

COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC365	Biomedical Engineering	3-0-0-3	2015
<b>Prerequisite:</b> Nil			
<b>Course objectives:</b> The purpose of this course is: <ol style="list-style-type: none"> <li>1. To introduce student to basic biomedical engineering technology</li> <li>2. To understand the anatomy &amp; physiology of major systems of the body in designing equipment for medical treatments.</li> <li>3. To impart knowledge about the principle and working of different types of bio-medical electronic equipment/devices.</li> </ol>			
<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> On completion of this course, the students will be able: <ol style="list-style-type: none"> <li>1. To understand diagnosis and therapy related equipments.</li> <li>2. To understand the problem and identify the necessity of equipment for diagnosis and therapy.</li> <li>3. To understand the importance of electronics engineering in medical field.</li> <li>4. To understand the importance of telemetry in patient care</li> </ol>			
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. K S Kandpur, "Hand book of Biomedical instrumentation", Tata McGraw Hill 2nd e/d.</li> <li>2. 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>1. J. J. Carr, "Introduction to Biomedical Equipment Technology", Pearson Education 4<sup>th</sup> e/d.</li> <li>2. John G Webster, "Medical Instrumentation application and design", John Wiley 3<sup>rd</sup> e/d.</li> <li>3. Richard Aston, "Principle of Biomedical Instrumentation and Measurement". Merrill Education/Prentice Hall.</li> <li>4. Barbara Christe, Introduction to Biomedical Instrumentation, Cambridge University Press, 2008.</li> </ol>			
<b>Course Plan</b>			
Module	Course content	Hours	Sem. Exam Marks
<b>I</b>	Introduction to bio-medical instrumentation system, overview of anatomy and physiological systems of the body.	1	<b>15</b>
	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**

The question paper shall consist of three parts. Part A covers I and II module, Part B covers III and IV module, Part C covers V and VI module. Each part has three questions which may have maximum four subdivisions. Among the three questions one will be a compulsory question covering both modules and the remaining from each module, of which one to be answered. Mark patterns are as per the syllabus with 100 % for theory.

KTU STUDENTS