

# Curriculum Framework

## Bachelor in Prosthetics and Orthotics (B.P.O.)

### Norms, Regulations & Course Content

Effective from Academic Session 2017-18  
Four and Half Years Duration (Annual)



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# **Bachelor in Prosthetics and Orthotics (B.P.O.) Programme<sup>1</sup>**

## **I. PREAMBLE**

Prosthetics and Orthotics is a specialized health care profession, which combines a unique blend of clinical and technological skills. The Prosthetic and Orthotic Professionals assess and evaluate patients, prescribe custom design, fabricate, and fit the orthoses and prostheses. Rehabilitation of persons with locomotor disabilities or neuromuscular disorder is a team work, where Centre of attention are the persons with disabilities. This work requires substantial clinical and technical judgment. Prosthetic and Orthotic Professional does not only provide service to persons with neuro- musculoskeletal disorder and persons with disability, but also it provides service to general health and work related disorder such as foot disorders, fracture, sports injuries, disorders due to aging, tendinitis, muscular pain , aesthetic restoration etc.. Prosthetics and Orthotics Professionals play an important role in the comprehensive pre and post-surgical management of amputee and other neuromusculoskeletal disorders. Prosthetics and Orthotics Professionals makes the patient independent, confident and useful member of the society through comprehensive prosthetic and orthotic management

## **II. OBJECTIVES**

At the end of the BPO Course, the learner shall be able :

1. To assess, prescribe and provide comprehensive prosthetic and orthotic management to the individual and the community appropriate to his/her position as a member of the health care team.
2. Be competent to take preventive, supportive, corrective and rehabilitative steps in respect to the commonly encountered problems related to prosthetics and orthotics.
3. To carry out Evidence Based Practice in prosthetics and orthotics
4. Appreciate the psycho-social, cultural, economic, and environmental factors affecting health, and develop humane attitude towards the patients/relatives, in discharging one's professional responsibilities
5. Be familiar with the various National policies and acts related to empowerment of Persons with Disabilities.

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<sup>1</sup>This Degree is as per UGC Notification on Specifications of Degrees March 2014 as published in the Gazette of India, July 5, 2014.

6. Acquire basic management & administrative skills in the areas of materials, financial and human resources related to prosthetics and orthotics
7. Develop the communication skills to establish effective communication with the stake holders
8. Practice prosthetics & orthotics ethics in patient care, service delivery, and research.
9. Develop attitude for self-learning and acquire necessary skills including the use of appropriate technologies.

### III. NOMENCLATURE

## BACHELOR IN PROSTHETICS & ORTHOTICS (B.P.O.)

### IV. PROGRAMME STRUCTURE

#### FIRST YEAR

| Course Code  | Title                                     | Theory Hrs | Practical Hrs | Total Hrs   | Marks Theory | Marks Practical | Total Marks | Credit Points |
|--------------|---|------------|---------------|-------------|--------------|-----------------|-------------|---------------|
| BPO101       | Anatomy                                   | 120        | 40            | 160         | 100          | --              | 100         |               |
| BPO102       | Physiology                                | 90         | 30            | 120         | 100          | --              | 100         |               |
| BPO103       | Workshop Technology & Material Science    | 80         | 20            | 100         | 100          | --              | 100         |               |
| BPO104       | Applied Mechanics & Strength of Materials | 80         | 20            | 100         | 100          | ---             | 100         |               |
| BPO105       | Biomechanics I                            | 60         |               | 60          | 100          | --              | 100         |               |
| BPO106       | Basic Electronics                         | 60         | -             | 60          | 100          |                 | 100         |               |
| BPO107 / 151 | *Prosthetic Science -I                    | 80         | 230           | 310         | 100          | 100             | 200         |               |
| BPO108 / 152 | *Orthotic Science -I                      | 80         | 230           | 310         | 100          | 100             | 200         |               |
|              | <b>Total</b>                              | <u>650</u> | <b>570</b>    | <b>1220</b> | <b>800</b>   | <b>200</b>      | <b>1000</b> |               |

## SECOND YEAR

| Course Code  | Subjects   | Theory Hrs | Practical Hrs | Total Hrs   | Marks Theory | Marks Practical | Total Marks | Credit Points |
|--------------|--|------------|---------------|-------------|--------------|-----------------|-------------|---------------|
| BPO201       | Pathology  | 80         |               | 80          | 100          | --              | 100         |               |
| BPO202       | Orthopaedics, Amputation Surgery & Imaging Science | 80         | 20            | 100         | 100          | --              | 100         |               |
| BPO203       | Community Rehabilitation & Disability Prevention   | 60         |               | 60          | 100          |                 | 100         |               |
| BPO204       | Biomechanics II                                    | 70         | 30            | 100         | 100          |                 | 100         |               |
| BPO 205      | Psychology & Sociology                             | 60         |               | 60          | 100          |                 | 100         |               |
| BPO206 / 251 | *Prosthetic Science-II                             | 80         | 300           | 380         | 100          | 100             | 200         |               |
| BPO207 / 252 | *Orthotic Science-II                               | 80         | 300           | 380         | 100          | 100             | 200         |               |
| BPO 208      | Pharmacology                                       | 60         |               | 60          | 100          |                 | 100         |               |
|              | <b>Total</b>                                       | <b>570</b> | <b>650</b>    | <b>1220</b> | <b>800</b>   | <b>200</b>      | <b>1000</b> |               |

### THIRD YEAR

| Course Code | Subjects                                   | Theory Hrs | Practical Hrs | Total Hrs   | Marks Theory | Marks Practical | Total Marks | Credit Points |
|-------------|--|------------|---------------|-------------|--------------|-----------------|-------------|---------------|
| BPO301/353  | Computer Science & graphical communication | 80         | 120           | 200         | 100          | 100             | 200         |               |
| BPO302      | Bio-Mechanics-III                          | 80         |               | 80          | 100          | --              | 100         |               |
| BPO303      | Assistive Technology                       | 80         |               | 80          | 100          | -               | 100         |               |
| BPO304      | Research Methodology & Bio Statistics      | 60         | ---           | 60          | 100          | ---             | 100         |               |
| BPO305/351  | *Prosthetic Science-III                    | 80         | 320           | 400         | 100          | 100             | 200         |               |
| BPO306/352  | *Orthotic Science-III                      | 80         | 320           | 400         | 100          | 100             | 200         |               |
|             | <b>Total</b>                               | <b>460</b> | <b>760</b>    | <b>1220</b> | <b>600</b>   | <b>300</b>      | <b>900</b>  |               |

### FOURTH YEAR

| Course Code | Subjects                       | Theory Hrs | Practical Hrs | Total Hrs   | Marks Theory | Marks Practical | Total Marks | Credit Points |
|-------------|--------------------------------|------------|---------------|-------------|--------------|-----------------|-------------|---------------|
| BPO401/451  | *Prosthetics Science-IV        | 60         | 160           | 220         | 100          | 100             | 200         |               |
| BPO402/452  | *Orthotic Science-IV           | 80         | 160           | 240         | 100          | 100             | 200         |               |
| BPO403      | Management & Administration    | 80         | --            | 80          | 100          | --              | 100         |               |
| BPO453      | *Prosthetics Clinical Practice | --         | 250           | 250         | -            | 200             | 200         |               |
| BPO454      | *Orthotics Clinical Practice   | ---        | 250           | 250         | -            | 200             | 200         |               |
|             |                                |            |               |             |              |                 |             |               |
| BPO455      | <b>Project Work**</b>          | --         | 180           | 180         | ---          | 100             | 100         |               |
|             | <b>Total</b>                   | <b>220</b> | <b>1000</b>   | <b>1220</b> | <b>300</b>   | <b>700</b>      | <b>1000</b> |               |

\*\*Joint projects may also be undertaken.

**Note:- \*All theory & Practical examinations in the discipline of Prosthetics and Orthotics shall be conducted only by the regular appointed Prosthetic and Orthotic Faculty / Teachers from a teaching institution.**

## **V. ADEQUACY OF THE SYLLABUS**

The syllabus prescribed for the B.P.O. is on the basis of minimum requirements and therefore, Universities and Institutes implementing the B.P.O. programme can exercise flexibility in opting the number of papers without compromising on the adequacy and validity of the contents prescribed by the RCI.

## **VI. DURATION OF THE PROGRAMME**

The duration of the programme is of four and half academic years (inclusive of 6 months of internship), which can be completed in a maximum of **6** years from the date of admission to the programme.

## **VII. WORKING DAYS & ATTENDANCE**

The programme will be conducted for **at least 200 working** days each year exclusive of the period of examination and admission. The institution shall work for a minimum of thirty six hours in a week (five or six days), during which physical presence in the institution of all the teachers and student clinician is necessary to ensure their availability for advice, guidance, dialogue and consultation as and when needed.

No student will be allowed to appear in the examination unless she/he has attended at least 75% of total number of classes in theory and 80 % in practical.

100% attendance in internship is compulsory.

## **VIII. ELIGIBILITY FOR ADMISSION**

A. Candidate who has passed 10+2 in science or equivalent with physics, chemistry biology/ mathematics, and English with minimum aggregate 50% marks in PCBE/PCME will be eligible for admission to this course. Relaxation and reservation for SC/ST/OBC/PwD and other categories shall be as per the rules/instructions of the Central Govt /State Govt whichever is applicable.

B. Lateral Entry for Diploma in Prosthetics and Orthotics (D.P.O.)holders

- 9 Candidates who have passed D.P.O. from a RCI recognized institute shall be eligible for admission directly in 3rd year i.e., 5th Semester of B.P.O. Programme.
- 9 Admissions will be on the availability of the seats within sanctioned seats by the Council.
- 9 In-service candidates may be permitted to undergo internship at their parent organization.

Admission process as per affiliating University norms.

All reservations in admission will apply as per Govt. rules for aided and Govt. institutions. The infrastructure will have to be enhanced as per the seats getting increased under reservation policy.

## **IX. PROGRAMME PATTERN**

The programme has been developed on Annual basis.

## **X. EXAMINATIONS**

As per the respective University norms. Minimum passing marks for every subject will be 50% both in theory and practical. Each candidate will be given maximum n+ 2 attempts to clear the examination whether annual or semester.

## **XI. NATURE OF EVALUATION**

Internal assessment for theory Courses will not exceed 20% and 25% in the practicum wherever applicable or as per respective University norms. Internal Assessment should be calculated by conducting minimum two class tests, two assignments, examination/practical examination and any other activities implemented by the parent organizations/university. Marks of Internal Assessment should be informed to the Students prior to commencement of university examinations.

## **XII. TRANSITORY REGULATIONS**

Whenever a course or scheme of instruction is changed in a particular year, two more examinations immediately following thereafter shall be conducted according to the old syllabus / regulations. Candidates not appearing at the examinations or failing in them shall take the examinations subsequently according to the changed syllabus / regulations/as per University norms.

## **XIII. FACULTY-STUDENT RATIO**

The faculty-student ratio in the area of B.P.O may be as per the RCI norms.

## **XIV. BPO TEACHING FACULTY NORMS:**

**Senior faculty in the discipline of Prosthetics and Orthotics shall be considered as course coordinator. The coordinator should be the controlling and informant authority for the correspondence related to the BPO program. He/she should hold qualification as laid down by RCI.**

## STAFF REQUIREMENT

| Sl. No. | Core Faculty  | Column-I upto 20 seats | Column-II 21-30 seats | Column-III 31-40 seats |
|---------|---|------------------------|-----------------------|------------------------|
| 1.      | Professor & Head<br>Department of Prosthetics & Orthotics | --                     | 01                    | 01                     |
| 2.      | Associate Professors (Prosthetics & Orthotics)            | 01                     | 02                    | 03                     |
| 3.      | Assistant Professor / Lecturer (Prosthetics & Orthotics)  | 03                     | 04                    | 06                     |
| 4.      | Prosthetist and Orthotist/ Demonstrator (P &O)            | 06                     | 06                    | 08                     |

## QUALIFICATION & EXPERIENCE OF THE CORE FACULTY

(Valid until the revision of curriculum)

| S. N. | DESIGNATION   | QUALIFICATION & EXPERIENCE   | PUBLICATIO<br>N           | PAY<br>SCALE       |
|-------|---|--|---------------------------|--------------------|
| 1.    | Professor (Prosthetics & Orthotics)                         | Master in Prosthetics & Orthotics from an institution with a minimum of 10 years of teaching and research experience as Associate Professor (Prosthetic & Orthotic)<br>Desirable:<br>PhD in Prosthetics & Orthotics                                  | Essential 05 publications | As per UGC norms   |
| 2.    | Associate Professor (Prosthetics & Orthotics)               | Master in Prosthetics & Orthotics & Orthotics with 05 years of teaching experience as a Assistant Professor / Lecturer (Prosthetics & Orthotics) in any recognized Prosthetic & Orthotic Institution<br>Desirable:<br>PhD in Prosthetics & Orthotics | Essential 03 publications | As per UGC norms   |
| 3.    | Assistant Professor (Prosthetics & Orthotics)               | Master in Prosthetics & Orthotics with 02 year experience in the field   |                           | As per UGC norms - |
| 4.    | <b>Prosthetist &amp; Orthotist/ Demonstrator (P &amp;O)</b> | Master in Prosthetics & Orthotics <b>or</b> Bachelor in Prosthetics and Orthotics) with 02 year experience in the field  |                           |                    |

### NOTE:

1. These qualifications are applicable for future recruitment. The case of teachers who are already holding teaching posts and have more than 10 years teaching experience will continue to hold their post in their respective institution.



2. Existing Experienced teachers having more than 10 years of teaching experience may be considered for promotion to Assistant Professor subject to fulfilment of essential qualification of Assistant Professor.
3. There shall be only three designations in respect of teachers in universities and colleges, namely, Assistant Professors, Associate Professors and Professors.
4. The pay of teachers and equivalent positions in Technical institutions shall be fixed according to their designations in two pay bands of Rs. 15600-39100 and Rs. 37400-67000 with appropriate " Grade Pay"
5. The ratio of Professors to Associate Professors to Assistant Professors in a UG College shall be in the ratio, ordinarily of 1:2:6. The ratio of Professors to Associate Professors or Assistant Professor in a PG College shall be in the ratio ordinarily of 1:2
6. Minimum qualification for Assistant Professor should be Master in Prosthetics and Orthotics.
7. Assistant Professors possessing Master's degree in prosthetics and orthotics shall be eligible for the GP of Rs. 7600 after completion of 5 years' service as Assistant Professor i.e. to the rank of Associate Professor.
8. Assistant Professors with completed service of 5 years at the GP of Rs. 7600 shall be eligible to move up to the GP of Rs. 8700/
9. Minimum of 2 teaching faculty members in core areas will be required for giving recognition for the first year.
10. Before the commencement of second academic year one more Faculty member must be appointed.
11. In case of Professor not being available, 1 Readers/Associate Professors (additional) should be appointed to accommodate teaching, research guidance and administrative work.

#### **GUEST/PART TIME FACULTY REQUIREMENTS FOR THE FOLLOWING DISCIPLINES**

1. Anatomy
2. Physiology
3. Applied Mechanics & Strength of Material
4. Workshop Technology & Material Science
5. Pathology
6. Orthopaedics& Amputation Surgery& Imaging
7. Electro technology
8. Psychology and Sociology
9. Research Methodology & Bio Statistics
10. Computer science ( CAD-CAM)
11. Management and Administration
12. Pharmacology

(Ministerial staff & others are not included)

#### **18.1. Clinical Facilities**

Facilities for diagnostic evaluation of locomotor impairment and associated disorders, both functional and organically based. Clients of all age groups with locomotor impairment.

Load and variety of patients/ clients should be commensurate with number of courses conducted and also to meet the clinical practicum requirement of each year of the course.

## **XV. INFRASTRUCTURAL REQUIREMENTS**

### **PHYSICAL FACILITIES:**

The Institute / College/ University should have separate department and academic block constructed in about 1000 square meters. Adequate hostel accommodation for students should be available in addition to the above mentioned built up area of the BPO course.

Details of the constructed area given below are for the intake capacity up to 40 students:

| <b>S.No.</b> | <b>Name</b>   | <b>Minimum size in Sq.Ft.</b> |
|--------------|---|-------------------------------|
| 1.           | Class rooms ( 04 NUMBERS)with audio-visual facility               | 04 @ 300 = 1200               |
| 2.           | One room for clinical meeting                                     | 600                           |
| 3.           | Two trial fitting rooms (One for men & one for women)             | 02@ 300 = 600                 |
| 4.           | Two measurement rooms (One for men & one for women)               | 02@ 200 = 400                 |
| 5.           | Prosthetic Lab  | 1050                          |
| 6.           | Orthotic Lab  | 1050                          |
| 7.           | Prosthetics & Orthotics faculty rooms ( Minimum 06)               | 06@ 100 = 600                 |
| 8.           | Two students common room (One for male & one for female students) | 1200                          |
| 9.           | One Office Room   | 150                           |
| 10.          | One course coordinator room                                       | 200                           |
| 11.          | Computer Laboratory Room  | 600                           |
| 12.          | Two Machinery Room  | 500                           |
| 13.          | One Store room  | 1350                          |
| 14.          | Gait training Laboratory  | 450                           |
| 15.          | One Plaster room  | 400                           |
| 16.          | Waiting room for the patients                                     | 1350                          |
| 17.          | Adequate hostel facility  |                               |
| 18.          | Reception & patient registration                                  | 400                           |
| 19.          | Common Multi Purpose Hall (optional)                              | 2000                          |

### **Note:**

**1. The above mentioned space shall be used only for Prosthetics&Orthotics training only.**

### **2.Class rooms**

There should be at least four classrooms with the capacity of accommodating the number of students admitted in each class. The rooms should be well ventilated/ thermo conditioning facility with proper lighting system. There should be built in LCD projector/White Boards.

Also there should be a desk/a big table and a chair for the teacher and Racks / cupboards for keeping teaching aids or any other equipment needed for the conduct of classes.

## **Library**

There should be a separate library in the Institute / College/ University. It should be easily accessible to the teaching faculty and the students,

It should have comfortable seating arrangements for half of the total strength of the students and teachers in the school.

There should be separate budget for the library. The library committee should meet regularly for keeping the library updated with current books, journals and other literature. Internet facility should be provided in the library and to the faculty.

The library should have proper lighting facilities and it should be well-ventilated. It should have a cabin for librarian with intercom phone facility.

There should be sufficient number of cupboards, books shelves and racks with glass doors for proper and safe storage of books, magazines, journals, newspapers and other literature. There should be provision for catalogue-cabinets, racks for students bags, book display racks, bulletin boards and stationery items like index cards, borrowers cards, labels, registers etc.

## **Offices Requirements**

### **Coordinator Room:**

There should be a separate office for the Coordinator with attached toilet and provision for visitor's room. Independent telephone facility with internet connection is a must for the Coordinator office.

There should be adequate number of office rooms as per the norms and in proportion to the number of teaching faculty with telephone and internet connection.

### **Record Room (Optional)**

There should be a separate record room with steel racks, built-in shelves and racks, cupboards and filing cabinets for proper storage of records and other important papers/ documents belonging to the college.

## **Other Facilities**

Safe drinking water and adequate sanitary/toilet facilities should be available for both men and women separately in the college. Toilet facility to the students should be there along with washbasin/ hand washing facilities.

### **Fire Extinguisher**

Adequate provision for extinguishing fire should be available as per the local byelaws.

### **Playground**

Playground should be spacious for outdoor sports like Volleyball, football, badminton etc.

### **Recreation**

There should be facilities for indoor and outdoor games for the students

**LIST OF TOOLS AND EQUIPMENT REQUIRED FOR BPO TRAINING**

**A. LIST OF COMMON EQUIPMENTS**

| S.N<br>o. | Name of Equipment  | Minimum<br>Requirement |
|-----------|--|------------------------|
| 1.        | HOT AIR OVEN, HEATING CHAMBER SIZE-36" WX24"DX30"H, WITH DOUBLE LAYER TOUGHENED FRONT VISIBLE GLASS WITH INSIDE LIGHT ARRANGEMENT, MAX TEMP. 350DEGREE C 12 KW RATING AND 1 HP3 PHASE MOTOR FOR FAN WITH DIGITAL TIMER THERMOSTAT TEMP CONTROLLER. | 1 no.                  |
| 2.        | POLISHER CONVERTED TO CONE SANDING, 2 HP 3 PHASE MOTOR   | 1 no.                  |
| 3.        | INFRA RED OVEN ( optional)   | 1no.                   |
| 4.        | BENCH GRINDER CUM SANDER, 0.5 HP SINGLE PHASE MOTOR, ABRASIVE WHEEL SIZE 10" X 1"  | 1 no.                  |
| 5.        | PILLAR DRILLING MACHINE, DRILLING CAPACITY 25MM, PILLAR DIA 87MM MAX. DISTANCE SPINDLE TO TABLE 600MM, TABLE WORKING SURFACE DIA 400MM WITH 1HP 3 PHASE MOTOR  | 1 no.                  |
| 6.        | BENCH DRILLING MACHINE WITH SAND, CAPACITY ½"  | 1 no.                  |
| 7.        | INDUSTRIAL LEATHER AND CANVAS SEWING MACHINE WITH ¼" HP MOTOR  | 1 no.                  |
| 8.        | ADJUSTABLE CIRCULAR SAW, CIRCULAR SAW DIA 18", WORKING TABLE SIZE 24"X36", MAX DEPTH OF CUT 5 ½" WITH 3HP 3 PHASE MOTOR  | 1 no.                  |
| 9.        | BELT AND DISC SANDER, DISC DIA. 10", BELT SIZE 6"X 48" WITH 1 HP 3 PHASE MOTOR   | 1 no.                  |
| 10.       | ALL-PURPOSE SAW , TEMPERATURE RANGE 100-600 DEGREES C, POWER INPUT 2000W   | 1 no.                  |
| 11.       | HOT AIR GUN , TEMPERATURE RANGE 100-600 DEGREE C, POWER INPUT 2000W  | 1 no.                  |
| 12.       | JIG SAW MACHINE, SAWING DEPTH IN WOOD 54MM, RATED 350W   | 1 no.                  |
| 13.       | HIGH VACUUM MACHINE WITH ¼" HP MOTOR   | 1 no.                  |
| 14.       | REMOVABLE MANDRILLS  | 3 no.                  |
| 15.       | MANDRILL FOR AIR SUCTION MOUNTING AND DRAPING FOR SOCKETS  | 3 no.                  |
| 17.       | HOT WATER BATH FOR SOFTENING LOW TEMPERATURE THERMOPLASTIC SHEETS  | 1 no.                  |
| 18.       | DRAPING FRAME SIZE (Small)   | 2 no.                  |

|       |  |       |
|-------|--|-------|
| 19.   | DRAPING FRAME SIZE (Large)   | 2 no. |
| 20.   | ADJUSTABLE / FIXED GRINDING AND MILLING MACHINE WITH DUST COLLECTOR            | 1no.  |
| 21.   | SANDING ROLL   | 02    |
| 22.   | SANDING SLEEVE   | 02    |
| 23.   | SANDING DRUM   | 02    |
| 24.   | TOOL HOLDER  | 05    |
| 25.   | DEEP DRAWING TOOL SET  | 02    |
| 26.   | RASP HEAD  | 01    |
| 27.   | HOT SEALING IRON   | 02    |
| 28.   | STAPLE GUN   | 02    |
| 29.   | HAND DRILL MACHINE   | 04    |
| 30.   | CORD LESS HAND DRILL MACHINE   | 02    |
| 31.   | Instrumented GAIT ANALYZER AND TRAINER ( optional for BPO program)             | 01    |
| 32.   | SHOE FINISHING MACHINE   | 01    |
| 33.   | WORKING TABLE WITH PEG BOARD ( minimum 10 tables are required for 10 students) | 10    |
| 34.   | OVER LOCKING MACHINE   | 01    |
| 35.   | LASER ALIGNER  | 01    |
| 36.   | Lathe Machine  | 01    |
| 37.   | Inter locking machine  | 01    |
| TOTAL |  |       |

## B. Lists of common Tools and Material

| S.No. | Name of Equipment / tool   | Minimum Requirements |
|-------|--|----------------------|
| 1.    | Flat file bastard 2 <sup>nd</sup> cut 10", 2 <sup>nd</sup> cut 12" | 10 no. each          |
| 2     | Aluminum Flat File 10" & 12"                                       | 10 no. each          |
| 3.    | Round file 6", 8", 2 <sup>nd</sup> cut                             | 10 no. each          |
| 4.    | Flat file 10" round 2 <sup>nd</sup> cut                            | 10 no each           |
| 5.    | Triangular file 6", 10" 2 <sup>nd</sup> cut                        | 10 no each           |
| 6.    | Rasp file half round 10", 12", 8"                                  | 10 no. each          |
| 7.    | Rasp file flat 10", 12"  | 10 no. each          |
| 8.    | Rasp file round 6", 10"  | 10 no. each          |
| 9.    | Screw driver 150x6mm, 200x8mm, 250x8mm                             | 10 no. each          |
| 10.   | Flat chisel 12mm, 20mm, 25mm                                       | 2no. each            |
| 11.   | Cold chisel 12mm, 20mm   | 2no. each            |
| 12.   | Half round chisel 12mm, 20mm                                       | 2 no. each           |
| 13.   | Ruler steel 600mm, 300mm   | 2no. each            |
| 14.   | Steel square with leg 200mm  | 2 no. each           |
| 15.   | Caliper inside/outside 200mm                                       | 2no. each            |
| 16.   | Compass/ Driver 200mm Outside/inside caliper                       | 2 no. each           |
| 17.   | Hammer ball peen 500 gms, 250gms                                   | 10 no. each          |
| 18.   | Mallet hammer with handle  | 2no. each            |
| 19.   | Hammer seaming plier (pincer) 10", 12"                             | 4 no. each           |
| 20.   | Nipper 150mm, 200mm  | 2 no. each           |
| 21.   | Plier 200mm  | 10 no. each          |
| 22.   | Long nose plier 150 mm   | 10 no. each          |
| 23.   | Revolving Hole punch 250gms  | 10 no. each          |
| 24.   | Centre punch   | 10 no. each          |
| 25.   | Hole punch 2mm, 3mm  | 3 no. each           |
| 26.   | Hole punch set   | 2 no.                |
| 27.   | Scissor 10" & 12 "   | 10 no. each          |
| 28.   | Hacksaw Frame 300mm  | 10 no.               |
| 29.   | Hacksaw blades 300mm   | 1 pkt of 144 pc      |
| 30.   | Tap set 3, 4, 5, 6, 7, .....mm                                     | 2 no. each           |
| 31.   | Tap handle   | 2 no. each           |
| 32.   | Grip plier   | 10 no.               |
| 33.   | Die set 3, 4, 5, 6, 7, .....mm                                     | 2 no. each           |
| 34.   | Cross pein hammer  | 10 no.               |
| 35.   | wire cutter  | 10 no.               |
| 36.   | Measuring tape   | 10 no.               |
| 37.   | Shoe maker hammer  | 5 no.                |
| 38.   | Anvil  | 2no.                 |
| 39.   | Half round leather Knife (Rapi)                                    | 5 no.                |
| 40.   | Nipper shoe maker 8"   | 5 no.                |
| 41.   | Leather knife  | 2 no.                |

|     |  |                |
|-----|--|----------------|
| 42. | Bender brace 5.5 mm  | 1 no.          |
| 43. | Bender brace 6.5 mm  | 1no.           |
| 44. | cone sander fine, medium, coarse   | 10 no. each    |
| 45. | Plaster knife 150x200mm,<br>2000x750x350mm   | 10 no.         |
| 46. | Upper Limb Prosthetic Kit ( B/E, A/E,<br>S.D) body powered                                       | 2 no. each     |
| 47. | <b>Externally powered kit ( B/E &amp; A/E)</b>   | <b>1 each</b>  |
| 48. | Vice limb maker (modified)   | 1 no.          |
| 49. | Bending fork (Set of two pieces)   | 2 no.          |
| 50. | Caliper A-P measurement above knee   | 2 no.          |
| 51. | Ear Protector  | 05 no.         |
| 52. | Nut replacement tool 7mm, 9mm  | 2 no. each     |
| 53. | Heat proof gloves  | 4 pairs        |
| 54. | Copper rivets ¼", ½"   | 1 kg each      |
| 55. | Aluminium rivets ¼", ½"  | 1 kg each      |
| 56. | Eyelet punch   | 10 no.         |
| 57. | Rivet head finishing punch   | 10 no.         |
| 58. | Plastic D-rings 1", 1 ½", & 2"   | 5 pkts each    |
| 59. | Buckles 1", 1 ½' & 2"  | 5 pktseach     |
| 60. | Micrometer   | 2 no.          |
| 61. | Ritz scale for M-L diameter/ALIMCO<br>B.K. caliper   | 2 no.          |
| 62. | Allen keys / T-handheld Allen keys (<br>1mm-10mm)  | 10 set         |
| 63. | Press button   | 5 pkts         |
| 64. | Evathene foam 4mm, 6mm, 8mm<br>thickness   | 5 sheets each  |
| 65. | Polypropylene and co polymer sheets (<br>white) 3mm, 4mm & 5mm thickness                         | 5 sheets each  |
| 66. | Dendrite solution  | 5 ltr ( 5 tin) |
| 67. | Velcro straps ( hook & loop) ¾", 1" and<br>2"  | 2 roll each    |
| 68. | Nappa leather  | 5000 d/m       |
| 68. | Low temperature thermo plastic sheets<br>3.2mm/4.2 mm thickness                                  | 5 sheets each  |
| 69. | Aluminum strips (4mm ) thickness   | 5 kg.          |
| 70. | Aluminium sheet (4mm thicknes), 1<br>mm=18 gauge (BSW)   | 2 sheet        |
| 71. | Drill bits, Full Set Max diameter (7/64",<br>1/8", 9/64", 5/32", 3/16", 11/64", ¼", 3/8",<br>½") | 1 set          |
| 72. | Different modular system for lower limb<br>prostheses  | 5 set each     |
| 73. | Torque wrench  | 01             |
| 74. | Bench Vice   | 10             |
| 75. | Vernier Caliper (adjustable digital)   | 10             |
| 76. | V-BOX  | 02             |

**C.LIST OF TOOLS AND EQUIPMENT REQUIRED FOR PATIENT EXAMINATION  
AND CASTING ROOM**

| S.No. | Name of Equipment                        | Minimum Requirement |
|-------|--|---------------------|
| 1.    | MEASURING TAPE                           | 10                  |
| 2.    | FLEXIBLE STEEL RULE                      | 10                  |
| 3.    | ALUMINIUM TRIPOD                         | 02                  |
| 4.    | CASTING APPARATUS UNDER WEIGHT BEARING   | 02                  |
| 5.    | CASTING APPARATUS FOR ABOVE KNEE AMPUTEE | 01                  |
| 6.    | PLASTER BANDAGE TROLLEY                  | 01                  |
| 7.    | FOOT MEASURING DEVICE                    | 01                  |
| 8.    | OSCILLATING SAW – MULTIMASTER            | 02                  |
| 9.    | SPINAL CASTING APPARATUS                 | 02                  |
| 10.   | HOOK KNIFE                               | 05                  |
| 11.   | PLASTER CUTTING SCISSORS                 | 04                  |
| 12.   | EXAMINATION COUCH                        | 02                  |
| 13.   | X-RAY IMAGE VIEWER                       | 02                  |
| 14.   | GONIOMETER                               | 05                  |
| 15.   | Pedobarography machine                   | 01                  |



### D.PLASTER MODIFICATION AREA / ROOM

| S.No. | Name of Equipment                    | Minimum Requirement |
|-------|--------------------------------------|---------------------|
| 1.    | PLASTER WORK TABLE                   | 02                  |
| 2.    | PLASTER CAST SHELF                   | 01                  |
| 3.    | PIPE VICE                            | 05                  |
| 4.    | PLASTER BUCKET                       | 05                  |
| 5.    | MIXING BOWL                          | 20                  |
| 6.    | PLASTER STIRRER                      | 20                  |
| 7.    | SURFORM FILE FLAT                    | 20                  |
| 8.    | SURFORM FILE ROUND (Blade only)      | 15                  |
| 9.    | SURFORM FILE HALF ROUND (Blade only) | 15                  |
| 10.   | PLASTER SPATULA                      | 15                  |
| 11.   | TAPE MEASURE                         | 10                  |
| 12.   | GONIOMETER                           | 05                  |
| 13.   | SPECIAL PLASTER KNIFE                | 05                  |
| 14.   | DRAW KNIFE                           | 02                  |
| 15.   | Plaster Cutting Scissors             | 04                  |
| 16.   | MANDRILLS                            | 20                  |
| 17.   | PLASTER SEPARATION SINK              | 01                  |

### E-PATIENT TRIAL AREA

| S.No. | Name of Equipment                     | Minimum Requirement |
|-------|---------------------------------------|---------------------|
| 1.    | PARALLEL BAR WITH MIRROR ON BOTH SIDE | 01                  |
| 2.    | PORTABLE HEAT GUN                     | 01                  |
| 3.    | CHORDLESS HAND DRILL MACHINE          | 01                  |
| 4.    | REVOLVING CENTRE PUNCH                | 05                  |

### XVI. CERTIFICATION AS A REGISTERED PROFESSIONAL

It is mandatory as per Section 13 of RCI Act for every Prosthetist and Orthotist to obtain a "Registered Professional Certificate" from the Rehabilitation Council of India to work in the field of Prosthetics and Orthotics in India. As continuous professional growth is necessary for the renewal of the certificate, the faculty as well as Prosthetist and Orthotist should undergo in-service programme periodically to update their professional knowledge. Amendments, if any, to the regulations of the course will be made periodically by the Rehabilitation Council of India. Any deviation from the above regulations should have the prior approval of the Rehabilitation Council of India.

***The successful students will be registered as Prosthetist and Orthotist(Professional). The training institution/organization should take appropriate action to ensure that all passed out students are registered with the Council.***

## **XVII. AWARD OF DEGREE**

After successful completion of all examinations and internship candidate will be awarded with the degree of Bachelor in Prosthetics and Orthotics (B.P.O.). The said degree will be classified in accordance with the affiliating University norms.

## **XVIII. CLINICAL PRACTICUM-**

**The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Assess the medical condition of a patient related to their orthotic or prosthetic management using appropriate investigative techniques which include patient history taking and clinical testing.
- $\frac{3}{4}$  Formulate an optimal prosthetic and orthotic solution using information from the patient assessment, other members of the health care team, medical charts, etc.
- $\frac{3}{4}$  Communicate and discuss patient goals and expectations and discuss and debate the prosthetic management with the patient, co-workers and other members of the health care team.
- $\frac{3}{4}$  Reliably measure and capture a positive cast or image of patient / clients' appendage while correctly positioning the body part and if appropriate apply the necessary corrective force system.
- $\frac{3}{4}$  Identify, prescribe and justify selection of appropriate materials and componentry in the fabrication of the prostheses or orthoses.
- $\frac{3}{4}$  Construct the prostheses or orthoses using appropriate fabrication techniques in preparation for the initial fitting.
- $\frac{3}{4}$  Fit the prostheses or orthoses to the patient using static and dynamic functional criteria established from the original assessment.
- $\frac{3}{4}$  Evaluate the quality of the prostheses or orthoses fit to ensure the appropriate interface contouring, force application and trim lines.
- $\frac{3}{4}$  Identify problems related to device fit and/or alignment and be able to suggest and implement appropriate correction.
- $\frac{3}{4}$  Assess and solve prosthetic or orthotic problems as part of short and long term patient care.
- $\frac{3}{4}$  Maintain accurate records of patient treatment and follow up as well as confidentiality of such information.
- $\frac{3}{4}$  Communicate effectively with patient, co-workers, and other health care professionals in such a manner that will ensure the highest quality of service and reflect a professional attitude on the part of the student.
- $\frac{3}{4}$  Educate the patient /client and/or caregiver on use, care and function of the prostheses or orthoses.
- $\frac{3}{4}$  Understand the methodology of problem identification, problem solving in a process that includes all stake holders, with the patient at the centre.

## **XIX. INTERNSHIP**

1. Internship is compulsory.
2. Duration: 6 months
3. Eligibility: Internship will start immediately after the declaration of result of final year/ semester & candidate is declared pass in all four years / eight semesters
4. Structure and duration of the postings:
  - i) The place of postings of the students for internship will be decided by the respective institute conducting the course.
  - ii) Students should spend minimum of 50% period of internship at parent institute and upto 50% period outside the parent institute like hospital set ups, educational set ups, special clinical facilities. Exposure should be for those areas where limited exposure was provided in the parent institute.
5. Mode of supervision during internship: Supervision should be provided by a Qualified Prosthetics and Orthotics Professional.
6. Maintenance of records by students: Every student should maintain records of the number of hours of clinical work in different areas and institutions. This should be certified by the head of the department/organisation/ institution or his/her nominee where the student is undergoing internship.
7. Extension of internship: Internship shall be extended by the number of days the student remains absent.
8. Stipend: As per the norms of the parent Institute.
9. Grading and evaluation of student: Grading and evaluation should be done by the institute where the candidate is doing internship. The student will be required to repeat those postings in which his/her performance is found unsatisfactory.
10. Certification: The parent institute/affiliating University will award a certificate after successful completion of the internship.
11. The University shall award the degree certificate only after the successful completion of the internship.

## FIRST YEAR

|   |
|---|
| <b>TITLE----- ANATOMY</b>                                 |
| <b>COURSE CODE--- BPO101</b>                              |
| <b>TEACHING HOURS---- 160 ( Theory-120, Practical-40)</b> |
| <b>CREDITS --- As per affiliated university norms</b>     |

### **Course Description:**

The student should understand the function of individual joints and muscles and be proficient in explaining their interaction. He/she should be knowledgeable in the area of clinical conditions and be able to analyse them by means of appropriate measuring instruments as well as by applying his/her knowledge of range of motion in order to be able to identify a viable prosthetic/orthotic treatment. The student should recognise that biomechanical as well as pathological factors must be viewed concurrently with anatomical factors.

### **The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Explain the process of human growth and development;
- $\frac{3}{4}$  Demonstrate competence in identifying and differentiating between surface anatomical structures of the lower limb, upper limb spine and trunk;
- $\frac{3}{4}$  Understand the inter-relations between the systems described. (student should know origin, insertion, nerve connection and blood supply of each muscle)
- $\frac{3}{4}$  Describe and relate the structure and function of the upper and lower limbs to clinical pathologies

### **DETAILED CONTENTS**

**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, kidney, urinary bladder, intestines.

### **d) Musculo Skeletal Anatomy**

- Anatomical positions of body, axes, planes, common anatomical terminologies
- Connective tissue classification
- Bones- Composition & functions, classification and types according to morphology and development
- Joints-definition-classification, structure of fibrous, cartilaginous joints, blood supply and nerve supply of joints

## **Upper Extremity:**

**a) Osteology:** Clavicles, Scapula, Humerus, Radius, Ulna, Carpals, Metacarpals, Phalanges.

**b) Soft parts:** pectoral region, axilla, cubital fossa, palm, dorsum of hand, muscles, nerves, blood vessels.

**c) Joints:** Shoulder girdle, shoulder joint, elbow joints, radio ulnar joint, wrist joint and joints of the hand.

d). Arches of hand, skin of the palm and dorsum of hand.

### **Lower Extremity:**

**a) Osteology :** Hip bone, femur, tibia, fibula, patella, tarsals, metatarsals and phalanges.

**b) Soft parts:** Gluteal region, front and back of the thigh (Femoral triangle, femoral canal and inguinal canal), medial side of the thigh (Adductor canal), lateral side of the thigh, popliteal fossa, anterior and posterior compartment of leg, sole of the foot, lymphatic drainage of lower limb, venous drainage of the lower limb, arterial supply of the lower limb, arches of foot, skin of foot.

**c) Joints:** Hip Joint, Knee joint, Ankle joint, joints of the foot.

### **Trunk & Pelvis:**

**a) Osteology:** Cervical, thoracic, lumbar, sacral and coccygeal vertebrae and ribs

**b) Soft tissue:** Pre and Para vertebral muscles, intercostals muscles, anterior abdominal wall muscles, Inter-vertebral disc.

c) Pelvic girdle and muscles of the pelvic floor

**Head and Neck:**Osteology: Mandible and bones of the skull

Applied Anatomy: Surface anatomy, locomotion and movements. Anthropometry.

### **Anatomy Practical:**

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

## RECOMMENDED BOOKS & JOURNALS

### ANATOMY

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

|  |
|--|
| <b>TITLE----- PHYSIOLOGY</b>                             |
| <b>COURSE CODE--- BPO102</b>                             |
| <b>TEACHING HOURS---- 120 ( Theory-90, Practical-30)</b> |
| <b>CREDITS --- As per affiliated university norms</b>    |

### **Course Description:**

The course is designed to assess the students to acquire the knowledge of the normal physiology of human body and understand the alteration in the physiology for the fabrication of the prosthesis and orthosis.

### **The student should be able to meet the following learning objectives:**

- <sup>3</sup>/<sub>4</sub> Describe and explain cell biology;
- <sup>3</sup>/<sub>4</sub> Explain and give examples of basic tissues, their properties and structure;
- <sup>3</sup>/<sub>4</sub> Compare and contrast the structure and properties of biological substances (ie: blood, lymphatic fluids, serum);
- <sup>3</sup>/<sub>4</sub> Describe parts and organs of the body by systems.

### **DETAILED CONTENTS**

#### **General Physiology:** Cell: Organelles: their structure and functions

- Transport Mechanisms across the cell membrane
- Body fluids: Distribution, composition.

#### **Blood**

- Introduction: Composition and functions of blood.
- Plasma: Composition, functions. Plasma proteins.
- RBC: count and its variations, Haemoglobin - Anemia. Blood indices, PCV, ESR.
- WBC: Classification. functions, count, its variation of each. Immunity
- Platelets: , functions, count, its variations
- Blood coagulation. ( brief)
- Lymph: Composition, and functions.

#### **Nerve Muscle Physiology**

- Introduction: Resting membrane potential. Action potential
- Nerve: Structure and functions of neurons. Properties and impulse transmission of nerve fibres.
- Neuroglia: Types and functions.
- Muscle: Classification. Skeletal muscle : Structure. Neuromuscular junction, Motor Unit



- Fatigue.

### **Cardiovascular System**

- Introduction: Physiological anatomy and nerve supply of the heart and blood vessels.
- Conducting system: Components. Impulse conduction Cardiac Cycle: Definition. Phases of cardiac cycle. Pressure and volume curves.. ECG: Definition.
- Cardiac Output: Definition.
- Functional anatomy of vascular and lymphatic system
- Arterial Blood Pressure: Definition. Normal values and its variations
- Hypertension

### **Respiratory System**

- Introduction: Physiological anatomy – Pleura, tracheo-bronchial tree, alveolus, respiratory membrane and their nerve supply. Functions of respiratory system. Respiratory muscles.
- Mechanics of breathing: – Inspiration; Expiration; Intrapleural pressure, Recoil tendency and lung volumes
- Hypoxia
- Disorders of Respiration: Dyspnoea. Orthopnoea. Hyperpnoea, hyperventilation, apnoea, tachypnoea :define
- 

### **Nervous System**

- Introduction: Organization of CNS – central and peripheral nervous system. Functions of nervous system.
- Synapse: Functional anatomy, classification, Synaptic transmission.
- Sensory Mechanism: Sensory receptors: function, classification and properties.
- Sensory pathway: The ascending tracts – Posterior column tracts, lateral spinothalamic tract and the anterior spinothalamic tract – their origin, course, termination and functions.
- Pain sensation: mechanism of pain. Cutaneous pain –slow and fast pain, hyperalgesia. Deep pain. Visceral pain – referred pain.
- Sensory cortex. Somatic sensations: crude touch, fine touch, tactile localization, tactile discrimination, stereognosis, vibration sense, kinesthetic sensations
- Motor Mechanism: Motor Cortex. Motor pathway: The descending tracts – pyramidal tracts, extrapyramidal tracts – origin, course, termination and functions.
- Reflex Action: Monosynaptic and polysynaptic reflexes, superficial reflexes, deep reflexes. Muscle tone –definition, and properties hypotonia, atonia and hypertonia. UMNL and LMNL
- Spinal cord Lesions: Complete transection and Hemisection of the spinal cord.
- Cerebellum: Functions
- Posture and Equilibrium:
- Thalamus and Hypothalamus: Nuclei. Functions.
- Basal Ganglia: Structures, functions.
- Cerebral Cortex: Lobes. Brodmann's areas and their functions. Higher functions of cerebral cortex – learning, memory and speech.

### **Kidney and micturition**

- Introduction and functional anatomy of kidney, innervation, renal circulation and care of any appliances fitting for dysfunction.
- Micturition – Physiological anatomy and nervous connection of the bladder, cystometrogrammicturition reflex.

**Integumentary system:** Structure of skin, function of skin: Protection, heat regulation, sensation and elasticity.

### **Endocrinology**

Endocrine Pancreas: Secretory cells, action, regulation of secretion of insulin and glucagon. Glucose metabolism and its regulation. Disorder: Diabetes mellitus.

### **Nutrition & Metabolism**

- An Introduction to Nutrition and Metabolism
- Factors influencing energy expenditure

#### **Practical:**

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

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

**Author: Raj Kapoor**

### **RECOMMENDED BOOKS & JOURNALS**

#### **PHYSIOLOGY**

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

|   |
|---|
| <b>TITLE----- WORKSHOP TECHNOLOGY&amp; MATERIAL SCIENCE</b> |
| <b>COURSE CODE--- BPO103</b>                                |
| <b>TEACHING HOURS---- 120</b>                               |
| <b>CREDITS --- As per affiliated university norms</b>       |

**Course Description:** Students would have competence in practicing effectively and safely within a workshop environment.

- <sup>3</sup>/<sub>4</sub> Be familiar with the occupational health and safety policy and procedures in the workplace.
- <sup>3</sup>/<sub>4</sub> Demonstrate proficiency in the use of hand tools and machine tools commonly used in the fabrication of Prostheses & Orthoses.
- <sup>3</sup>/<sub>4</sub> Explain the important properties of various types of materials: metals, ceramics, polymers, and composites.
- <sup>3</sup>/<sub>4</sub> Describe the relationships that exist between the structural elements of these materials and their characteristics.
- <sup>3</sup>/<sub>4</sub> Explain mechanical and failure behaviour of these materials, along with techniques used to improve the mechanical and failure properties in terms of alteration of structural elements.
- <sup>3</sup>/<sub>4</sub> Describe the basis for the selection of different materials for specific prosthetic and orthotic applications.
- <sup>3</sup>/<sub>4</sub> Demonstrate knowledge of toxicity and safety issues associated with the use of specific materials.

### **DETAILED CONTENTS**

**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 Equipment's, 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 aluminium.

Fundamental of riveting, soldering, brazing and welding.

**Workshop Technology Practical Practice:** Practical work on workshop practices. Practical training on lathes, Drilling Machine (Bench and Pedestal), Grinding Machine, Router, hot air oven, sanding machine, heat gun, pneumatic machines and

other machines. Practical work on various materials and tools and its use in prosthetics & Orthotics.

## **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 Polyester. Elastomers, H.D.P.E. PP, PP-CP, Viscoelastic behaviour of plastics. Introduction to fibre 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

## RECOMMENDED BOOKS & JOURNALS

### WORKSHOP TECHNOLOGY & MATERIAL SCIENCE

| Sl. No. | Title                   | Author                                     | Publisher               | Year/Vol.        |
|---------|-------------------------|--|-------------------------|------------------|
| 1.      | Calin, Andrea           | Material science & engineering             |                         | 6th ed.          |
| 2.      | Biller, Jose            | Physics of plastics                        |                         |                  |
| 3.      | Bulson, P.S.ed          | Carbon materials for advanced technologies |                         |                  |
| 4.      | Ram, Arie               | Fundamentals of polymer engineering        |                         |                  |
| 5.      | Chan, Karence K. ed.    | Plastics technology handbook               |                         | 2nd ed.          |
| 6.      | Nigel Mills             | Polymer Foams Handbook                     |                         |                  |
| 7.      | O.P.Khanna              | Text book of Material Science & metallurgy |                         |                  |
| 8.      | S.W.Tasi                | Introduction to Composite materials        |                         |                  |
| 9.      | L.J.Broutman&R.H. Kroch | Composite Materials                        |                         |                  |
| 10.     | M.K.Murlidhar           | Material Science & Process                 |                         |                  |
| 11.     | B.S. Raghuvanshi        | Workshop Technology Vol. I & II            | Dhanpat Rai & Co. Delhi |                  |
| 12      | John Lord& Ann Reed     | Basics Mechanics Explained                 | Butter North, Oxford    |                  |
| 13.     | Chapman                 | Workshop Technology                        |                         | Vol. I, II & III |

|   |
|---|
| <b>TITLE- Applied Mechanics &amp; Strength of Materials</b> |
| <b>COURSE CODE--- BPO104</b>                                |
| <b>TEACHING HOURS---- 100</b>                               |
| <b>CREDITS --- As per affiliated university norms</b>       |

**Course Description:**

**The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Demonstrate an ability to utilize appropriate terminology and units to describe mechanical principles.
- $\frac{3}{4}$  Derive free body diagrams in order to describe clinical problems and generate treatment solutions.
- $\frac{3}{4}$  Apply the mechanical principles of statics and dynamics to quantify and explain linear and angular motion of the human body
- $\frac{3}{4}$  Apply the concepts of stress and strain in the analysis of basic structural elements.
- $\frac{3}{4}$  Determine and draw diagrams for internal forces and bending moments (axial forces, shear forces, moments and torques) in a structural member.
- $\frac{3}{4}$  Explain the principles of composition and resolution of forces and use these principles to solve clinical problems
- $\frac{3}{4}$  Discuss the concepts of work energy and power
- $\frac{3}{4}$  Explain the principles of fluid mechanics and describe how the principles can be applied in clinical situations.
- $\frac{3}{4}$  Explain mechanisms underlying failure of structures under deformation.

**DETAILED CONTENTS**

**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.

**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:** definition and scope in modern industrial social studies on Machinery 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.

**RECOMMENDED BOOKS & JOURNALS**

| SI. No. | Author     | Title                 | Publisher | Year/Vol. |
|---------|------------|-----------------------|-----------|-----------|
| 1.      | R.S.Khurmi | Applied Mechanics     |           |           |
| 2.      | JagdishLal | Strength of Materials |           |           |

|   |
|---|
| <b>TITLE - BIO-MECHANICS- I</b>                       |
| <b>COURSE CODE--- BPO 105</b>                         |
| <b>TEACHING HOURS----- 80</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** The understanding of Bio-mechanical principles of Prosthetics and Orthotics will be the foundation of the work of the students. It is essential to have a sound theoretical knowledge of the subject and students are able to demonstrate the rigorous application of these principles to practical P&O situations and in the analysis of those situations.

**The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Demonstrate an ability to apply principles of tissue mechanics to explain the principles of P&O treatment, (involving various force systems) and the practical problems encountered in prosthetics and orthotics
- $\frac{3}{4}$  Use biomechanical terminology to describe position and motion of the human body
- $\frac{3}{4}$  Discuss mechanical principles governing human motion
- $\frac{3}{4}$  Utilise temporal spatial, kinematic and kinetic information to distinguish between normal and abnormal function of the upper limbs, lower limbs & Spine.
- $\frac{3}{4}$  Analyse the forces at a skeletal joint for various static and dynamic activities
- $\frac{3}{4}$  Demonstrate the ability to analyse forces and moments applied to the body by prosthetic and orthotic devices.
- $\frac{3}{4}$  Apply biomechanical principles to generate optimal solutions to clinical problems in prosthetics and orthotics.
- $\frac{3}{4}$  Understand the concepts of differentiation and integration and evaluate derivatives and integrals of a function

### **DETAILED CONTENTS**

#### **Basic Concepts in Biomechanics: Kinematics and Kinetics:**

Types of Motion, Location of Motion, Direction of Motion, Magnitude of Motion, Definition of Forces, Force of Gravity Reaction forces, Equilibrium, Objects in Motion, Force of friction, Concurrent force systems, Parallel force systems, Work, Moment arm of force, Force components Equilibrium of levers.

**Joint structure and Function:** Joint design, Materials used in human joints, General properties of connective tissues, Human joint design, Joint function, Joint motion



Introduction to Normal Human locomotion, Biomechanics of Ankle & Foot,  
 .Biomechanics of Foot & ankle foot Orthosis. Biomechanics of Symes prosthesis,  
 partial foot prosthesis, below knee (trans tibial) prosthesis.

## RECOMMENDED BOOKS & JOURNALS

### BIOMECHANICS

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

|     |                     |  |                       |                  |
|-----|---------------------|--|-----------------------|------------------|
| 14. | Duane Knudson       | Fundamentals of Bio-Mechanics            |                       | 2nd ed.          |
| 15. | StanleyBell P Frank | Principles of mechanics and biomechanics | B. I. Publications uk |                  |
| 16. | Black Jonathan      | Clinical Biomechanics                    |                       |                  |
| 17. | Donatelli, R.A.     | Biomechanics of the Foot and Ankle       | Davis, Philadelphia   |                  |
| 18. | Kapandgi, I.A.      | Physiology of Joints                     | Churchill-Livingstone | Vol. I, II & III |

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|---|
| <b>TITLE- BASIC ELECTRONICS</b>                       |
| <b>COURSE CODE--- BPO 106</b>                         |
| <b>TEACHING HOURS----- 80</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** The student will have knowledge of basic principles of electricity and electronics with particular reference to applications in prosthetics, orthotics and workshop practice.

**The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Explain basic concept of electricity and electronics covering following:  
DC circuits, inductance and capacitance, AC circuits, power, supplies, amplifiers, feedback, interference rejection techniques, myoelectrodes and bioelectricity
- $\frac{3}{4}$  Explain electronics measuring system
- $\frac{3}{4}$  Explain safety practice of electricity

### **DETAILED CONTENTS**

**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 semiconductors.

**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

#### RECOMMENDED BOOKS & JOURNALS

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

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| <b>TITLE- PROSTHETICS SCIENCE-I</b>                   |
| <b>COURSE CODE--- BPO107</b>                          |
| <b>TEACHING HOURS---- 80 ( Theory-80)</b>             |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** This subject is delivered in a coordinated manner with the Practical part of the Prosthetic Science course. The student will be required to acquire and comprehend the necessary theoretical knowledge and to be able to integrate this effectively in clinical practice.

**The student should be able to meet the following learning objectives:**

- <sup>3</sup>/<sub>4</sub> Compare and contrast strategies for clinical assessment of patients and describe appropriate investigative techniques including patient history taking and physical examination.
- <sup>3</sup>/<sub>4</sub> Recognize and describe the signs and symptoms of the most common pathologies which require prosthetic solutions including, etiology, clinical presentation, prognosis and appropriate device management.
- <sup>3</sup>/<sub>4</sub> Demonstrate empathy between Prosthetics theory and the environment in which the client is situated.
- <sup>3</sup>/<sub>4</sub> Distinguish between the physical characteristics of the limbs and discuss the relative implication for device design.
- <sup>3</sup>/<sub>4</sub> Describe and compare temporospatial and kinematic characteristics of normal and pathological gait and use this information to justify the selection and design of appropriate devices.
- <sup>3</sup>/<sub>4</sub> Discuss biomechanical force systems and use these principles in generating an appropriate prosthetic prescription.
- <sup>3</sup>/<sub>4</sub> Describe the mechanics of materials and be able to apply these concepts to the design and construction of devices.
- <sup>3</sup>/<sub>4</sub> Compare and contrast the functional characteristics of prosthetic components.
- <sup>3</sup>/<sub>4</sub> Formulate appropriate prosthetic and orthotic prescriptions for wide range clinical situations.
- <sup>3</sup>/<sub>4</sub> Understand and describe the roles of key members of the health care team and identify how they interrelate with the Prosthetist and Orthotists

### **DETAILED CONTENTS**

**Introduction:** Introduction to Prosthetics, definitions of various terminologies, Historical development in Lower Extremity Prosthetics in India and abroad.

**Prosthetic Feet:** Classes of Various types of Prosthetic Feet

**Partial Foot Prostheses:** Various types of Partial foot prosthesis. Biomechanics of Partial foot prosthesis, Prescription Principles, Materials used for partial foot prostheses, various casting & fabrication techniques of 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 & alignment techniques for Symes prosthesis.

**Trans Tibial:** Various types of trans-tibial prostheses 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 TSBetc, Different types of suspension. Alignment techniques

**Gait Deviations and Analysis:** Person with Chopart, Symes, Trans-tibial prosthesis.

Check-Out Procedures with Chopart, Symes& Trans-tibial prosthesis.

|   |               |
|---|---------------|
| <b>TITLE----- ORTHOTICS SCIENCE-I</b>                 |               |
| <b>COURSE CODE---</b>                                 | <b>BPO108</b> |
| <b>TEACHING HOURS----- 80</b>                         |               |
| <b>CREDITS --- As per affiliated university norms</b> |               |

**Course Description:** This subject is delivered in a coordinated manner with the Practical part of the Orthotic course. The student will be required to acquire and comprehend the necessary theoretical knowledge and to be able to integrate this effectively in clinical practice.

**The student should be able to meet the following learning objectives:**

- <sup>3</sup>/<sub>4</sub> Compare and contrast strategies for clinical assessment of patients and describe appropriate investigative techniques including patient history taking and physical examination.
- <sup>3</sup>/<sub>4</sub> Recognize and describe the signs and symptoms of the most common pathologies which require Orthotic solutions including, etiology, clinical presentation, prognosis and appropriate device management.
- <sup>3</sup>/<sub>4</sub> Demonstrate empathy between Orthotic theory and the environment in which the patient is situated.
- <sup>3</sup>/<sub>4</sub> Distinguish between the physical characteristics of the limbs and discuss the relative implication for device design.
- <sup>3</sup>/<sub>4</sub> Describe and compare temporospatial and kinematics characteristics of normal and pathological gait and use this information to justify the selection and design of appropriate devices.
- <sup>3</sup>/<sub>4</sub> Discuss biomechanical force systems and use these principles in generating an appropriate orthotic prescription.
- <sup>3</sup>/<sub>4</sub> Describe the mechanics of materials and be able to apply these concepts to the design and construction of devices.
- <sup>3</sup>/<sub>4</sub> Compare and contrast the functional characteristics of orthotic components.
- <sup>3</sup>/<sub>4</sub> Formulate appropriate orthotic prescriptions for wide range clinical situations.
- <sup>3</sup>/<sub>4</sub> Understand and describe the roles of key members of the health care team and identify how they interrelate with the Prosthetist & Orthotist.

### **DETAILED CONTENTS**

**General:** Introduction to Orthotics, definitions of various terminologies, History of Orthoses in India and abroad. Various materials used in Orthotics. Foot & Ankle Deformities.

**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:

**Pedorthics:** Medial/Lateral raise (Inside /outside shoe), M.T. Bar (Inside / Outside shoe), Arch support, Meta tarsal pad, Calcaneal heel wedge, Heel raise, Thomas Heel, Heel pad for Calcaneal spur, 'T' strap (Medial and lateral), Fixation of stirrup plate in shoes/ Sandal, Various types of Arch Supports – flexible/semi rigid/rigid/custom moulded, SMO-Custom moulded Supra malleolar orthosis. Various types of Foot Orthoses for diabetic feet and other sensory deficiencies.

**AFO (Ankle Foot Orthosis):** Conventional AFO-, Custom made AFO ( Articulated& Non articulated A.F.O & various types of ankle joints, **Clubfoot Orthosis:** Orthotic management of CTEV, Ankle support

Orthotic management of Anaesthetic Foot. Orthosis for the management of below knee fracture.

### RECOMMENDED BOOKS & JOURNALS

| S. No. | Author  | Title  | Publisher  | Year/Vol. |
|--------|---|--|--|-----------|
| 1.     | Shurr. G.<br>Donald&J.W.Michel                              | Prosthetics & Orthotics  |  |           |
| 2.     | Seymour, Ron  | Prosthetics & Orthotics<br>LowerLimb& Spine                          |  |           |
| 3.     | May Bella J.  | Amputations & Prosthetics  | Jaypee Publisher<br>New Delhi  |           |
| 4.     | Nowoczenski,<br>Deborah A.                                  | Orthotics in functional<br>rehabilitation of the lowerlimb           |  |           |
| 5.     | American Academy<br>of Orthopaedic<br>Surgeons              | Atlasfor prosthetic<br>rehabilitation,<br>Surgeryandlimb deficiency. | Mosby publications/<br>or N.Y.U. St.Louice,<br>London, Chikago                     |           |
| 6.     | Edestein, Joan E.   | Orthotics  | Jaypee Publisher<br>New Delhi  |           |
| 7.     | Hsu, John D.  | AAOS atlas of Orthosis and<br>assistive devices,                     | Mosby publications/<br>or N.Y.U. St.Louice,<br>London, Chikago                     |           |
| 8.     | Kent, Wu  | FOOT ORTHOSIS  |  |           |
| 9.     | D.N. Condieand S.<br>Turner                                 | An Atlas of Lower Limb<br>Orthotic Practice                          |  |           |
| 10     | Michelle M. Lusardi<br>PhD PT andCaroline<br>C. Nielsen PhD | Orthotics and Prosthetics in<br>Rehabilitation                       |  |           |
| 11.    | Deborah A.<br>Nawocze                                       | Orthotics<br>inFunctionalRehabilitation of<br>the LowerLimb          |  |           |
| 12.    | P.Bowker, D.N.<br>CondeD.L.Bader,<br>D.J.PRATT              | Bio-mechanical basis of<br>Orthotics<br>Management                   | Butter worth-<br>Heinemann Ltd.<br>Linacre House,<br>Jordon Hill,Oxford<br>OX2 BDP |           |
| 13     | Michel M. Lusardi   | Orthotic & Prosthetic<br>management                                  |  |           |



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|---|
| <b>TITLE----- PRACTICAL PROSTHETICS SCIENCE-I</b>     |
| <b>COURSE CODE--- BPO 151</b>                         |
| <b>TEACHING HOURS----- 310</b>                        |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** This should include the supervised manufacture and fitting of all common devices and at least exposure to the range of devices not routinely seen in clinical practice.

**The student should be able to meet the following learning objectives:**

- <sup>3</sup>/<sub>4</sub> Assess the medical condition of a patient related to their orthotic or prosthetic management using appropriate investigative techniques which include patient history taking and clinical testing.
- <sup>3</sup>/<sub>4</sub> Formulate an optimal prosthetic solution using information from the patient assessment, other members of the rehabilitation team, medical charts, etc.
- <sup>3</sup>/<sub>4</sub> Communicate and discuss patient goals and expectations and discuss and debate the prosthetic management with the patient, co-workers and other members of the rehabilitation team.
- <sup>3</sup>/<sub>4</sub> Reliably measure and capture a positive cast or image of clients' appendage while correctly positioning the body part and if appropriate apply the necessary corrective force system.
- <sup>3</sup>/<sub>4</sub> Identify, prescribe and justify selection of appropriate materials and component in the construction of the device.
- <sup>3</sup>/<sub>4</sub> Construct the device using appropriate fabrication techniques in preparation for the initial fitting.
- <sup>3</sup>/<sub>4</sub> Fit the device to the patient using static and dynamic functional criteria established from the original assessment.
- <sup>3</sup>/<sub>4</sub> Evaluate the quality of the device fit to ensure the appropriate interface contouring, force application and tramlines.
- <sup>3</sup>/<sub>4</sub> Identify problems related to device fit and/or alignment and be able to suggest and implement appropriate correction.
- <sup>3</sup>/<sub>4</sub> Assess and solve prosthetic problems as part of long term patient care.
- <sup>3</sup>/<sub>4</sub> Maintain accurate records of patient treatment and follow up as well as confidentiality of such information.
- <sup>3</sup>/<sub>4</sub> Communicate effectively with patient, co-workers, and other health care professionals in such a manner that will ensure the highest quality of service and reflect a professional attitude on the part of the student.
- <sup>3</sup>/<sub>4</sub> Educate the patient / client and/or caregiver on use, care and function of the device.
- <sup>3</sup>/<sub>4</sub> Understand the methodology of problem identification, problem solving in a process that includes all stake holders, with the client at the centre.

**Prosthetics Practical:**

1. Taking case history of a minimum of 10 individuals / Patients
2. Fabrication of Prosthetic Feet,
3. Assessment, casting & fabrication of Partial foot prosthesis on model / mannequins
4. Assessment, casting & fabrication of Chopart Prosthesis on model / mannequins
5. Assessment, casting & fabrication of Symes Prosthesis on model / mannequins
6. Assessment, casting & fabrication of Trans-tibial prosthesis on model / mannequins

|   |
|---|
| <b>TITLE----- PRACTICAL ORTHOTICS SCIENCE-I</b>       |
| <b>COURSE CODE--- BPO 152</b>                         |
| <b>TEACHING HOURS---- 310</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** This should include the supervised manufacture and fitting of all common devices and at least exposure to the range of devices not routinely seen in clinical practice.

**The student should be able to meet the following learning objectives:**

- <sup>3</sup>/<sub>4</sub> Assess the medical condition of a patient related to their orthotic management using appropriate investigative techniques which include patient history taking and clinical testing.
- <sup>3</sup>/<sub>4</sub> Formulate an optimal orthotic solution using information from the patient assessment, other members of the rehabilitation team, medical charts, etc.
- <sup>3</sup>/<sub>4</sub> Communicate and discuss patient goals and expectations and discuss and debate the orthotic or prosthetic management with the patient, co-workers and other members of the rehabilitation team.
- <sup>3</sup>/<sub>4</sub> Reliably measure and capture a positive cast or image of clients' appendage while correctly positioning the body part and if appropriate apply the necessary corrective force system.
- <sup>3</sup>/<sub>4</sub> Create the final design of the orthosis through modification of the positive cast and/or tracing of the body part or when indicated, measure and fit prefabricated devices.
- <sup>3</sup>/<sub>4</sub> Identify, prescribe and justify selection of appropriate materials and componentry in the construction of the device.
- <sup>3</sup>/<sub>4</sub> Construct the device using appropriate fabrication techniques in preparation for the initial fitting.
- <sup>3</sup>/<sub>4</sub> Fit the device to the patient using static and dynamic functional criteria established from the original assessment.
- <sup>3</sup>/<sub>4</sub> Evaluate the quality of the device fit to ensure the appropriate interface contouring, force application and tramlines.
- <sup>3</sup>/<sub>4</sub> Identify problems related to device fit and/or alignment and be able to suggest and implement appropriate correction.
- <sup>3</sup>/<sub>4</sub> Assess and solve orthotic problems as part of long term patient care.
- <sup>3</sup>/<sub>4</sub> Maintain accurate records of patient treatment and follow up as well as confidentiality of such information.
- <sup>3</sup>/<sub>4</sub> Communicate effectively with patient, co-workers, and other health care professionals in such a manner that will ensure the highest quality of service and reflect a professional attitude on the part of the student.
- <sup>3</sup>/<sub>4</sub> Educate the patient / client and/or caregiver on use, care and function of the device.
- <sup>3</sup>/<sub>4</sub> Understand the methodology of problem identification, problem solving in a process that includes all stake holders, with the patient / client at the centre.

**Practical:**

1. Taking case history of a minimum of 10 individuals / Patients
2. Assessment, Evaluation & fabrication of Different types of foot Orthoses on model / mannequins
3. Assessment & Evaluation of Shoe modifications
4. Assessment, casting & fabrication of all types of Mechanical Ankle Joint, conventional & Custom moulded (A.F.O.) on model / mannequins
5. Assessment, casting & fabrication of functional fracture Orthosis for below knee on model / mannequins

## SECOND YEAR

|   |
|---|
| <b>TITLE----- PATHOLOGY</b>                           |
| <b>COURSE CODE--- BPO201</b>                          |
| <b>TEACHING HOURS---- 80</b>                          |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** The student should be able to describe and contrast the etiology and progression of diseases and to identify early signs and symptoms of conditions that are commonly encountered by Prosthetist & Orthotist. In addition, s/he should be able to advise on care and appropriate treatment options.

**The student should be able to meet the following learning objectives.**

- <sup>3</sup>/<sub>4</sub> Describe the basic pathological processes that underlie disease (eg: cell injury and necrosis, inflammation and healing, ischemia, infarction and neoplasia);
- <sup>3</sup>/<sub>4</sub> Apply knowledge of basic pathological processes to explain the etiology, pathogenesis, structural and functional manifestations of diseases commonly encountered in clinical practice, including relevant conditions affecting locomotion and body systems (musculoskeletal system and nervous system, vascular system).

### DETAILED CONTENTS

- a. **General:** 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. Ischemic, necrosis, thrombosis, embolism, Infarction, shock. Gangrene. 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. Neurovascular diseases: Outline of Cerebral-vascular disorders ,Trauma to brain and spinal cord, Demyelinating diseases like multiple sclerosis., Degenerative diseases like parkinsons disease. Peripheral vascular disease , 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.

#### RECOMMENDED BOOKS & JOURNALS

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

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|--|
| <b>TITLE----- ORTHOPAEDICS, AMPUTATION SURGERY AND IMAGING</b> |
| <b>COURSE CODE--- BPO202</b>                                   |
| <b>TEACHING HOURS----- 100</b>                                 |
| <b>CREDITS --- As per affiliated university norms</b>          |

**Course Description:** In this unit the students learn about the various orthopedic conditions in detail with review of the disabling conditions. It also covers the various common surgical techniques and its influences in the orthotics and prosthetics fit and design.

**The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Have an understanding of different clinical conditions that may indirectly impact on the clients' ability to successfully rehabilitate using the device.
- $\frac{3}{4}$  Explain the management of different disabling conditions.
- $\frac{3}{4}$  Explain the principles of amputations and revision amputation, types and techniques
- $\frac{3}{4}$  Explain the post operative care of the stump and stump hygiene
- $\frac{3}{4}$  Describe the stump dermatology and the common skin diseases and management.
- $\frac{3}{4}$  Describe and fabricate the post operative fitting in the lower extremity.
- $\frac{3}{4}$  Describe common surgical technique and how they may influence prosthetics and Orthotics fit and design
- $\frac{3}{4}$

### **DETAILED CONTENTS**

**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 (Calcaneovarus, Pes Valgus, varus, Metatarsalgia, plantarfasciitis, Anesthetic feet, Bunion toe Hallux Valgus)

**Shoulder:** Outline of Recurrent dislocation, Bicipital tendinitis and periarthrits.

**Elbow and forearm:** Outline of Cubitusvarus 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.

Different Imaging Techniques- X-ray, Sonography, CT Scan & MRI

Demonstration of different conditions & relevant x-ray films, how to read x-ray, how to measure the deformity x-ray, Cobbs & Rib angle measurement etc. Assessment related to P&O management.

### RECOMMENDED BOOKS & JOURNALS

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



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| <b>TITLE- Community Rehabilitation &amp; Disability Prevention</b> |
| <b>COURSE CODE--- BPO203</b>                                       |
| <b>TEACHING HOURS---- 60</b>                                       |
| <b>CREDITS --- As per affiliated university norms</b>              |

**Course Description:** The course is designed to assist the students to develop understanding of the health and socio-economic context of people with disabilities in the community.

**The student should be able to meet the following learning objectives to**

- <sup>3</sup>/<sub>4</sub> recognise members of the clinic team and identify benefits associated with a team approach
- <sup>3</sup>/<sub>4</sub> Describe and discuss theoretical principles of Physiotherapy & Occupational Therapy
- <sup>3</sup>/<sub>4</sub> Describe theories related to the psychology of loss and disability;
- <sup>3</sup>/<sub>4</sub> Discuss the social causes of disability in India and the link between poverty and disability.
- <sup>3</sup>/<sub>4</sub> Reflect and analyze on their attitude/values and attitudes towards persons with disabilities, their families and the community (Socio-cultural and religious)
- <sup>3</sup>/<sub>4</sub> Explain the UN convention rights and role as Prosthetist and Orthotist

### **DETAILED CONTENTS**

**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.

**Therapeutic Techniques:** Electrotherapy, Heat therapy, Hydrotherapy, Exercise Therapy

**Muscle Testing:** Concept, introduction, significance and limitations. Grade systems, techniques of muscle testing, goniometry.

Child development in brief - milestone and delayed milestone, Assessment procedure, Evaluation of muscle power, range of motion, checking of joint stability

Functional Assessment including Activities of Daily Living (ADL), stretching, pre prosthetic management, Exercise through games involving parents or guardians, Stump bandaging application etc.

Introduction to impairment, disability and handicap and International Classification of Functioning, Disability and Health (ICF). Introduction to disability issues, Government schemes and initiatives, legislation and UNCRPD,

**Specific disorders and management:** Peripheral nerve injuries. Poliomyelitis, Cerebral Palsy, Muscular Dystrophy, Club foot (CTEV), Spina Bifida, Hemiplegia, Spinal Cord injuries (paraplegia/ Quadriplegia),

- 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

Concept of comprehensive 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 other disabilities including visual, speech & hearing and mental retardation and disability evaluation.

Rehabilitation of Geriatric population: problems related with ageing and their management.

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.

**Community Based Rehabilitation:** CBR and its need – difference between IBR and CBR, Simple knowledge about other disabilities, its prevention and its management, Role of P&O Professionals in CBR, Role of other 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

## RECOMMENDED BOOKS & JOURNALS

### PHYSIOTHERAPY/OCCUPATIONAL THERAPY

| Sl. No. | Author                          | Title  | Publisher                 | Year/Vol. |
|---------|---------------------------------|--|---------------------------|-----------|
| 1       | 1 Park, J.E.                    | Text Book of Preventive and Social Medicine                                | Banarsidas, Jabalpur      | 1987      |
| 2.      | Pedretti, L.W.                  | Occupational Therapy: Practice skill                                       | Harcourt-Brace, New York  | 1990      |
| 3.      | Win & Parry                     | Hand Splinting   |                           |           |
| 4.      | Brunn Stones                    | Movement Therapy in hemiplegia   |                           |           |
| 5.      | Pagliarulo, M.A.                | Introduction to Physical Therapy   | Mosby, London             |           |
| 6.      | Jones,                          | Human Movement Explained   | Butterworth Heine         |           |
| 7.      | Gardiner, Dena                  | Principles of Exercise Therapy   | CBS, New Delhi            |           |
| 8.      | Froster, A. and Palastanga, N.  | Clayton's Electrotherapy: Theory and Practice                              | AITBS, Delhi              |           |
| 9.      | Jhon, Low and A Reed            | Electrotherapy Explained   | Butterworth Heine Oxford  |           |
| 10.     | Hislop, H.J. and Montgomery, J. | Daniels and Worthingham's Muscle Testing: Techniques of Manual Examination | W.B.Saunders Philadelphia | 2002      |
| 11.     | Tidy's Physiotherapy            | Thomson, A   | Varghese, Mumbai          |           |
| 12.     | Kendal, F.P.                    | Muscles Testing and Function   | Lippi cott, New York      | 1993      |

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| <b>TITLE-----BIO-MECHANICS-II</b>                     |
| <b>COURSE CODE--- BPO 204</b>                         |
| <b>TEACHING HOURS----- 100</b>                        |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** The understanding of Bio-mechanical principles of Prosthetics and Orthotics will be the foundation of the work of the students. It is essential to have a sound theoretical knowledge of the subject and students are able to demonstrate the rigorous application of these principles to practical P&O situations and in the analysis of those situations.

**The student should be able to meet the following learning objectives:**

- <sup>3</sup>/<sub>4</sub> Demonstrate an ability to apply principles of tissue mechanics to explain the principles of P&O treatment, (involving various force systems) and the practical problems encountered in prosthetics and orthotics
- <sup>3</sup>/<sub>4</sub> Use biomechanical terminology to describe position and motion of the human body
- <sup>3</sup>/<sub>4</sub> Discuss mechanical principles governing human motion
- <sup>3</sup>/<sub>4</sub> Utilise temporospatial, kinematic and kinetic information to distinguish between normal and abnormal function of the upper limbs, lower limbs & Spine.
- <sup>3</sup>/<sub>4</sub> Analyse the forces at a skeletal joint for various static and dynamic activities
- <sup>3</sup>/<sub>4</sub> Demonstrate the ability to analyzer forces and moments applied to the body by prosthetic and orthotic devices.
- <sup>3</sup>/<sub>4</sub> Apply biomechanical principles to generate optimal solutions to clinical problems in prosthetics and orthotics.
- <sup>3</sup>/<sub>4</sub> Understand the concepts of differentiation and integration and evaluate derivatives and integrals of a function

### **DETAILED CONTENTS**

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

Biomechanics of Hip , biomechanics of Knee

Posture & Gait: 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 wing and stance phase, force analysis of 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.

**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.

## RECOMMENDED BOOKS & JOURNALS

### BIOMECHANICS

| Sl. No. | Author   | Title  | Publisher   | Year/Vol.           |
|---------|--|--|---|---------------------|
| 1.      | P. Bowker, D.N.<br>Conde, D.L. Bader,<br>D.J.PRATT | Bio-mechanical basis<br>of Orthotics<br>Management | Butter worth-<br>Heinemann Ltd.<br>Linacre House,<br>Jordon Hill,<br>Oxford OX2 BDP |                     |
| 2.      | Humphrey, Jay D.                                   | Introduction to<br>biomechanics                    |   |                     |
| 3.      | Hamill, Joseph                                     | Biomechanical Basis<br>of human movement           |   | 2 <sup>nd</sup> ed. |
| 4.      | Rose, Jessicaed                                    | Human walking                                      |   |                     |
| 5.      | Soderberg, L.ed                                    | Kinesiology  |   |                     |
| 6.      | Hoffoman shirt J. ed.                              | Introduction of<br>Kinesiology                     |   | 2 <sup>nd</sup> ed. |

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|-----|---|--|--------------------------|---------------------|
| 7.  | Tyldesley, Barbara                        | Muscles, nerves & movement               |                          | 3 <sup>rd</sup> ed. |
| 8.  | Perry, Jacquelin                          | Gait analysis                            |                          |                     |
| 9.  | Tozeren, Aydin                            | Humanbody dynamics                       |                          |                     |
| 10. | Harries, G.F.ed                           | Human motion analysis                    |                          |                     |
| 11. | Dvir, Zeevi                               | Clinical biomechanics                    |                          |                     |
| 12. | HallSusan J                               | Basic Biomechanics                       | McGraw-Hill              |                     |
| 13. | Hausdorff, Alexander<br>Jeffrey M, Neil B | Gait disorders                           | B. I. Publications<br>P  |                     |
| 14. | Duane Knudson                             | Fundamentals of Bio-Mechanics            |                          | 2nd ed.             |
| 15. | StanleyBell P<br>Frank                    | Principles of mechanics and biomechanics | B. I. Publications<br>uk |                     |
| 16. | Black<br>Jonathan                         | Clinical Biomechanics                    |                          |                     |
| 17. | Donatelli, R.A.                           | Biomechanics of the Foot and Ankle       | Davis,<br>Philadelphia   |                     |
| 18. | Kapandgi, I.A.                            | Physiology of Joints                     | Churchill-Livingstone    | Vol. I, II & III    |

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| <b>TITLE----- PHARMACOLOGY</b>                        |
| <b>COURSE CODE--- BPO208</b>                          |
| <b>TEACHING HOURS--- 60</b>                           |
| <b>CREDITS --- As per affiliated university norms</b> |

1. General Pharmacology:

- Introduction, Definitions, Classification of drugs, Sources of drugs, Routes of drug administration, Distribution of drugs, Metabolism and Excretion of drugs, Pharmacokinetics, Pharmacodynamics, Factors modifying drug response, Elementary knowledge of drug toxicity, drug allergy, drug resistance, drug potency, efficacy & drug antagonism.

2. Autonomic Nervous system

Cholinergic and Anti-Cholinergic drugs, Adrenergic and Adrenergic blocking drugs, Peripheral muscle relaxants.

3. Neuropharmacology (in brief) :Sedative-Hypnotic Drugs: Barbiturates, Benzodiazepines, Antianxiety Drugs: Benzodiazepines, Other Anxiolytics, Drugs Used in Treatment of Mood Disorders: Monoamine Oxidase Inhibitors, Tricyclic Antidepressants, Atypical Antidepressants, Lithium, Antipsychotic drugs

4. Disorders of Movement (in brief) :Drugs used in Treatment of Parkinson's Disease, Antiepileptic Drugs, Spasticity and Skeletal Muscle Relaxants

5. Inflammatory/Immune Diseases-Non-narcotic Analgesics and Nonsteroidal Anti-Inflammatory Drugs, Acetaminophen, NSAIDs, Aspirin, Nonaspirin NSAIDs, drug Interactions with NSAIDs, Glucocorticoids: Pharmacological Uses of Glucocorticoids, adverse effects,

Physiologic Use of Glucocorticoids, Drugs Used in Treatment of Arthritic Diseases: Rheumatoid Arthritis, Osteoarthritis, Gout, Drugs Used in the Treatment of Neuromuscular Immune/Inflammatory Diseases: Myasthenia gravis, Idiopathic Inflammatory Myopathies, systemic lupus Erythematosis, Scleroderma, Demyelinating Disease,

6. Respiratory Pharmacology (in brief) : Obstructive Airway Diseases, Drugs used in Treatment of Obstructive airway Diseases, Allergic Rhinitis

7. Digestion and Metabolism (in brief): Gastrointestinal Pharmacology: Peptic Ulcer Disease, Constipation, Diarrhea, Drugs Used in Treatment of Diabetes Mellitus: Insulin, Oral Hypoglycemics

8. Geriatrics: Pharmacology and the geriatric Population: Adverse effects of special concern in the Elderly, Dementia, Postural hypotension, urinary incontinence.

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| <b>TITLE----- PSYCHOLOGY AND SOCIOLOGY</b>            |
| <b>COURSE CODE--- BPO 205</b>                         |
| <b>TEACHING HOURS--- 60</b>                           |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course Description:** The course is designed to assist the students to develop understanding of the health and socio-economic context of people with disabilities in the community and their role and the role of CBR and introduce different members of the clinic team and theoretical principles of rehabilitation.

**The student should be able to meet the following learning objectives**

- ¾ Recognise members of the clinic team and identify benefits associated with a team approach
- ¾ Describe and discuss theoretical principles of rehabilitation;
- ¾ Reflect and analyse on their attitude/values and attitudes towards persons with disabilities, their families and the community (Socio-cultural and religious)
- ¾ Explain the different approaches to rehabilitation.
- ¾ Explain different component of CBR and the guiding principles of CBR implementation.
- ¾ Explain P & O role in a CBR programme

**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.

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.

### RECOMMENDED BOOKS & JOURNALS

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

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| <b>TITLE----- PROSTHETICS SCIENCE-II</b>              |
| <b>COURSE CODE--- BPO 206</b>                         |
| <b>TEACHING HOURS----- 80</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**DETAILED CONTENTS**

**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

**Gait Deviations and Analysis:** Trans Femoral Gait Analysis, Trans Femoral Check-out Procedures,

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| <b>TITLE----- ORTHOTICS SCIENCE-II</b>                |
| <b>COURSE CODE--- BPO 207</b>                         |
| <b>TEACHING HOURS----- 80</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

### DETAILED CONTENTS

**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 checkout procedures.

**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 Orthotic management of Rickets and Knee Arthritis

### RECOMMENDED BOOKS & JOURNALS

| SI. No. | Title   | Author                                     | Publisher                                   |
|---------|---|--|---|
| 1.      | Prosthetics & Orthotics                                       | Shurr. G.<br>Donald&J.W.Michel             |   |
| 2.      | Prosthetics & Orthotics<br><br>LowerLimb& Spine               | Seymour, Ron                               |   |
| 3.      | Amputations & Prosthetics                                     | May Bella J.                               | Jaypee Publisher New<br>Delhi               |
| 4.      | Orthotics in functional<br>rehabilitation of the<br>lowerlimb | Nowoczenski, Deborah<br>A.                 |   |
| 5.      | Atlasfor prosthetic<br>rehabilitation,                        | AmericanAcademy of<br>Orthopaedic Surgeons | Mosby publications/ or<br>N.Y.U. St.Louice, |

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|-----|--|--|--|
|     | Surgery and limb deficiency.                                       |  | London, Chicago  |
| 6.  | Hydraulics and pneumatics  | Parr, Andrew   |  |
| 7.  | Foot and ankle sports  | Bates, Andrea  |  |
| 8.  | Functional fracture bracing  | Sarmiento, A.  |  |
| 9.  | AAOS atlas of Orthosis and assistive devices,                      | Hsu, John D.   | Mosby publications/ or N.Y.U. St. Louis, London, Chicago |
| 10. | Maintenance and care of the prosthesis                             | C.A. Harnesseg   |  |
| 11. | Manual for lower Extremity prosthetics<br>Publisher : Mosby        |  | Mosby publications/ or N.Y.U. St. Louis, London, Chicago |
| 12. | Hip disarticulation Prosthesis                                     | C.A. Melancik  |  |
| 13. | FOOT ORTHOSIS  | Kent, Wu   |  |
| 14. | Orthotics: Individual: A Comprehensive Interactive Tutorial CD-ROM | Jan Bruckner and Joan Edelstein                        |  |
| 15. | An Atlas of Lower Limb Orthotic Practice                           | D.N. Condie and S. Turner                              |  |
| 16. | Orthotics and Prosthetics in Rehabilitation                        | Michelle M. Lusardi PhD PT and Caroline C. Nielsen PhD |  |
| 17. | Orthotics in Functional Rehabilitation of the Lower Limb           | Deborah A. Nawocze                                     |  |
| 18. | Orthology: Pathomechanics of Lower-Limb Orthotic Design            | American Academy of Prosthetists & Orthotists          |  |

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|-----|---|---|--|
| 19. | Introduction to microprocessor                                      | Mathur U.N. Dhur<br>A.P                         | Mac-Graw Hill Inc.<br>New Delhi  |
| 20. | Orthotics Etcetera  | John B Redford                                  |  |
| 21. | New Advances in<br>Prosthetics and Orthotics                        | <a href="#">Mark H Bussell</a>                  |  |
| 22. | Manual of Lower Extremity<br>Orthotics                              | AAOS  | Springfield  |
| 23. | Prosthetic<br>& patient management                                  | Kevin Croll                                     |  |
| 24. | The Immediate post-<br>operative Prosthesis in<br>L.E E. Amputation | Andrew C. Ruoff &<br>Others                     |  |
| 25. | Congenital Limb<br>Deficiency                                       | Charles A Frank                                 |  |
| 26. | Above Knee Amputation-<br>Prosthetic Principles<br>& Practice       | Zems Grim                                       |  |
| 27. | Hemipelvectomy Prosthesis   | Fred Hampton                                    |  |
| 28  | Hip Disarticulation<br>Prosthesis                                   | C. A. Mclaucik                                  |  |
| 29. | Powered Lower Limb<br>Orthotics in Paraplegia                       | J. Hughes                                       |  |
| 30. | Bio-mechanical basis of<br>Orthotics<br>Management                  | P. Bowker, D.N. Conde<br>D.L. Bader, D.J. PRATT | Butterworth-<br>Heinemann Ltd.<br>Linacre House,<br>Jordon Hill, Oxford<br>OX2 BDP |

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| <b>TITLE----- PROSTHETICS SCIENCE-II</b>              |
| <b>COURSE CODE--- BPO 251</b>                         |
| <b>TEACHING HOURS----- 260 ( Practical)</b>           |
| <b>CREDITS --- As per affiliated university norms</b> |

**Prosthetics Practical:** all types of above Knee prosthesis and through knee prosthesis. Silicone Cosmetic prosthesis on model / mannequins

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| <b>TITLE----- ORTHOTICS SCIENCE-II</b>                |
| <b>COURSE CODE--- BPO 252</b>                         |
| <b>TEACHING HOURS----- 260</b>                        |
| <b>CREDITS --- As per affiliated university norms</b> |

**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.

Note: The orthoses to be fabricated on model / mannequin's

## THIRD YEAR

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| <b>TITLE----- COMPUTER SCIENCE &amp; GRAPHICAL COMMUNICATION</b> |
| <b>COURSE CODE--- BPO 301</b>                                    |
| <b>TEACHING HOURS---- 80 ( Practical -120)</b>                   |
| <b>CREDITS --- As per affiliated university norms</b>            |

**Course description:** Student will acquire computer knowledge to design the prosthetics and orthotics components and apply in research and development in prosthetics and orthotics field.

**The student should be able to meet the following learning objectives:**

Describe the advanced application of computer in prosthetics and orthotics field.  
Design various components for prosthetics and orthotics use.  
Make use of computer knowledge in the statistics data analysis and documentation.  
Describe the principles of computer aided design(CAD) & computer aided manufacture(CAM)

### **DETAILED CONTENTS**

Dimension on technical drawing , indication of linear and angular tolerance, methods of dimensing and toleracing, cone methods of indicating surface texture on technical metal work

Orthographic projections, points, line and simple objects, Orthographic and isometric projection of P & O components

Introduction to computers and Components of computers: Physical Composition, Central Processing Unit, Main Memory, Input and Output units and alsoall 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, data base and presentation software, e.g. Windows XP or Windows 2000 Professional, Microsoft Office XP or 2000 Professional etc., upgraded as used currently, Anti Virus.

Basic Engineering Drawing:

## 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 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

### RECOMMENDED BOOKS & JOURNALS

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



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|---|
| <b>TITLE-----BIO-MECHANICS-III</b>                    |
| <b>COURSE CODE--- BPO 302</b>                         |
| <b>TEACHING HOURS-----70</b>                          |
| <b>CREDITS --- As per affiliated university norms</b> |

**DETAILED CONTENTS**

Biomechanics of Hand, wrist complex, elbow complex & shoulder complex.

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, myoelectric 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.

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.

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.

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. Column of the spine, biomechanics of spinal injuries, follower load, Euler's theory of buckling

## RECOMMENDED BOOKS & JOURNALS

### BIOMECHANICS

| Sl. No. | Author  | Title   | Publisher   | Year/Vol.           |
|---------|---|---|---|---------------------|
| 1.      | P. Bowker, D.N.<br>Conde,<br><br>D.L. Bader,<br>D.J.PRATT | Bio-mechanical basis of<br>Orthotics Management | Butter worth-Heinemann<br>Ltd. Linacre House,<br>Jordon Hill, Oxford OX2<br>BDP |                     |
| 2.      | Humphrey, Jay D.  | Introduction to<br>biomechanics                 |   |                     |
| 3.      | Hamill, Joseph  | Biomechanical Basis of<br>human movement        |   | 2 <sup>nd</sup> ed. |
| 4.      | Rose, Jessicaed.  | Human walking                                   |   |                     |
| 5.      | Soderberg, L.ed.  | Kinesiology                                     |   |                     |
| 6.      | Hoffoman shirt J. ed.                                     | Introduction of<br>Kinesiology                  |   | 2 <sup>nd</sup> ed. |
| 7.      | Tyldesley, Barbara  | Muscles, nerves<br>&movement                    |   | 3 <sup>rd</sup> ed. |
| 8.      | Perry, Jacuelin   | Gait analysis                                   |   |                     |
| 9.      | Tozeren, Aydin  | Humanbody dynamics                              |   |                     |
| 10.     | Harries, G.F.ed   | Humanmotion analysis                            |   |                     |
| 11.     | Dvir, Zeevi   | Clinical biomechanics                           |   |                     |
| 12.     | Hall Susan J  | Basic Biomechanics                              | McGraw-Hill   |                     |
| 13.     | Hausdorff, Alexander<br>Jeffrey M, Neil B                 | Gait disorders                                  | B. I. Publications P  |                     |
| 14.     | Duane Knudson   | Fundamentals of Bio-<br>Mechanics               |   | 2nd ed.             |
| 15.     | StanleyBell P<br>Frank                                    | Principles of mechanics<br>and biomechanics     | B. I. Publications uk   |                     |
| 16.     | Black Jonathan  | Clinical Biomechanics                           |   |                     |
| 17.     | Donatelli, R.A.   | Biomechanics of the Foot<br>and Ankle           | Davis, Philadelphia   |                     |
| 18.     | Kapandgi, I.A.  | Physiology of Joints                            | Churchill- Livingstone  | Vol. I, II & III    |

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|---|
| <b>TITLE----- ASSISTIVE TECHNOLOGY</b>                |
| <b>COURSE CODE--- BPO303</b>                          |
| <b>TEACHING HOURS-----80</b>                          |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course description:** Students would learn about the use of various types of mobility aids required by PWDs and related analysis of the gait pattern.

**The student should be able to meet the following learning objectives:**

- <sup>3</sup>/<sub>4</sub> Explain the prescription of commonly used mobility aids like crutches, walking stick, and walkers. Assess and prescribe the best possible mobility solution for a wheelchair user
- <sup>3</sup>/<sub>4</sub> Carry out repair and maintenance of wheelchair
- <sup>3</sup>/<sub>4</sub> Describe the correct use of the wheelchairs, transfers and various modifications of wheel chairs
- <sup>3</sup>/<sub>4</sub> Train users to make the best use of their wheelchair.
- <sup>3</sup>/<sub>4</sub> Assess, prescribe and fabricate different types of developmental aids
- <sup>3</sup>/<sub>4</sub> Describe the analysis of gait with the related mobility aids.

### **DETAILED CONTENTS**

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, user assessment, prescription, measurement, fitting, Transfer techniques, Wheelchair mobility skills, customized wheelchair, 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. Robotics Arms,

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.

#### **RECOMMENDED BOOKS & JOURNALS**

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|--|
| <b>TITLE----- RESEARCH METHODOLOGY&amp;BIOSTATISTICS</b> |
| <b>COURSE CODE--- BPO 304</b>                            |
| <b>TEACHING HOURS-----60</b>                             |
| <b>CREDITS --- As per affiliated university norms</b>    |

**Course description:** The student would acquire the knowledge of the research problem, design, Sampling, data collection, analysis of data, Testing hypotheses, interpretation and report writing to prosthetics and Orthotics

**The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Explain the process, types, design, needs, principles of research
- $\frac{3}{4}$  Formulate an appropriate research plan in order to solve a clinical problem
- $\frac{3}{4}$  Examine the concepts of estimation and hypothesis testing with applications to population proportions, means, variances
- $\frac{3}{4}$  Describe the sampling, data collection and processing of data
- $\frac{3}{4}$  Examine the data by using different measures
- $\frac{3}{4}$  Perform effective descriptive statistical analysis as well as statistical inference for a variety of mainstream applications
- $\frac{3}{4}$  Use appropriate empirical and probability distributions to model data.
- $\frac{3}{4}$  Conduct a basic research study in order to solve a clinical problem

### **DETAILED CONTENTS**

#### **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.

#### **RECOMMENDED BOOKS & JOURNALS**

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

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| <b>TITLE----- PROSTHETICS SCIENCE-III</b>             |
| <b>COURSE CODE--- BPO 305</b>                         |
| <b>TEACHING HOURS----- 90</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**DETAILED CONTENTS**

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: passive, 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. Checkout 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. Checkout procedures, Testing and Training.

Trans Humeral: 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. Checkout 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. Checkout procedures, Testing and Training.



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| <b>TITLE----- ORTHOTIC SCIENCE-III</b>                |
| <b>COURSE CODE--- BPO 306</b>                         |
| <b>TEACHING HOURS----- 80</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**DETAILED CONTENTS**

Control systems: Introduction to control theory, application of Functional Electrical Stimulation (FES) in Orthotics, 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. Orthotic management of rheumatic arthritis and burns 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.

Upper Limb: Orthosis biomechanics, application of external power, myoelectric control of external power and usage of devices.

### RECOMMENDED BOOKS & JOURNALS

| Sl. No. | Title  | Author  | Publisher   | Year/Vol.           |
|---------|--|---|---|---------------------|
| 1.      | Prosthetics & Orthotics  | Shurr. G.<br>Donald&J.W.Michel                        |   | 2 <sup>nd</sup> ed. |
| 2.      | Atlasfor prosthetic rehabilitation, Surgeryandlimb deficiency. | AmericanAcademy of Orthopaedic Surgeons               | Mosby publications/ or N.Y.U. St.Louice, London, Chickago | 3 <sup>rd</sup>     |
| 3.      | Orthotics  | Edestein, Joan E.                                     | Jaypee Publisher New Delhi                                |                     |
| 4.      | AAOS atlas of Orthosis and assistive devices,                  | Hsu, John D.  | Mosby publications/ or N.Y.U. St.Louice, London, Chickago | 4 <sup>th</sup> ed. |
| 5.      | Maintenanceandcare of the prosthesis                           | C.A.Hannesseg   |   |                     |
| 6.      | Manualfor Upper Extremity Prosthesis                           | William R.SANTASHI Edn                                |   |                     |
| 7.      | Orthotics and Prosthetics in Rehabilitation                    | Michelle M. Lusardi PhD PT andCaroline C. Nielsen PhD |   |                     |
| 8.      | Guidelines for Prescribing Foot Orthotics                      | Mark A. Reiley  |   |                     |
| 9.      | Orthotics inFunctionalRehabilitati on of the LowerLimb         | Deborah A. Nawocze                                    |   |                     |
| 10.     | Hand and Upper Extremity Splinting : principles and methods    | Fess,Gettle,Philips ElaineEwing,KaranS, Cynthia A     | Elsevier Mosby St. Luis B. I. Publications P              |                     |
| 11.     | <b>Powered upper limbprosthesis</b>                            | AmericanAcademy of Prosthetists&Orthotis ts           |   |                     |
| 12.     | Upper Extremity Orthotics                                      | Anderson, Miles H.                                    | Jaypee Publisher New Delhi                                |                     |
| 13.     | New Advances in Prosthetics and Orthotics                      | <a href="#">Mark H Bussell</a>                        |   |                     |
| 14.     | Prosthetic &patientmanagement                                  | KevinCroll  |   | 1 <sup>st</sup>     |

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| <b>TITLE----- PRACTICAL PROSTHETICS SCIENCE-III</b>   |
| <b>COURSE CODE--- BPO 351</b>                         |
| <b>TEACHING HOURS----340</b>                          |
| <b>CREDITS --- As per affiliated university norms</b> |

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.

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| <b>TITLE----- PRACTICAL ORTHOTICS SCIENCE-III</b>     |
| <b>COURSE CODE--- BPO 352</b>                         |
| <b>TEACHING HOURS----300</b>                          |
| <b>CREDITS --- As per affiliated university norms</b> |

Orthotics Practical: Fabrication of at least 5 types of splints belonging to each group on model / mannequins

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| <b>TITLE----- PRACTICAL COMPUTER SCIENCE</b>          |
| <b>COURSE CODE--- BPO 353</b>                         |
| <b>TEACHING HOURS---- 120</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**Practical:**

1.Student has to be thorough in all branches of MS Office especially WORD and POWERPOINT. In addition to that it would be better if Student also learn one additional drawing and imaging software among e.g. Corel Draw, PageMaker, Photoshop or similar kind of softwares.

2. Student has to be thorough in all branches CAD-CAM especially AUTOCAD. Student should make design of all common types of P&O components which are regularly in use by using AutoCAD software.

## **FOURTH YEAR**

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| <b>TITLE----- PROSTHETICS SCIENCE-IV</b>              |
| <b>COURSE CODE--- BPO 401</b>                         |
| <b>TEACHING HOURS----60</b>                           |
| <b>CREDITS --- As per affiliated university norms</b> |

### **DETAILED CONTENTS**

**Hip Disarticulation Prosthesis:** Various types of through hip Prosthesis. Prescription principles, Materials and components to be used, Casting and measurement techniques, Cast modification, alignment, suspension, Fitting, donning and doffing techniques. Check out procedures, Testing and Training. Through hip Gait analysis and deviations.

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

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| <b>TITLE----- ORTHOTICS SCIENCE-IV</b> |
| <b>COURSE CODE--- BPO402</b>           |
| <b>TEACHING HOURS----80</b>            |
| <b>CREDITS ---</b>                     |

**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. Indications and contraindications for spinal orthosis

**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& Kyphosis. All types of under arm orthoses and variants. Various types of Immobilisers, Fitting,

donning and doffing techniques. Checkout 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. Cranial Orthoses Orthotic management of spinal deformities / injuries. Orthotic management of Pott's spine

#### RECOMMENDED BOOKS & JOURNALS

| Sl. No. | Author  | Title  | Publisher  | Year/Vol.           |
|---------|---|--|--|---------------------|
| 1.      | Shurr. G.<br>Donald&J.W.Michel                              | Prosthetics & Orthotics  |  | 2 <sup>nd</sup> ed. |
| 2.      | Seymour, Ron  | Prosthetics & Orthotics<br>LowerLimb& Spine                                  |  |                     |
| 3.      | AmericanAcademy of<br>Orthopaedic Surgeons                  | Atlasfor prosthetic<br>rehabilitation,<br>Surgeryandlimb<br>deficiency.      | Mosby publications/<br>or N.Y.U. St.Louice,<br>London, Chickago                    | 3 <sup>rd</sup>     |
| 4.      | Hsu, John D.  | AAOS atlas of Orthosis<br>and assistive devices,                             | Mosby publications/<br>or N.Y.U. St.Louice,<br>London, Chickago                    | 4 <sup>th</sup> ed. |
| 5.      | C.A.Melancik  | Hip disarticulation<br>Prosthesis  |  |                     |
| 6.      | KentonD.Leatherman<br>Rober A. Dickson                      | The Management of<br>Spinal deformities                                      | Butter worth-<br>Heinemann Ltd.<br>Linacre House,<br>Jordon Hill,Oxford<br>OX2 BDP |                     |
| 7.      | E.F.Murphy  | Principal in Prosthetic<br>managementforMultiple<br>handicapped              |  |                     |
| 8.      | Jan Bruckner and Joan<br>Edelstein                          | Orthotics: Individual: A<br>Comprehensive<br>Interactive Tutorial CD-<br>ROM |  |                     |
| 9.      | D.N. Condieand S.<br>Turner                                 | An Atlas of Lower Limb<br>Orthotic Practice                                  |  |                     |
| 10.     | Michelle M. Lusardi<br>PhD PT andCaroline C.<br>Nielsen PhD | Orthotics and<br>Prosthetics in<br>Rehabilitation                            |  |                     |
| 11.     | Deborah A. Nawocze  | Orthotics<br>inFunctionalRehabilitati<br>on of the LowerLimb                 |  |                     |
| 12.     | AmericanAcademy of<br>Prosthetists&Orthotists               | Orthology:<br>Pathomechanics of<br>Lower-Limb Orthotic<br>Design             |  |                     |

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| <b>TITLE----- MANAGEMENT &amp; ADMINISTRATION</b>     |
| <b>COURSE CODE--- BPO 403</b>                         |
| <b>TEACHING HOURS----60</b>                           |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course description:** Students would have an understanding of the planning, construction, human management, store management and safety of the workshop

**The student should be able to meet the following learning objectives:**

- $\frac{3}{4}$  Explain techniques related to the design, planning, control and improvement of service and manufacturing operations.
- $\frac{3}{4}$  Demonstrate basic knowledge of financial management practices such as cost calculations and accounting processes.
- $\frac{3}{4}$  Address issues related to clinic management including, appointment systems and record keeping.
- $\frac{3}{4}$  Discuss the importance of quality control and workflow management.
- $\frac{3}{4}$  Apply appropriate inventory management protocols
- $\frac{3}{4}$  Understand and discuss the benefits associate with the use of quality assurance systems
- $\frac{3}{4}$  Understand the organization of the workplace environment.

### **DETAILED CONTENTS**

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 Departments at various levels, all types of various scales. Layout, plant Layout. Costing, billing, documentation especially development of recording system to manage individual's records. Leadership. Human resource management & Environmental Science: Hospital waste disposal. Role of the International Health Agencies

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 Professionals

Introduction of administration, Nature and scope of administration, How to be an effective administrator, Principles of administration and its applications to Prosthetics and orthotics setup. Rules of Professional Conduct.

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| <b>TITLE----- PROSTHETICS SCIENCE-IV</b>              |
| <b>COURSE CODE--- BPO 451</b>                         |
| <b>TEACHING HOURS----- 160</b>                        |
| <b>CREDITS --- As per affiliated university norms</b> |

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

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| <b>TITLE----- ORTHOTICS SCIENCE-IV</b>                |
| <b>COURSE CODE--- BPO 452</b>                         |
| <b>TEACHING HOURS----- 160</b>                        |
| <b>CREDITS --- As per affiliated university norms</b> |

**Practical:** Fabrication of all types of orthoses on model / mannequins



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| <b>TITLE----- PROSTHETICS CLINICAL PRACTICE</b>       |
| <b>COURSE CODE--- BPO 453</b>                         |
| <b>TEACHING HOURS----250</b>                          |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course description:** The student will have experience in the clinical environment of supplying prostheses and orthoses to patients undergoing treatment. This experience should cover as wide a range as possible but with emphasis on the major levels of provision.

**The student will develop skills in the:**

- ¾ communication
- ¾ assessment and prescription;
- ¾ clinical provision of prostheses and orthoses;
- ¾ manufacture of prostheses and orthoses;
- ¾ interpersonal relationships;
- ¾ organisation and management;
- ¾ Clinical research.
- ¾ Contributing too and learning from the clinic team.

**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 health care team and other trainees. Besides fitting, trainee would also work with other rehabilitation team members to understand “Total Rehabilitation”.

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| <b>TITLE----- ORTHOTICS CLINICAL PRACTICE</b>         |
| <b>COURSE CODE---</b> <b>BPO 454</b>                  |
| <b>TEACHING HOURS-----250</b>                         |
| <b>CREDITS --- As per affiliated university norms</b> |

**Course description:** The student will have experience in the clinical environment of supplying prostheses and orthoses to patients undergoing treatment. This experience should cover as wide a range as possible but with emphasis on the major levels of provision.

**The student will develop skills in the:**

- $\frac{3}{4}$  communication
- $\frac{3}{4}$  assessment and prescription;
- $\frac{3}{4}$  clinical provision of prostheses and orthoses;
- $\frac{3}{4}$  manufacture of prostheses and orthoses;
- $\frac{3}{4}$  interpersonal relationships;
- $\frac{3}{4}$  organisation and management;
- $\frac{3}{4}$  Clinical research.
- $\frac{3}{4}$  Contributing too and learning from the clinic team.

**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 health care team and other trainees. Besides fitting, trainee would also work with other rehabilitation team members to understand “Total Rehabilitation”.

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| <b>TITLE----- PROJECT WORK</b>                        |
| <b>COURSE CODE---</b> <b>BPO</b>                      |
| <b>TEACHING HOURS----- 180</b>                        |
| <b>CREDITS --- As per affiliated university norms</b> |

Each Trainee shall take a project work under supervision of a guide. Project work has to be well documented and presented in essay form. The major focus will be trainee’s original work which she or he has to present prior to final examination. The subject and the guide should be chosen within four weeks from the day of admission to the fourth year.