

Nirma University
Institute of Technology
B. Tech (Instrumentation and Control Engineering)
Semester: V/VI

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(Open Elective for other than IC Eng.)

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| Course Code | 2ICOE27 |
| Course Title | Introduction to Biomedical Engineering |

Course Outcomes (COs):

At the end of the course, students will be able to –

1. illustrate medical terminology relevant to biomedical instrumentation
2. analyze different diagnostic and therapeutic methods
3. compare different medical imaging systems for different pathological diagnoses
4. select biomedical instruments for diagnostic purpose

Syllabus

Teaching Hours

UNIT 1: Introduction to Biomedical Instrumentation

Role of technology in medicine, basic medical instrumentation system

02

UNIT 2: Fundamental of Biomedical Instrumentation

Sources of biomedical signals, general constraints in designing of medical instrumentation systems, biomedical transducers, biopotential amplifiers

05

UNIT 3: Biopotential Electrodes

Theory of electrode, body surface recording electrodes, internal electrodes, microelectrodes, pH electrodes, pO₂ electrodes, pCO₂ electrodes

04

UNIT 4: Biomedical Recorders

Basics of cardiovascular system, Electrocardiograph machine, Phonocardiograph, Electroencephalograph machine, Electromyograph machine

05

03

UNIT 5: Pacemakers and Defibrillators

Need of cardiac Pacemaker, External pacemaker, implantable pacemakers, need for defibrillator, DC defibrillator

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| UNIT 6: Pulmonary Function Analyzer | 03 |
| Basics of respiratory system, Pulmonary function measurement, Spirometer and respiratory gas analyzers | |
| UNIT 7: Haemodialysis Machine | 03 |
| Function of kidneys, artificial kidneys, dialyzers, Haemodialysis machine | |
| UNIT 8: Medical Imaging Systems | 06 |
| Information content of an image, Radiography (X-rays), computed tomography, MRI, ultrasonography | |
| UNIT 9: Patient Monitoring System | 06 |
| Measurement of heart rate, blood pressure measurement, blood flow meter, blood gas analyser, biotelemetry, wearable medical devices | |
| UNIT 10: Instruments for Surgery | 05 |
| Surgical diathermy, High frequency heat therapy, Short wave diathermy, Microwave diathermy, Ultrasonic therapy unit, Laser applications in biomedical field | |
| UNIT 11: Patient Safety | 03 |
| Physiological effects of electricity, Macro shock hazards, Micro shock hazards, basic approaches to protection against shock | |

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

References:

1. R.S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill.
2. Carr & Brown, Introduction to biomedical equipment technology, Prentice – Hall.
3. Leslie Cromwell, Biomedical Instrumentation and Measurements, Prentice – Hall.
4. John G. Webster, Medical Instrumentation: Application and Design, John Wiley & Sons.

L= Lecture, T= Tutorial, P= Practical, C = Credit