M.TECH/AEIE/3RD SEM/AEIE 6151/2016

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) The material which has negative gauge factor is
(a) Copper (b) Iron (c) Zinc (d) Nickel.

(ii) Piezoelectric crystal is a/an---------- transducer
(a) active (b) inverse
(c) passive (d) (a) and (b).

(iii) Value of action potential is approximately
(a) -20 μV (b) -70 μV (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) The number of electrodes required to record a standard electrocardiogram is usually
(a) 4 (b) 5 (c) 12 (d) 10.

(vi) Korrotkoff sound is used in
(a) blood flow measurement (b) heart valve functioning
(c) ultrasound imaging (d) blood pressure measurement.

(vii) The node where pacemaker cells are there is known as
(a) AV node (b) AS node
(c) Cathode (d) SA node.

(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) Computed Axial Tomography (CAT) measures the
(a) transmitted intensity of *X*-ray (b) incident intensity of *X*-ray
(c) both (a) and (b) (d) attenuation value of *X*-ray.

Group – B

2. (a) What are the different types of blood pressure measurement? With a neat diagram, explain indirect methods of blood pressure measurement.

(b) With a neat sketch, explain the Fick's method for measuring volumetric blood flow.

(2 + 6) + 4 = 12

3. (a) State the properties of piezoelectric transducers. Explain with a neat sketch, the operation of a strain gauge in blood pressure measurements.

(b) What do you mean by accuracies at full-scale reading and point reading? If an instrument (0-100V) has a specified ±5% error at full-scale reading then what will be the error at 50 V?

(2 + 6) + (2 + 2) = 12

Group – C

4. (a) What is half-cell potential? On what factors the magnitude of such potential depends?

(b) Draw an equivalent circuit of an electrode-electrolyte interface. What are the polarizable and non-polarizable electrodes? Give one example of each. What are the off-set voltage and noise due to the motion artefacts?

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

5. (a) What are the different types of electrodes? Mention their applications. What special features of bioelectric amplifiers make them suitable for Biomedical applications?

(b) With a suitable circuit diagram, explain the operation of an instrumentation amplifier and derive for the overall gain of the amplifier.

(2 + 2 + 3) + 5 = 12

Group – D

6. (a) What are the different types of ECG leads? Explain the conducting system of the heart with the necessary diagrams.

(b) What is medical imaging? What are the different imaging techniques and respective applications in biomedical instrumentation?

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

7. (a) What is biotelemetry? Draw and explain the transmitter and receiver sections of a telemetric system.

(b) With suitable diagram, explain the operation of an ultrasound imaging process.

(2 + 3 + 3) + 4 = 12

Group – E

8. (a) What is a pacemaker? What are the different types of pacemakers? What is the function of synchronous pacemaker?

(b) Draw and explain a defibrillator circuit.

(1 + 2 + 3) + 6 = 12

9. Write Short notes on any two
(i) Velocity measurements using Ultrasound
(ii) Measuring electrodes
(iii) Errors in measurement
(iv) Impedance Plethysmography.

6 + 6 = 12