

**MEDICAL INSTRUMENTATION
(AEIE 5132)**

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) The beta-wave in the EEG complex signal lies in the range of
(a) 1-3 Hz (b) 3-13 Hz (c) 13-30 Hz (d) >100 Hz.
- (ii) Einthovan's triangle is related to
(a) ECG (b) EEG (c) EMG (d) EOG.
- (iii) In LEAD-III configuration, electrodes are placed on
(a) LL-RA (b) LL-LA (c) LA-RA (d) LL-RL.
- (iv) The value of action potential of a cell is approximately
(a) -20 μ V (b) -70 μ V (c) -20 mV (d) -70 mV.
- (v) The no. of electrodes are there in 12 lead system of ECG
(a) 3 (b) 6 (c) 4 (d) 10.
- (vi) If the rate of heart beat is slower than the normal, then it is called:
(a) Tachycardia (b) Arrhythmia
(c) Fibrillation (d) Bradycardia.
- (vii) Half-cell potential is formed due to
(a) skin-electrolyte interface (b) electrolytic impedance
(c) skin impedance (d) metal-electrolyte interface.
- (viii) X-ray imaging combined with computer technique is known as
(a) EMG (b) ECG (c) USG (d) CT.
- (ix) 1ST Heart sound called 'dub', frequency range is
(a) below 30Hz (b) 50-70Hz (c) 30-45Hz (d) None of these.
- (x) In ECG Waveform QRS complex represents —
(a) atrial depolarisation (b) atrial repolarisation
(c) ventricular depolarization (d) both (b) and (c).

Group – B

2. (a) Define the term cardiac output (CO). Explain any process with necessary diagram to measure CO. Also write the advantages and/or disadvantages of the process.
- (b) Imagine that the average velocity of blood in a 100 mm artery diameter (inner) is measured using ultrasonic flow meter. The transmission angle is $\theta = 45^\circ$. The measured transit times are t_1 0.9950 ms and t_2 are 1.00ms. Calculate the arterial blood velocity.

$$(1 + 5 + 2) + 4 = 12$$

3. (a) What are the drawbacks found in electromagnetic blood flow meter compare to industrial electromagnetic flow meter?.
- (b) Define the transformer voltage of electromagnetic blood flow meter. Describe one of the convenient methods to eliminate it. Explain the working principle of Magnetic flow probe.

$$3 + (1 + 5 + 3) = 12$$

Group – C

4. (a) State the significance of Microelectrodes. Define the configurations of various types of micro electrodes with specifications.
- (b) Classify the property of any two types of microelectrodes with equivalent circuit.

$$(2 + 4) + (3 + 3) = 12$$

5. (a) Name the principal ions which are responsible for producing cell potentials. What is Resting and Action potential? Specify the absolute refractory period.
- (b) Explain the term 'Half cell potential' and write down the equation for calculating Half cell potential.

$$(3 + 3 + 2) + (2 + 2) = 12$$

Group – D

6. (a) Explain the electrical conductive pathways of the heart with the necessary diagram. Classify the ECG electrodes in detail.
- (b) What do you mean by medical imaging? State the different imaging techniques with respective applications in biomedical instrumentation.

$$(4 + 4) + (1 + 3) = 12$$

7. (a) Why is biotelemetry so important these days? Explain with a neat sketch the block diagram of a telemetry system to send patient's physiological events at doctor's end.
- (b) What is EEG? Specify different EEG waves and their frequencies.

$$(2 + 3 + 3) + (1 + 3) = 12$$

Group – E

8. (a) Define the lead wire and electrodes of an artificial pacemaker.
(b) Describe different types of synchronous pacemaker.

4 + 8 = 12

9. (a) Explain the various method for accident prevention.
(b) Write short notes on any two:
(i) Impedance Plethysmography
(ii) MRI
(iii) Defibrillator

4 + (2 × 4) = 12

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/MjQ0ODYwMzA2OTcx/a/Mjc0MTgyMDk4NDA3/details