

MEDICAL INSTRUMENTATION
(AEIE 5132)

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

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

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) Which property does a capacitive transducer change to measure displacement?
(a) Resistance (b) Capacitance (c) Voltage (d) Current.
- (ii) What does threshold in measurement refer to?
(a) Highest measurable value (b) Smallest detectable input
(c) Sensitivity to change (d) Average value over time.
- (iii) What is the typical resting potential of a neuron?
(a) -70 mV (b) +30 mV (c) 0 mV (d) -30 Mv.
- (iv) What type of artifact is commonly observed with surface electrodes?
(a) Electrical interference (b) Motion artifact
(c) Temperature drift (d) Electromagnetic coupling.
- (v) Which ion is mainly responsible for depolarization in neurons?
(a) Potassium (K⁺) (b) Sodium (Na⁺)
(c) Calcium (Ca²⁺) (d) Chloride (Cl⁻).
- (vi) Which imaging technique uses high-frequency sound waves?
(a) MRI (b) CAT scan
(c) Ultrasonic imaging (d) X-ray imaging.
- (vii) The frequency range of ultrasound waves used in medical imaging typically lies between _____.
(a) 1-20 Hz (b) 20 Hz - 20 kHz
(c) 2-20 MHz (d) 100-200 MHz
- (viii) What device is used to restore a normal heart rhythm by delivering an electric shock?
(a) ECG machine (b) Defibrillator
(c) Pacemaker (d) Biotelemetry unit.

- (ix) What type of current is most dangerous to the human body?
 (a) Direct Current (DC) (b) Alternating Current (AC)
 (c) Pulsed Current (d) Static Electricity.
- (x) What is the purpose of a hearing aid?
 (a) Improve heart rhythm
 (b) Amplify sound for hearing-impaired individuals
 (c) Regulate breathing patterns
 (d) Monitor brain activity.

Fill in the blanks with the correct word

- (xi) In a piezoelectric transducer, mechanical stress is converted into _____.
- (xii) The electrical potential across the membrane of a resting neuron is called the _____ potential.
- (xiii) _____ is used to detect and prevent electrical leakage in medical devices.
- (xiv) Long exposure to electrical current can cause severe _____ damage.
- (xv) The main component of a signal conditioner is an _____.

Group - B

2. (a) What is capacitance? [[C01](Remember/LOCQ)]
 (b) Describe how a capacitive transducer measures displacement. [[C01](Apply/IOCQ)]
 (c) Evaluate the impact of environmental factors on its performance. [[C01](Analyse/HOCQ)]
3 + 5 + 4 = 12
3. (a) What is calibration? [[C01](Remember/LOCQ)]
 (b) Describe how medical devices are calibrated. [[C01](Apply/IOCQ)]
 (c) Identify risks of using uncalibrated devices. [[C01](Analyse/HOCQ)]
3 + 5 + 4 = 12

Group - C

4. (a) What is an offset potential? [[C02](Remember/LOCQ)]
 (b) Explain how it occurs during measurements. [[C02](Apply/IOCQ)]
 (c) Identify ways to mitigate its effects. [[C02](Analyse/HOCQ)]
3 + 5 + 4 = 12
5. (a) What is electrode drift? [[C02](Remember/LOCQ)]
 (b) Explain how it affects long-term measurements. [[C02](Apply/IOCQ)]
 (c) Identify methods to minimize drift. [[C02](Analyse/HOCQ)]
3 + 5 + 4 = 12

Group - D

6. (a) What is a CT scan? *[[C03](Remember/LOCQ)]*
(b) Explain how it generates images. *[[C03](Apply/IOCQ)]*
(c) Compare it with X-ray. *[[C03](Analyse/HOCQ)]*
3 + 5 + 4 = 12
7. (a) Define biotelemetry. *[[C04](Remember/LOCQ)]*
(b) Explain its use in patient monitoring. *[[C04](Apply/IOCQ)]*
(c) Identify challenges in real-time monitoring. *[[C04](Analyse/HOCQ)]*
3 + 5 + 4 = 12

Group - E

8. (a) What is a GFCI? *[[C06](Remember/LOCQ)]*
(b) Explain how it prevents hazards. *[[C06](Apply/IOCQ)]*
(c) Assess its role in healthcare facilities. *[[C06](Analyse/HOCQ)]*
3 + 5 + 4 = 12
9. (a) What are ground shock hazards? *[[C06](Remember/LOCQ)]*
(b) Explain how they occur. *[[C06](Apply/IOCQ)]*
(c) Assess strategies to mitigate them. *[[C06](Analyse/HOCQ)]*
3 + 5 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	25	41.66	33.34

