



Kadi Sarva Vishwavidyalaya
Gandhinagar-382015

B.E Semester:7
Electronics & Communication Engineering
Subject Name: Biomedical Instrumentation
Subject Code : EC-704-C (EP 1)

A. Course Objective:

The educational objectives of this course are

- To present a problem oriented introductory knowledge of Biomedical Instrumentation
- To address the underlying concepts and methods behind Biomedical Instrumentation.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EC-704-C	Biomedical Instrumentation	4	0	2	6	5	3	70	30	20	30	150

C. Syllabus

- 1. Introduction to Biomedical Instrumentation:**
The age of Biomedical Engineering, Development of Biomedical Instrumentation, Biometrics, Introduction to the Man- instrument System, Components of the Man- Instrument System, Physiological Systems of the Body.
- 2. Sources of Bioelectric Potentials:**
Action and Resting Potential, Propagation of Action Potential, The Bioelectric Potential.
- 3. Basic Transducers principles:**
The Transducer and Transduction Principles, Active Transducer, Passive Transducers, Transducers for Biomedical Application.
- 4. Electrodes:**
Electrode Theory, Bio potential Electrode, Biochemical Transducer.
- 5. The Cardiovascular System:**
The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristic of Blood Flow, Heart Sounds.



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6. Cardiovascular Measurement:

Electrocardiography, Blood Pressure, Blood Flow and Cardiac Output, Plethysmography, Heart Sounds, Echocardiography , Colour Doppler measurement

7. Bio Medical Equipment :

ECG, EMG, EEG, Pace Maker, Defibrillator, Heart lung Machine, Dialysis, Diathermy Unit for surgery and therapy, LASER in Surgery, Equipment in Intensive Care Unit, Robotic Surgical Equipments, Invasive Medical Procedures

8. Medical Imaging :

Principle Of Radiation, Components Of X-Ray System, Principle Of CT Scan, USG, MRI, PET Scan.

9. Biotelemetry:

Introduction to Biotelemetry, Physiological parameters adaptable to Biotelemetry, The Components of a Biotelemetry System, Implantable Units, Application of Telemetry in Patient Care.

10. Electrical Hazards & Patient safety in Bio-medical equipments:

Significance of Electrical Danger, Physiological Effect of Electrical Current, Ground Shock, Hazards and Methods of Accident Prevention.

11. Patient Monitoring system:

Heart Rate Measurement, Pulse Rate Measurement, Respiration Rate Measurement, Blood Pressure Measurement, Microprocessor Applications in Patient Monitoring.

D. Lesson Planning

SR. No.	No. of Hours	% Weightage in Exam	Topic
1	5	7	<p>Introduction to Biomedical Instrumentation:</p> <p>The age of Biomedical Engineering, Development of Biomedical Instrumentation, Biometrics, Introduction to the Man- instrument System, Components of the Man- Instrument System, Physiological Systems of the Body.</p>
2	5	12	<p>Sources of Bioelectric Potentials:</p> <p>Action and Resting Potential, Propagation of Action Potential, The Bioelectric Potential.</p>



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3	5	12	<p>Basic Transducers principles:</p> <p>The Transducer and Transduction Principles, Active Transducer, Passive Transducers, Transducers for Biomedical Application.</p>
4	5	12	<p>Electrodes:</p> <p>Electrode Theory, Biopotential Electrode, Biochemical Transducer.</p>
5	6	07	<p>The Cardiovascular System:</p> <p>The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristic of Blood Flow, Heart Sounds.</p>
6	6	07	<p>Cardiovascular Measurement:</p> <p>Electrocardiography, Blood Pressure, Blood Flow and Cardiac Output, Plethysmography, Heart Sounds, Echocardiography, Colour Doppler measurement</p>
7	7	12	<p>Bio Medical Equipment :</p> <p>ECG, EMG, EEG, Pace Maker, Defibrillator, Heart lung Machine, Dialysis, Diathermy Unit for surgery and therapy, LASER in Surgery, Equipment in Intensive Care Unit, Robotic Surgical Equipments, Invasive Medical Procedures</p>
8	6	07	<p>Medical Imaging :</p> <p>Principle Of Radiation, Components Of X-Ray System, Principle Of CT Scan, USG, MRI, PET Scan.</p>
9	6	07	<p>Biotelemetry:</p> <p>Introduction to Biotelemetry, Physiological parameters adaptable to Biotelemetry, The Components of a Biotelemetry System, Implantable Units, Application of Telemetry in Patient Care.</p>
10	4	10	<p>Electrical Hazards & Patient safety in Bio-medical equipments:</p> <p>Significance of Electrical Danger, Physiological Effect of Electrical Current, Ground Shock, Hazards and Methods of Accident Prevention.</p>
11	5	07	<p>Patient Monitoring system:</p> <p>Heart Rate Measurement, Pulse Rate Measurement, Respiration</p>



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			Rate Measurement, Blood Pressure Measurement, Microprocessor Applications in Patient Monitoring.
TOTAL	60	100	

E. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weight age should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- Experiments shall be performed in the laboratory related to course contents.

F. Suggested list of Experiments

1. Identify ECG, EEG, EMG electrodes & Patient cable
2. Measure blood pressure using sphygmomanometer.
3. Measure respiration rate using respiration rate-meter.



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4. Calibrate & maintain ECG machine.
5. Obtain EEG of patient using EEG machine.
6. To study Components Of X-Ray System.
7. To study CT Scan system.
8. To study Heart Rate Measurement.
9. To study Electrocardiography.
10. To study Microprocessor Applications in Patient Monitoring.

G. Students Learning Outcomes

On successful completion of the course

- The student can identify different areas of Biomedical Instrumentation. Can find the applications of all the areas in day to day life. Can identify the operations, working, construction, material etc. Aspects of Biomedical Instrumentation, types of Biomedical Instrumentation etc.

H. Recommended Study Materials

Text/ Reference Books:

1. Biomedical Instrumentation And Measurements- By Leslie Cromwell
2. Human Physiology: The Mechanism Of Function By Vander, Sherma
3. Medical Instrumentation By John. G. Webster –John Wiley
4. Introduction To Biomedical Equipment Technology- By Carr & Brow
5. Handbook Of Biomedical Instrumentation By R. S. Khandpur
6. Biomedical Instrumentation By Dr. M. Arumugam, Anuradha