University of Mumbai			
CLASS: T.E. (Electronics Engineering)		**Semester - VI**	
SUBJECT: Medical Electronics (Elective-1)			
Periods per week (each of 60 min.)	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical examination	3	
	Oral Examination	-	
	Term Work	-	25
	Total		125

Objective	To understand generation of electrical signal after studying anatomy and physiology of human body and different systems. .Picking of signal and use of different instruments under different category such as Diagnostic, Intensive care, Therapeutic equipment and Imaging units. To know safety measures in biomedical equipments, Recording electrodes and recording systems used. Introduce concept of Telemetry and Hospital management system	
Pre-requisite	Knowledge of basic requirements of a good Instrument and Human body and different life processes	
Module	**Contents**	**Hours**
1	**Sources of Bio-Electric Potential** • Man-Instrument system requirements, difficulties and types • Basics of generation of action potential • Recording Electrodes • Electrode - Electrolyte Interface • Physiological Transducers	8
2	**Bio-potential Amplifiers and signal conditioner and Recording Systems** • Electrocardiogram • Electroencephalogram • Electro-myogram • Electronic Spirometer • Electrooculogram • Electroretinogram	8

3	**Diagnostic Equipments** • Electrocardiograph(ECG) • Electroencephalograph(EEG) • Electromyograph • Pulse oximeter • Measurement of blood pressure, blood flow and cardiac output • Impedance Plethysmography. • Measurements in the respiratory system	8
4	**Therapeutic and Prosthetic Equipment** • Defibrillators • Pacemakers • Ventilators, • Bedside Monitor, • Audiometer • Hemodialysis • Infant Incubators • Muscle and Nerve stimulators • Electrocautery machine • Short wave Diathermy • Ultrasound therapy Unit	8
5	**Imaging equipments** • Computed Tomography • Magnetic Resonance Imaging • Ultrasonic Imaging System • Positron Emission Tomography	8
6	**Safety and Telemetry in Biomedical Instrumentation** • Causes of Electrical shock micro& macro shock • Electrical safety codes and standards • Methods of accident preventions • Test of grounding system in patient care area, chassis leakage current • Biomedical Telemetry • Hospital management system	8

Text Books:

1. Webster J. G. -Medical Instrumentation - Application and Design, Wiley and Sons Inc, third edition, 1999
2. Khandpur R. S., Handbook of Biomedical Instrumentation, Tata McGraw Hill, second edition, 2003

Additional Reading:

1. Carr and Brown, Introduction to biomedical equipment technology, fourth edition, Pearson press, 2003

2. Cromwell L. Weibell & Pfeiffer, Biomedical Instrumentation and measurements, Prentice Hall of India, 1993
3. John G. Webster, Bioinstrumentation John Wiley and sons,2004

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Practical list

Sr.no	Topic	Title of Experiment
1	Sources of Bio-Electric Potential	Recording system can be implemented using Lab VIEW VI
2	Bio-potential Amplifiers and	Implement ECG preamplifier using Instrumentation Amplifier
3	signal conditioner and Recording Systems	Design Band pass Filters for EEG (different types of EEG waveform) using LabVIEW
4	Therapeutic and	Working ECG machine
5	Prosthetic	Blood Pressure monitor Unit
6	Equipment	Pulse Oximeter
7		Electro-spirometer
8	Therapeutic and	DC Defibrillator Demo
9	Prosthetic Equipment	Muscle stimulator

Termwork:

The term-work shall consist of at least six laboratory experiments covering the whole of syllabus, duly recorded and graded The experiments can performed with the help of LabVIEW S/W as mentioned in the list.. This will carry a weightage of Ten marks. A test shall be conducted and will carry a weightage of ten marks.

The distribution of marks for term work shall be as follows,
Laboratory work (Experiments and Journal + Presentation) : 10 marks.
Test (at least one) : 10 marks.
Attendance (Practical and Theory) : 05 marks.
The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Theory Examination:

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and will cover all modules.
4. Remaining questions will be from the same module or mixed in nature. (e.g.- suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
5. In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
6. No question should be asked from pre-requisite module