

**MEDICAL INSTRUMENTATION
(AEIE 5132)**

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 of the following is a preferred electrode for measuring EMG?
(a) Surface electrodes (b) Needle electrodes
(c) Pregelled electrodes (d) Scalp electrodes.
- (ii) If the rate of heart beat is faster than the normal, then it is called
(a) Tachycardia (b) Arrhythmia
(c) Fibrillation (d) Bradycardia.
- (iii) Generally what is the material of needle electrodes?
(a) Stainless steel (b) Copper
(c) Lead (d) Iron.
- (iv) Low body temperature is called as _____
(a) Hyperthermia (b) Hypothermia
(c) Hypotherm (d) Hypertherm.
- (v) At the time of diastole at left ventricle
(a) SA node generates new pulse (b) Aortic valve opens
(c) 2nd heart sound occurs (d) all the above information are true.
- (vi) Blood volume flow can be measured by
(a) Magnetic Flow-probes (b) Indicator Dilution method
(c) Photo Plethysmography (d) All of the above.
- (vii) The ventricular tachycardia occurs when the
(a) heart rate is reduced to 50 beat per min
(b) heart rate is increased to 120 beat per min
(c) two simultaneous ventricular depolarisation occurs
(d) both (b) and (c) are true.

- (viii) In Continuous Infusion Technique _____ is used as the indicator.
 (a) Cold Water (b) Hot Water
 (c) Oxygen (d) Indo-cyanine Green
- (ix) In Semiconductor Strain Gauge
 (a) Resistance Temperature Co-efficient is high
 (b) Gauge Factor is high
 (c) Hysteresis loss is small
 (d) All the above are true.
- (x) Stroke Volume is defined as the
 (a) number of times brain stroke occurs in a person.
 (b) volume of blood flushed out from ventricles per minute.
 (c) volume of blood flushed out from ventricles per heartbeat
 (d) both (b) and (c) are true.

Fill in the blanks with the correct word

- (xi) Recording electrical activities associated with heart is known as _____.
- (xii) Normal EEG frequency range is _____.
- (xiii) MRI stands for _____.
- (xiv) The peak to peak amplitude of the waves that can be picked from the scalp is _____.
- (xv) Source of Bioelectric potential is _____ in nature.

Group - B

2. (a) Define the terms: Cardiac Output(CO), Stroke Volume. [[CO1](Define/LOCQ)]
 (b) Explain the method of Blood flow measurement using continuous infusion technique. Write one Advantage and One Disadvantage of the method. [[CO1](Describe/IOCQ)]
 (c) Explain the operating principle and establish the necessary equation of impedance plethysmography method for blood volume measurement. [[CO1] (Solve/HOCQ)]

$$2 + (3 + 2) + (2 + 3) = 12$$
3. (a) Describe the operating principle and explain how the following sensors (**any two**) contribute in the measurement of various cardiovascular parameters like Blood pressure, Volume or instantaneous blood flow, heart-beat rate etc:
 (i) Thermistor
 (ii) Strain gauge
 (iii) Ultrasonic sensor. [[CO1](Explain/HOCQ)]
 (b) Compare the two terms: accuracy and precision. [[CO2] (Compare/IOCQ)]

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

Group - C

4. (a) Name the three basic types of electrodes for the measurement of bioelectric potentials. [[C02](Remember/LOCQ)]
(b) What are the uses of microelectrodes? [[C02](Remember/LOCQ)]
(c) Differentiate between microelectrodes and body surface electrodes. [[C03](Evaluate/HOCQ)]
3 + 4 + 5 = 12
5. (a) Name the electrodes used for EEG measurement. [[C02](Remember/LOCQ)]
(b) Point out three types of lead systems used to record ECG. [[C03](Analyze/IOCQ)]
(c) Summarize LATENCY in EMG. [[C03](Evaluate/HOCQ)]
3 + 5 + 4 = 12

Group - D

6. (a) What do you mean by CT Scan? [[C03](Remember/LOCQ)]
(b) Explain the principle and properties of Ultrasound. [[C04](Analyze/IOCQ)]
(c) Explain with neat diagram the principle of operation and working of MRI system. [[C03](Remember/LOCQ)]
4 + 4 + 4 = 12
7. (a) Illustrate single channel telemetry. [[C04](Remember/LOCQ)]
(b) Discuss the applications of biotelemetry. [[C04](Analyze/IOCQ)]
(c) Deduce the anticipated problems of telemetry systems in the future. [[C03](Evaluate/HOCQ)]
3 + 4 + 5 = 12

Group - E

8. (a) Explain defibrillator and give its disadvantages. [[C05](Remember/LOCQ)]
(b) Explain the working of DC defibrillator with a neat block diagram. [[C05](Remember/LOCQ)]
(c) Discuss about the tests to be carried out to ensure safety of medical equipments. [[C06](Understand/LOCQ)]
4 + 4 + 4 = 12
9. (a) Explain how the electrical hazards protection can be provided in the biomedical instrumentation systems. [[C06](Remember/LOCQ)]
(b) What is a pacemaker? [[C05](Analyze/IOCQ)]
(c) Distinguish between demand pacemaker and synchronized pacemaker. [[C05](Evaluate/HOCQ)]
5 + 4 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	48	29	23

Course Outcome (CO):

After the completion of the course students will be able to

1. Explain the fundamental principles and applications of different transducers used for body parameter measurements.
2. Understand the physiology of biomedical systems and different methods in the design of biomedical instruments.
3. Learn the different methods of medical imaging systems, concepts related to the operations and analysis of biomedical instruments.
4. Design signal processing hardware circuits.
5. Learn various therapeutic devices.
6. Aware of the importance of electrical safety and apply it in the design of different assisting, therapeutic and diagnostic medical devices.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*