

MEDICAL INSTRUMENTATION
(AEIE 4222)

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 electrical activities associated with brain is known as _____
(a) EEG (b) EOG (c) EMG (d) ECG.
- (iii) The principal ion that is not involved with the phenomena of producing cell potentials is _____
(a) sodium (b) potassium
(c) chlorine (d) hydrogen.
- (iv) The variation of the electrical potential associated with the passage of a pulse along the membrane of a muscle cell or a nerve cell is called _____
(a) muscle potential (b) action potential
(c) resting potential (d) half cell potential.
- (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) Recording electrical activities associated with heart is known as _____
(a) EEG (b) EOG (c) EMG (d) ECG.
- (viii) Which of the following is considered to be the primary pacemaker of the heart?
(a) Sino-atrial node (b) Atrio-ventricular node
(c) Purkinje fibres (d) Bundle of his.

- (ix) Atrio ventricular node is located at _____
(a) upper part of the heart wall between the two atrial
(b) lower part of the heart wall above the two atrial
(c) lower part of the heart wall between the two atrial
(d) upper part of the heart wall above the two atria.
- (x) Which of the following has the widest range of temperature measurement?
(a) RTD (b) Thermocouple
(c) Thermistor (d) Mercury thermometer.

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) Describe the RTD and explain how it can be used to measure temperature. [(CO1)(Remember/LOCQ)]
(b) Describe the principle of operation and construction details of gas sensor. [(CO1)(Apply/IOCQ)]
(c) Summarize the advantages and disadvantages of LVDT. [(CO1)(Create/HOCQ)]
4 + 5 + 3 = 12

Group - C

4. (a) Describe the standard 12 lead system used for recording ECG. [(CO2)(Remember/LOCQ)]
(b) Sketch a typical 'PQRST' complex waveform with respect to ECG. [(CO2)(Apply/IOCQ)]
(c) Draw EINTHOVEN TRIANGLE and how it is used in ECG measurement. [(CO2)(Evaluate/HOCQ)]
4 + 4 + 4 = 12
5. (a) Summarize LATENCY in EMG. [(CO2) (Remember/LOCQ)]
(b) Explain in detail about EEG lead system, recording methods and waveform. [(CO2)(Apply/IOCQ)]
(c) With the action potential waveforms summarize depolarization, repolarisation and absolute and relative refractory periods. [(CO2)(Evaluate/HOCQ)]
4 + 5 + 3 = 12

Group - D

6. (a) Write a note on the working of MRI Scan. [(CO4)(Remember/LOCQ)]
 (b) Distinguish a de-fibrillator from a pace maker. [(CO4)(Analyze /IOCQ)]
 (c) Differentiate between external pacemaker and implanted pacemaker. [(CO3)(Understand/LOCQ)]
 $4 + 5 + 3 = 12$
7. (a) Discuss the working of pressure and volume controlled ventilator. [(CO4)(Remember/LOCQ)]
 (b) Explain the principle and properties of Ultrasound. [(CO3)(Analyze/IOCQ)]
 (c) Explain different modes of Ultrasound used in medical diagnostics. [(CO3)(Analyze/IOCQ)]
 $(2 + 2) + 3 + 5 = 12$

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) Explain biotelemetry. [(CO5)(Remember/LOCQ)]
 (b) Draw the block diagram of a bio-telemetry system. [(CO5)(Apply/IOCQ)]
 (c) Discuss about the tests to be carried out to ensure safety of medical equipments. [(CO6)(Evaluate/HOCQ)]
 $4 + 5 + 3 = 12$

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	35.42	47.92	16.66

Course Outcome (CO):

After the completion of the course 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. Learn various therapeutic devices.
5. Design various type bio-telemetry systems.

6. Aware of the importance of electrical safety and apply it in the design of different assisting

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