

**MEDICAL INSTRUMENTATION  
(AEI5132)**

**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 transducer uses a change in resistance to measure force?  
(a) Capacitive transducer (b) Strain gauge transducer  
(c) Piezoelectric transducer (d) Thermo-resistive transducer
- (ii) Which type of error is caused by deviation from linearity?  
(a) Sensitivity error (b) Resolution error  
(c) Calibration error (d) Zero error
- (iii) What is the role of Ag/AgCl electrodes?  
(a) Reduce polarization (b) Increase noise  
(c) Improve impedance (d) Generate offset potentials
- (iv) What is half-cell potential?  
(a) Electrical potential at electrode-electrolyte interface  
(b) Resting potential of cells  
(c) Motion artifact potential  
(d) Voltage between two electrodes
- (v) X-rays are most commonly used to visualize \_\_\_\_\_.  
(a) Brain activity (b) Bone fractures  
(c) Blood flow (d) Soft tissues
- (vi) What is the main advantage of MRI over CT scans?  
(a) MRI is faster  
(b) MRI provides better imaging of soft tissues  
(c) MRI uses ionizing radiation  
(d) MRI is more affordable
- (vii) Which component of the MRI machine emits the radiofrequency (RF) pulses?  
(a) Magnet (b) Gradient coils  
(c) RF coil (d) Scanner console

- (viii) Which part of the body is most commonly examined using ultrasonography?  
 (a) Brain                      (b) Lungs                      (c) Abdomen                      (d) Bones
- (ix) Which device regulates abnormal heartbeats by sending electrical pulses?  
 (a) Pacemaker    (b) Defibrillator  
 (c) EEG machine    (d) EMG machine
- (x) Which type of therapeutic instrument is used to regulate heart rhythm in arrhythmic patients?  
 (a) Pacemaker    (b) EEG  
 (c) Defibrillator    (d) X-ray machine

*Fill in the blanks with the correct word*

- (xi) A \_\_\_\_\_ transducer changes resistance based on applied pressure.
- (xii) The movement of ions across the membrane generates an \_\_\_\_\_ potential.
- (xiii) MRI stands for \_\_\_\_\_.
- (xiv) EMG measures the electrical activity of \_\_\_\_\_.
- (xv) The most common type of current that causes severe injury is \_\_\_\_\_ current.

### **Group - B**

2. (a) What is a strain gauge transducer? Explain its operation.                      *[[CO1](Remember/LOCQ)]*  
 (b) How does it measure blood pressure?    *[[CO1](Apply/IOCQ)]*  
 (c) What errors can occur during its operation?    *[[CO1](Analyse/HOCQ)]*  
**(2 + 3) + 4 + 3 = 12**
3. (a) Define sensitivity and resolution.    *[[CO1](Remember/LOCQ)]*  
 (b) Provide an example where high sensitivity is needed.    *[[CO1](Apply/IOCQ)]*  
 (c) Assess the trade-offs between sensitivity and accuracy.    *[[CO1](Analyse/HOCQ)]*  
**4 + 4 + 4 = 12**

### **Group - C**

4. (a) What is resting potential?    *[[CO2](Remember/LOCQ)]*  
 (b) Explain how it is measured.    *[[CO2](Apply/IOCQ)]*  
 (c) Compare it with action potential.    *[[CO2](Analyse/HOCQ)]*  
**3 + 5 + 4 = 12**
5. (a) What are microelectrodes?    *[[CO2](Remember/LOCQ)]*  
 (b) Explain their role in intracellular recordings.    *[[CO2](Apply/IOCQ)]*  
 (c) Assess their advantages and limitations.    *[[CO2](Analyse/HOCQ)]*  
**4 + 4 + 4 = 12**

### **Group - D**

6. (a) What are muscle signals?    *[[CO4](Remember/LOCQ)]*

- (b) Explain how EMG records them. *[[CO4)(Apply/IOCQ)]*  
 (c) Compare EMG with ECG. *[[CO4)(Analyse/HOCQ)]*  
**3 + 5 + 4 = 12**
7. (a) Explain different types Ultrasound scanning techniques. *[[CO3)(Remember/LOCQ)]*  
 (b) How ultrasound discriminates between various internal tissues and bony structures. *[[CO3)(Apply/IOCQ)]*  
 (c) Explain the advantage and disadvantage of Ultrasonography compared to other Imaging techniques. *[[CO3)(Analyse/IOCQ)]*  
**6 + 2 + 4 = 12**

### Group - E

8. (a) What is a defibrillator? *[[CO5)(Remember/LOCQ)]*  
 (b) Explain how it restores heart rhythm. *[[CO5)(Apply/IOCQ)]*  
 (c) Compare manual and automated defibrillators. *[[CO5)(Analyse/HOCQ)]*  
**3 + 5 + 4 = 12**
9. (a) Describe the construction of Leads wire and Electrodes used in artificial Pacemaker. *[[CO5)(Remember/LOCQ)]*  
 (b) Explain the working of various synchronous Pacemaker. *[[CO6)(Analyse/HOCQ)]*  
**(2 + 2) + (4 + 4) = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33.33	34.38	32.29

