

BIOMEDICAL INSTRUMENTATION
(AEIE 4241)

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) LVDT is a type of:
 - (a) Optical transducer
 - (b) Capacitance transducer
 - (c) Inductive transducer
 - (d) Piezoelectric transducer
- (ii) The main advantage of using capacitive pressure transducers is:
 - (a) High sensitivity
 - (b) Less noise
 - (c) Simple operation
 - (d) High power consumption
- (iii) The key function of biomedical transducers is to:
 - (a) Convert electrical signals into mechanical signals
 - (b) Convert one form of energy into another
 - (c) Store electrical energy
 - (d) Act as a power source
- (iv) The motion artifact in an electrode is caused by:
 - (a) Temperature fluctuations
 - (b) Electrode displacement
 - (c) High-frequency interference
 - (d) Poor skin contact
- (v) Needle electrodes are mainly used for:
 - (a) ECG recording
 - (b) EEG recording
 - (c) EMG recording
 - (d) Blood pressure measurement
- (vi) Which imaging method provides real-time moving images of internal organs?
 - (a) MRI
 - (b) CT Scan
 - (c) Ultrasound
 - (d) PET Scan
- (vii) Which component of an MRI scanner generates the strong magnetic field?
 - (a) Gradient coils
 - (b) RF coils
 - (c) Superconducting magnet
 - (d) Detector array
- (viii) Which device is used to regulate abnormal heart rhythms?
 - (a) Defibrillator
 - (b) Pacemaker
 - (c) EEG Machine
 - (d) CT Scanner

- (ix) Ventilators are primarily used to:
 (a) Pump blood (b) Assist breathing
 (c) Detect electrical impulses in the brain (d) Monitor blood pressure
- (x) The primary function of an artificial pacemaker is to:
 (a) Monitoring brain activity (b) Diagnosing heart abnormalities
 (c) Measuring lung function (d) Assessing muscle activity

Fill in the blanks with the correct word

- (xi) _____ electrodes are used on the surface of the skin for ECG measurements.
- (xii) EMG measures the electrical activity of _____.
- (xiii) A _____ is used to restore normal heart rhythm by delivering electrical shocks.
- (xiv) _____ electrodes are inserted into tissues for recording localized bio-potentials.
- (xv) The primary waveforms observed in EEG are _____ waves.

Group - B

2. (a) Explain how the piezoelectric effect is utilized in biomedical transducers. [[CO1](Analyse/HOCQ)]
 (b) Discuss the operating specifications of piezoelectric transducers. [[CO1](Remember/LOCQ)]
 (c) How do piezoelectric transducers compare with electromagnetic transducers? [[CO1](Apply/IOCQ)]
4 + 4 + 4 = 12
3. (a) Explain the principle of electromagnetic induction in blood flow transducers. [[CO1](Analyse/HOCQ)]
 (b) What are the different types of blood flow transducers based on electromagnetic effects? [[CO1](Remember/LOCQ)]
 (c) Compare electromagnetic and piezoelectric blood flow transducers. [[CO1](Apply/IOCQ)]
4 + 5 + 3 = 12

Group - C

4. (a) What are off-set potentials in biomedical electrodes? [[CO2](Analyse/HOCQ)]
 (b) How does electrode impedance affect signal quality? [[CO2](Remember/LOCQ)]
 (c) Discuss the importance of electrode gel in reducing impedance. [[CO2](Apply/IOCQ)]
3 + 5 + 4 = 12
5. (a) Explain the importance of biopotentials in medical diagnosis. [[CO2](Analyse/HOCQ)]
 (b) Describe the process of recording EMG signals. [[CO2](Remember/LOCQ)]
 (c) How do muscle and nerve disorders affect EMG readings? [[CO2](Apply/IOCQ)]
4 + 4 + 4 = 12

Group - D

6. (a) Explain the principle of X-ray imaging. [[CO2](Analyse/HOCQ)]
(b) Discuss the role of contrast agents in X-ray imaging. [[CO2](Remember/LOCQ)]
(c) Describe the advantages and limitations of X-ray imaging. [[CO2](Apply/IOCQ)]
4 + 4 + 4 = 12
7. (a) Explain the components and working of a modern patient monitoring system. [[CO4](Analyse/HOCQ)]
(b) Discuss how different vital parameters (ECG, blood pressure, temperature) are monitored in a hospital. [[CO4](Remember/LOCQ)]
(c) Explain the significance of remote patient monitoring in healthcare. [[CO4](Apply/IOCQ)]
4 + 4 + 4 = 12

Group - E

8. (a) Explain the working principle of a medical ventilator. [[CO6](Remember/LOCQ)]
(b) Discuss the different types of ventilators and their applications. [[CO6](Apply/IOCQ)]
(c) What are the risks associated with prolonged ventilator use? [[CO6](Analyse/HOCQ)]
3 + 5 + 4 = 12
9. (a) Explain the importance of grounding medical equipment. [[CO6](Analyse/HOCQ)]
(b) Discuss different types of grounding schemes used in hospitals. [[CO6](Remember/LOCQ)]
(c) Explain how improper earthing can lead to patient safety hazards. [[CO6](Apply/IOCQ)]
3 + 5 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	35.42	33.33	31.25

