

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC482	Biomedical Engineering	3-0-0-3	2016
<b>Prerequisite:</b> Nil			
<b>Course objectives:</b> <ul style="list-style-type: none"> <li>To introduce basics of biomedical engineering technology</li> <li>To understand the anatomy &amp; physiology of major systems of the body in designing equipment for medical treatments.</li> <li>To impart knowledge about the principle and working of different types of bio-medical electronic equipment/devices.</li> </ul>			
<b>Syllabus:</b> Human body-overview, Physiological systems of body, Measurement of physiological parameters, Assisting and therapeutic devices, Medical laboratory equipments, Telemetry in patient care, Patient safety, Medical imaging system			
<b>Expected outcome:</b> The students will be able: <ol style="list-style-type: none"> <li>To understand diagnosis and therapy related equipments.</li> <li>To understand the problem and identify the necessity of equipment for diagnosis and therapy.</li> <li>To understand the importance of electronics engineering in medical field.</li> <li>To understand the importance of telemetry in patient care</li> </ol>			
<b>Text Books:</b> <ol style="list-style-type: none"> <li>K S Kandpur, "Hand book of Biomedical instrumentation", Tata McGraw Hill 2nd e/d.</li> <li>Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, PHI, 2nd Edition, 2004</li> </ol>			
<b>References:</b> <ol style="list-style-type: none"> <li>Barbara Christe, Introduction to Biomedical Instrumentation, Cambridge University Press, 2008.</li> <li>J J Carr, "Introduction to Biomedical Equipment Technology", 4ed, Pearson Education</li> <li>John G Webster, "Medical Instrumentation application and design", 3ed, John Wiley</li> <li>Richard Aston, "Principle of Biomedical Instrumentation and Measurement", Merrill Education/Prentice Hall.</li> </ol>			
<b>Course Plan</b>			
Module	Course content	Hours	End Sem. Exam Marks
I	Introduction to bio-medical instrumentation system, overview of anatomy and physiological systems of the body.	1	15%
	Sources of bio-electric potential: Resting and action potential, propagation of action potentials. Bioelectric potentials examples (ECG, EEG, EMG, ERG, EOG, EGG, etc introduction only.)	2	

	Electrode theory: Nernst relation Bio potential electrodes: Microelectrodes, skin surface electrodes, needle electrodes.	1	
	Instrumentation for clinical laboratory: Bio potential amplifiers-instrumentation amplifiers, carrier amplifiers, isolation amplifiers, chopper amplifiers	2	
II	Heart and cardiovascular system (brief discussion), electro conduction system of the heart. Electrocardiography, ECG machine block diagram, ECG lead configurations, ECG recording system, Einthoven triangle, analysis of ECG signals.	3	15%
	Measurement of blood pressure: Direct, indirect and relative methods of blood pressure measurement, auscultatory method, oscillometric and ultrasonic non-invasive pressure measurements.	2	
	Measurement of blood flow: Electromagnetic blood flow meters and ultrasonic blood flow meters.	2	
FIRST INTERNAL EXAM			
III	The human nervous system. Neuron, action potential of brain, brain waves, types of electrodes, placement of electrodes, evoked potential, EEG recording, analysis of EEG.	2	15%
	Electromyography: Nerve conduction velocity, instrumentation system for EMG.	1	
	Physiology of respiratory system (brief discussion), Respiratory parameters, spirometer, body plethysmographs, gas exchange and distribution.	2	
	Instruments for clinical laboratory: Oxymeters, pH meter, blood cell counter, flame photometer, spectrophotometer	3	
IV	Therapeutic Equipments: Principle, block schematic diagram, working and applications of: pacemakers, cardiac defibrillators, heart–lung machine, dialyzers, surgical diathermy equipment, ventilators	6	15%
SECOND INTERNAL EXAM			
V	Medical Imaging systems (Basic Principle only): X-ray imaging - Properties and production of X-rays, X-ray machine, applications of X-rays in medicine.	2	20%
	Computed Tomography: Principle, image reconstruction, scanning system and applications.	2	
	Ultrasonic imaging systems: Basic pulse echo system, propagation of ultrasonic through tissues and reflections, display types, A-Scan, B-Scan, M-Scan, applications, real-time ultrasonic imaging systems and probes.	3	
VI	Magnetic Resonance Imaging – Basic NMR components, Biological effects and advantages of NMR imaging	3	20%

	Biomedical Telemetry system: Components of biotelemetry system, application of telemetry in medicine, single channel telemetry system for ECG and temperature	2	
	Patient Safety: Electric shock hazards, leakage current, safety codes for electro medical equipments	1	
<b>END SEMESTER EXAM</b>			

### **Question Paper Pattern ( End semester exam)**

The question paper shall consist of three parts. Part A covers modules I and II, Part B covers modules III and IV, and Part C covers modules V and VI. Each part has three questions uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 100% for theory.

