Technology Type	1 Nos.

### **Seminar in Prosthetics**

**20 hrs**

**Student will have to make a presentation on the subjects as mentioned below designated to him/her by his/her Guide.**

- Biomechanics related to Prosthetics
- Prosthetics in CBR
- Hydraulics and Pneumatics
- Ergonomics designs of Prosthesis.

# 1.5 Information Technology & Management Skills

Number of Hours (Theory): 60 Hrs

Marks: 100

## **Information Technology**

1. Information Technology, the internet, information systems
2. Applications Software
3. System Software, Operating systems, Utilities & Device Drivers.
4. Input & Output
5. Information Storage & Management
6. Connectivity
7. Websites of P & O
8. Database Managements Systems
9. Network Management & Security.
10. Development of software for patient information systems & Hospital management systems
11. Web page Designing/Hosting.

## **Management Skills**

1. Introduction to Management.
2. Functions of Management.
3. Communication.
4. Planning.
5. Decision Making.
6. Organization & Organizational Dynamics
7. Relationship Management & Human Capital Development
8. Direction & Co-ordination
9. Control.
10. Understanding of Indian Administration System.
11. Manager & Leadership Qualities.
12. Personnel Management
13. People with Disability – Act 1995.

**SCHEME OF EXAMINATION FOR I- M.Sc. (P&O) AS PER  
R.C.I. NORMS**

<b>SN</b>	<b>Subjects</b>	<b>Theory (Marks)</b>	<b>Term Work (Marks)</b>	<b>Practical/ Oral (Marks)</b>	<b>Paper Duration</b>
01	Biomechanics & Kinesiology	100	--	--	3 hrs
02	Advances in Materials for Prosthetics & Orthotics	100	--	--	3 hrs
03	Advances in Lower Extremity Orthotics	100	50	50	3 hrs
04	Advances in Lower Extremity Prosthetics	100	50	50	3 hrs
05	Information Technology & Management Skills	100	--	--	3 hrs
<b>Total Marks</b>		<b>500</b>	<b>100</b>	<b>100</b>	<b>700 hrs</b>

- There will be no internal assessment tests in the subjects cited above.
- Candidate can take a maximum of one supplementary exam per academic year.
- For passing the exams, a candidate must secure minimum 50% marks each in theory & practical. After successful completion of 1<sup>st</sup> year & 2<sup>nd</sup> year of the course, Post Graduate degree will be awarded by the University.

# **SYLLABUS FOR** **SECOND YEAR – M.Sc. (P&O)**

## **Subjects**

1. Mobility Aids in Rehabilitation.
2. Advances in Upper Extremity Orthotics.
3. Advances in Upper Extremity Prosthetics.
4. Advances in Spinal Orthotics.
5. Research Methodology & Data Analysis.
6. Project Work.

## **2.1 Mobility aids in Rehabilitation**

**Number of Hours (Theory): 50 Hrs**

**Marks: 100**

- Advances in wheel chairs & tri-cycles
- Low height mobility devices.
- Mobility devices for various neuro-muscular disorders.
- Mobility devices for C.B.R.
- Advanced gait aids.
- Moulded seats: bio-mechanics, prescription criteria, casting & measurement techniques, cast modification & fabrication of moulded seats with inside or out side posting, use of different materials & technologies to fabricate the same, suspension or right kind of strapping.
- Advances in wheel chair modifications for individual needs

## **2.2 Advances in Upper Extremity Orthotics**

**Number of Hours (Theory): 50 Hrs – Practicals: 160 Hrs**

**Marks : Theory 100 + 100 Practicals [ 50 term work + 50 Practical exams]**

- Prescription criteria of Upper Extremity Orthoses.
- Nomenclature & Knowledge of difference type of Orthoses, their Purposes & check out.
- Biomechanical principles used in Upper Extremity Orthoses.
- Sources of power & their importance
- Feeders
- Orthoses for burns.
- Advancements in Hand & Wrist Hand Orthosis
- Advancements in Shoulder, Elbow & Wrist Hand Orthosis
- Recent advancements in the orthotic management of Ulnar, Median & Radial nerve palsies.
- Recent advancements in the orthotic management of Brachial plexus Injuries.
- Molded design & concepts

### **CLINICAL ASSESSMENT/PRACTICE**

#### **Advances in Upper Extremity Orthotics**

**(50 Mks Term Work & 50 Mks Practical Exams)**

**Each candidate has to fabricate and fit the appliances and maintain a Journal detailing the results.**

<b>Practical Assignments</b>		
<b><u>ORTHOTICS</u></b>		
<u>Category</u>	<u>Description</u>	<u>Nos</u>
Hand	WHO	2 Nos
Shoulder	Flail Arm Orthosis	1 Nos
<b><u>CAD-CAM AIDED DESIGNS</u></b>		
Upper Extremity Orthosis	Designing an orthosis for flail arm	1 Nos

## **2.3 Advances in Upper Extremity Prosthetics**

**Number of Hours (Theory): 50 Hrs – Practicals : 140 Hrs**

**Marks: Theory 100 + 100 Practicals [ 50 term work + 50 Practical exams)**

- Levels of amputations and fitting problems associated with them.
- Modern Prosthetic Components for the Wrist, Elbow & Shoulder.
- Selection of components, assembly, alignment, check-out of different types of Prosthesis.
- Advances in the Management of partial hand, wrist disarticulation, and elbow disarticulation, shoulder disarticulation & fore quarter amputees.
- Myo-electric Prosthesis for the trans-radial & trans-humeral amputees.
- Bilateral Upper Limb Prosthesis.
- Prosthetic Adaptations in Competitive Sports & Recreation.
- Research Trends in Upper Extremity Prosthetics.
- Cosmetic Prosthesis.

### **CLINICAL ASSESSMENT/PRACTICE**

#### **Advances in Upper Extremity Prosthetics (50 Mks Term Work & 50 Mks Practical Exams)**

**Each candidate has to fabricate and fit the appliances and maintain a Journal detailing the results**

<b>Practical Assignments</b>		
<b><u>Category</u></b>	<b><u>Description</u></b>	<b><u>Nos</u></b>
Below-Elbow	Myoelectric type & Body powered type	1 No each.
A/E & Shoulder	Preferably bilateral amputee	1 Nos
<b><u>CAD-CAM AIDED DESIGNS</u></b>		
Upper Extremity Prosthesis	Designing a prosthesis for a shoulder amputee	1 Nos

## **2.4 Advances in Spinal Orthotics**

**Number of Hours (Theory): 50 Hrs – Practical : 150 Hrs**

**Marks : Theory 100 + 100 Practicals [50 term work + 50 Practical exams]**

- An Overview of conventional spinal orthoses.
- Biomechanics of the Spine and its three-column structure, follower load concept, Euler's model.
- Flexural rigidity of the spine & Biomechanical implications of surgical stabilization of the spine vis –a-vis orthotic stabilization.
- Recent advances in Orthotic management of spinal fractures.
- Recent advances in Orthotic management of spinal pain.
- Advanced materials in Orthotic Management of the Spine.
- Recent advances in Orthotic management of spinal deformities.
- Mass Production Technology.

### **CLINICAL ASSESSMENT / PRACTICE**

#### **Advances in Spinal Orthotics (50 Mks Term Work & 50 Mks Practical Exams)**

Each candidate has to fabricate and fit the appliances and maintain a Journal detailing the results

<b>Practical Assignments</b>		
<b>Category</b>	<b>Description</b>	<b>Nos</b>
Spinal Orthosis	LSO/TLSO/CTLSO (Conv & Advanced type)	3 Nos
	Halo – Pelvic Systems	1 Nos
<b>CAD-CAM AIDED DESIGNS</b>		
Spinal Orthosis	Miami/Boston (under arm orthosis)	2 Nos

## **2.5 Research Methodology & Data Analysis**

**Number of Hours : 50 Hrs**

**Marks: 100**

- 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

### **2.6 Project Work (Dissertation)**

**Number of Hours: 500 Hrs**

A Candidate has to select a topic of his/her choice in P&O for dissertation and perform studies as regards:-

- Materials
- Fabrication
- Designs
- Analysis of performance

and prepare a detailed report to be submitted to the University.

### **2.7 Field visits**

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

**SCHEME OF EXAMINATION FOR II – M. Sc. ( P & O) AS PER  
R.C.I. NORMS**

<b>SN</b>	<b>Subjects</b>	<b>Theory Marks</b>	<b>Term Work Marks</b>	<b>Practical / Oral Marks</b>	<b>Paper Duration</b>
1.	Mobility Aids in Rehabilitation	100	--	--	3 hrs
2.	Advanced Upper Extremity Orthotics	100	50	50	3 hrs
3.	Advanced Upper Extremity Prosthetics	100	50	50	3 hrs
4.	Advanced Spinal Orthotics	100	50	50	3 hrs
5.	Research Methodology & Data Analysis	100	--	--	3 hrs
6.	Project Work	--	--	200	--
<b>Total Marks</b>		<b>500</b>	<b>150</b>	<b>350</b>	<b>1000</b>

**\* There will be no internal assessment tests in the subjects cited above**