BIOMEDICAL INSTRUMENTATION
(AEIE 4241)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Source of bioelectric potential is _____ in nature.
(a) electronic (b) electric
(c) ionic (d) mechanical

(ii) Recording of electrical activities associated with brain is known as _____
(a) EEG (b) EOG
(c) EMG (d) ECG.

(iii) Recording of electrical activities associated with heart is known as _____
(a) EEG (b) EOG
(c) EMG (d) ECG.

(iv) Phonocardiography is listening to _____
(a) arm muscle sound (b) lungs sound
(c) heart sound (d) respiratory tract sound.

(v) Which of the following represents action potential?
(a) 70 mV (b) -70 mV
(c) 20 mV (d) -20 mV.

(vi) Which of the following is a preferred electrode for measuring EMG?
(a) Surface electrodes (b) Needle electrodes
(c) Pregelled electrodes (d) Scalp electrodes.

(vii) The contraction of the skeletal muscles results in the generation of action potential in the individual muscle fibers. Record of this action potential is called_____.
(a) ECG (b) EMG
(c) EEG (d) EKG

(viii) Ag-AgCl electrodes are _____
(a) polarized (b) non-polarized
(c) partially polarized (d) cannot be said.

(ix) MRI stands for _____
(a) Mechanical Resonance Imaging (b) Magnetic Resonance Imaging
(c) Mutually Related Imaging (d) Magnetic Resultant Imaging.

(x) Electrodes to measure EEG are placed on _____
(a) forehead (b) scalp
(c) cheek (d) ears.

Group- B

2. (a) Describe the methods by which capacitive transducers are used for the measurement of linear and angular displacement. *[(CO1)(Remember/LOCQ)]*
(b) Describe the principle of operation and construction details of LVDT**.** *[(CO1)(Analyze/IOCQ)]*
(c) How a piezoelectric transducer could be used as an accelerometer? *[(CO1)(Analyze/IOCQ)]*
4 + 5 + 3 =12

3. (a) Distinguish between RTD and Thermistor. What is meant by pt-100? *[(CO1)(Remember/LOCQ)]*
(b) State the types of capacitive transducer. *[(CO1)(Apply/IOCQ)]*
(c) Generalize the property of Piezo- electric transducer. *[(CO1)(Create/HOCQ)]*
(3 + 1) + 5 + 3 = 12

Group - C

4. (a) Explain resting and action Potential. *[(CO2)(Remember/LOCQ)]*
(b) With the action potential waveforms summarize depolarization, repolarisation and absolute and relative refractory periods. *[(CO2)(Evaluate/HOCQ)]*
(c) Draw Einthoven triangle and how it is used in ECG measurement. *[(CO2)(Evaluate/HOCQ)]*
4 + 4 + 4 = 12

5. (a) Name the three basic of electrode types used to monitor bioelectric potentials. *[(CO2)(Remember/LOCQ)]*
(b) What are the uses of microelectrodes? *[(CO2)(Remember/LOCQ)]*
(c) Differentiate between microelectrodes and body surface electrodes. *[(CO2)(Evaluate/HOCQ)]*
3 + 4 + 5 = 12

Group - D

6. (a) Illustrate single channel telemetry. *[(CO4)(Remember/LOCQ)]*
(b) Discuss the applications of biotelemetry. *[(CO4)(Analyse/IOCQ)]*

(c) Deduce the anticipated problems of telemetry systems in the future. *[(CO4)(Evaluate/HOCQ)]*

3 + 4 + 5 = 12

7. (a) What do you mean by CT? *[(CO3)(Remember/LOCQ)]*
   (b) Explain with neat block diagram the principle of operation and working of MRI system. *[(CO3)(Remember/LOCQ)]*
   (c) Explain the advantages of MRI scan. *[(CO3)(Evaluate/HOCQ)]*

4 + 5 + 3 = 12

Group - E

8. (a) Discuss Let-go current of human body. *[(CO6)(Remember/LOCQ)]*
   (b) What is meant by macro shock? Classify the ways by which macro shocks can be reduced. *[(CO5)(Apply/IOCQ)]*
   (c) Discuss the hazards of leakage current. *[(CO6)(Evaluate/HOCQ)]*

3 + (3 + 3) + 3 = 12

9. (a) Distinguish a de-fibrillator from a pace maker. *[(CO5)(Analyze/IOCQ)]*
   (b) Differentiate between external pacemaker and implanted pacemaker. *[(CO5)(Understand/LOCQ)]*
   (c) Classify the types of pacemaker based on modes of operation of the pacemakers. *[(CO5)(Apply/IOCQ))]*

4 + 4 + 4 = 12

Cognition Level	*LOCQ*	*IOCQ*	*HOCQ*
Percentage distribution	*39.58*	*32.29*	*28.13*

Course Outcome (CO):

After the completion of the course, the students will be able to:

1. Explain the fundamental principles and applications of different transducers used for body parameter measurements.
2. Understand the physiology of biomedical systems and different methods in the design of biomedical instruments.
3. Learn the different methods of medical imaging systems, concepts related to the operations and analysis of biomedical instruments.
4. Design signal processing hardware circuits.
5. Learn various therapeutic devices.
6. Aware of the importance of electrical safety and apply it in the design of different assisting, therapeutic and diagnostic medical devices.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*