

**MEDICAL INSTRUMENTATION  
(AEIE 6151)**

**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) A polarizable electrode is made up of  
(a) Copper (b) Iron  
(c) platinum (d) Silver.
- (ii) A strain gauge is usually used to measure blood-----  
(a) pressure (b) temperature  
(c) cardiac output (d) (a) and (b).
- (iii) Value of action potential is approximately  
(a) -20  $\mu$ V (b) -70  $\mu$ V  
(c) -20 mV (d) -70 mV.
- (iv) Bio-potential amplifier should have  
(a) Low gain, low-input impedance, low CMRR  
(b) High gain, high input impedance, low CMRR  
(c) Low gain, high input impedance, low CMRR  
(d) High gain, high input impedance, high CMRR.
- (v) In a 12-lead ECG scheme, the number of electrodes used is  
(a) 12 (b) 5 (c) 4 (d) 10.
- (vi) If the rate of heart beat is faster than the normal, then it is called:  
(a) Tachycardia (b) Arrhythmia  
(c) Fibrillation (d) Bradycardia.
- (vii) CMRR of the practical bioinstrumentation amplifier should be around (in dB)  
(a) 40 (b) 20 (c) 80 (d) infinity.

- (viii) X-ray imaging combined with computer technique is known as  
 (a) EMG (b) ECG (c) USG (d) CT.
- (ix) Unit of X-ray is  
 (a) volt (b) rontgen (c) dose (d) curie.
- (x) In LEAD-III configuration, electrodes are placed on  
 (a) LL-RA (b) LL-LA (c) LA-RA (d) LL-RL.

**Group - B**

2. (a) Explain the working principle of electromagnetic flow meter.  
 (b) What is the gauge factor of a strain gauge? Explain with a neat sketch, the operation of a strain gauge in blood pressure measurements.

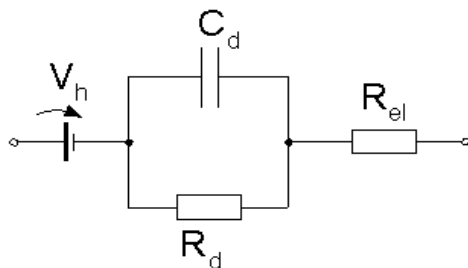
**4 + (2 + 6) = 12**

3. (a) Define the terms associated with the static characteristics of a transducer:  
 (i) accuracy, (ii) resolution, (iii) sensitivity, and (iv) linearity.  
 (b) An instrument provides a set of the blood temperatures of a person. Write down the steps for assessing the precision of the device.

**8 + 4 = 12**

**Group - C**

4. (a) With a neat diagram, explain the formation of an Ag - AgCl electrode.  
 (b) The figure1 shows the equivalent circuit of an electrode. Find the effective impedance of the electrode. Draw the frequency response of the impedance of the electrode taking frequency axis in logarithmic scale. Explain how would you determine the passive component values of the electrode



**Fig. 1**

**4 + (4 + 4) = 12**

5. (a) What are chopper and isolation amplifiers in the biopot amplifiers?  
 (b) What are the different types of electrodes? What is the purpose of electrode paste?

**(4 + 4) + (2 + 2)**

**Group - D**

6. (a) With a neat diagram, explain the operation of an X-Ray computed tomography. Why it is better than the normal X-Ray images?  
 (b) Draw and explain the EEG block diagram and mention its applications.

**(5 + 1) + 6**

7. (a) What is biotelemetry? Draw and explain the block diagram of a biotelemetry system.  
 (b) With a suitable diagram, explain the operation of an X-ray in fluorescence technique.

**(2 + 3 + 3) + 4**

**Group - E**

8. (a) Draw and explain the model of an electrical danger. What are the physiological effects of current flowing through the body?  
 (b) Draw and explain a defibrillator circuit.

**(5 + 3) + 4**

9. Write short notes on any two  
 (i) Dye dilution method of blood flow measurements  
 (ii) Ultrasonic imaging  
 (iii) Errors in measurement  
 (iv) Evoked Potential.

**6 + 6**