| GANPAT UNIVERSITY | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FACULTY OF ENGINEERING & TECHNOLOGY | | | | | | | | | |
| Programme | Bachelor of Technology | | | | | Branch/Spec. | Biomedical Engineering | | |
| Semester | VII | | | | | Version | 1.0.0.1 | | |
| Effective from Academic Year | | | 2025-2026 | | | Effective for the batch Admitted in | | | July 2022 |
| Subject code | 2BM7203 | | Subject Name | | | Therapeutic Techniques & Instrumentation | | | |
| Teaching scheme | | | | | | Examination scheme (Marks) | | | |
| (Per week) | Lecture(DT) | | Practical(Lab.) | | Total | | CE | SEE | Total |
| | L | TU | P | TW | | | | | |
| Credit | 3 | - | 1 | - | 4 | Theory | 40 | 60 | 100 |
| Hours | 3 | - | 2 | - | 5 | Practical | 30 | 20 | 50 |

Pre-requisites

Basic knowledge of human anatomy and physiology, Fundamental of sensor, transducers and electronics

Course Outcomes

On successful completion of the course, the students will be able to:

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| CO1 | Demonstrate an **Understanding** of the principles and working of various therapeutics instruments. |
| CO2 | **Analyze** the design, functionality, and performance of life-saving devices such as pacemakers, defibrillators, and ventilators. |
| CO3 | **Explain** the clinical applications of therapeutic equipment in healthcare. |
| CO4 | **Understand** the integration of technology in neonatal, anaesthesia, and critical care instrumentation. |
| CO5 | **Evaluate** the safety, reliability, and effectiveness of medical devices used in patient care. |

Theory syllabus

| Unit | Content | Hrs. |
|---|---|---|
| 1 | CARDIAC PACEMAKER:<br>Need for pacemaker, External pacemakers, Implantable pacemakers- Types, basic requirements of implantable circuit; programmable pacemaker, Performance aspects of implantable pacemaker, classification codes ICHD and NASPE / BPEG generic code for pacemaker, Leads and electrodes: Lead components, Unipolar and bipolar leads, Active and passive fixation; Power Source for pacemaker, Sensitivity and pacing threshold measurement, Reliability aspects of cardiac pacemaker, Pacing system analyser. | 6 |
| 2 | DEFIBRILLATOR:<br>Reason of fibrillation, need of defibrillator and defibrillation, Basic types of defibrillators, Principle and circuit description of DC defibrillator, Rectangular wave defibrillator, Defibrillator electrodes, Basic principle and comparison of output wave forms of different DC defibrillator, Energy requirements, Synchronous operation, Cardioverter, Performance aspects of DC defibrillator. Implantable defibrillator and defibrillator analysers, Defibrillator safety. | 8 |
| 3 | DIALYSERS:<br>Principle of haemodialysis, Ultra-filtration phenomenon, Artificial kidney, Peritoneal dialysis, Hemofiltration, Function and working of dialyzer, Types of Dialyzer: parallel flow, coil, hollow fiber, Performance analysis of dialyzers, Block diagram and working of haemodialysis machine, Composition of dialysate, Circuits: Dialysate temperature control and blood leak detector, Portable kidney machine –Principle of using sorbent compounds for dialysate regeneration. | 7 |
| 4 | SURGICAL DIATHERMY:<br>Principle of surgical diathermy, electrosurgical equipment and techniques, electrotomy, fulguration, coagulation, desiccation, electro surgery units, spark gap valve, solid-state generator, Construction and working of surgical diathermy machine, electrodes, Safety aspects of electrosurgical unit like burns, high frequency current hazard, and explosion hazard, operating principle of surgical diathermy analyser. | 5 |

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|---|---|---|
| 5 | PHYSIOTHERAPY AND ELECTROTHERAPY EQUIPMENT:<br>Physiotherapy: Short wave diathermy, Micro wave diathermy, Ultrasonic therapy unit.<br>Electrotherapy: Different current waveforms used in electrotherapy, Interferential Current Therapy, Transcutaneous electrical nerve stimulator (TENS), Spinal cord stimulator, Bladder stimulators. | 4 |
| 6 | VENTILATOR:<br>Basic principles of ventilators, Classification of positive pressure ventilators, Different volume and pressure controlled modes with pressure-volume-flow diagrams: Control, Assist control, CPAP, Bi-PAP, PEEP, IMV, SIMV, I: E ratio. High frequency ventilators. | 7 |
| 7 | NEONATAL INSTRUMENTATION:<br>Incubator/Baby warmer, Apnoea detection, Infusion pump. | 2 |
| 8 | ANAESTHESIA MACHINE:<br>Complete schematic of anaesthesia machine, Gas supply and delivery system, Designing and component of vaporizer, Patient breathing circuit, Humidifiers. | 6 |
| Practical content**:** | | |
| Term Work and Practical shall be based on the above syllabus. | | |
| Text Books**:** | | |
| 1 | Handbook of Bio-Medical Instrumentation By R. S. Khandpur | |
| 2 | Medical Instrumentation By John Webster | |
| Reference Books **:** | | |
| 1 | Introduction to Biomedical Equipment and Technology By Carr and Brown | |
| 2 | Electrical & Electronics Measurement and Instrumentation By A K Sawnhey | |
| ICT References **:** | | |
| 1 | https://www.youtube.com/watch?v=GZeFkCGClSU | |
| 2 | https://onlinecourses.swayam2.ac.in/nou23_bt05/preview | |
| 3 | https://www.youtube.com/watch?v=_K8YdKkkdxo | |
| 4 | https://vam.anest.ufl.edu/websims/VAM/ | |

**Mapping of CO with PO and PSO:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 2 | 3 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 3 | 2 | 1 |
| **CO2** | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 3 |
| **CO3** | 2 | 2 | 2 | 1 | 2 | 3 | 0 | 3 | 1 | 2 | 0 | 2 | 2 | 2 | 2 |
| **CO4** | 3 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 1 | 2 | 1 | 3 | 3 | 2 | 2 |
| **CO5** | 3 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 3 | 3 | 2 | 2 |