

**BIOMEDICAL INSTRUMENTATION  
(AEIE 4241)**

**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 represents action potential?  
(a) 70 mV (b) -70 mV  
(c) 20 mV (d) -20 mV.
- (ii) If the rate of heart beat is slower than the normal, then it is called  
(a) Tachycardia (b) Arrhythmia  
(c) Fibrillation (d) Bradycardia
- (iii) Low body temperature is called as \_\_\_\_\_.  
(a) Hyperthermia (b) Hypothermia  
(c) Hypotherm (d) Hypertherm.
- (iv) The material that has a negative gauge factor is \_\_\_\_\_.  
(a) nickle (b) copper (c) iron (d) tin
- (v) Which of the following is a preferred electrode for measuring EMG?  
(a) Surface electrodes (b) Needle electrodes  
(c) Pregelled electrodes (d) Scalp electrodes.
- (vi) The figure of merit which describes the overall behaviour of the wire under stress is determined from \_\_\_\_\_.  
(a) gauge resistance (b) gauge factor  
(c) elastic factor (d) elastic modulus
- (vii) 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.

- (viii) Indocyanine green is used in bolus of indicator in CO measurement, as it is
  - (a) inert
  - (b) harmless
  - (c) measurable
  - (d) all the above are true.
- (ix) 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.
- (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) Source of Bioelectric potential is \_\_\_\_\_ in nature.
- (xii) Phonocardiography is listening to \_\_\_\_\_.
- (xiii) The contraction of the skeletal muscles results in the generation of action potential in the individual muscle fibers. Record of this action potential is called \_\_\_\_\_.
- (xiv) The peak to peak amplitude of the waves that can be picked from the scalp is \_\_\_\_\_.
- (xv) MRI stands for \_\_\_\_\_.

### Group - B

- 2. (a) Describe the RTD and explain how it can be used to measure temperature. [[CO1](Define/LOCQ)]
  - (b) Describe the principle of operation and construction details of LVDT. [[CO1](Describe/IOCQ)]
  - (c) Summarize the advantages and disadvantages of LVDT. [[CO1](Solve/HOCQ)]
- 4 + 4 + 4 = 12**
- 3. (a) Write short notes on **any two** from the following:
    - (i) Direct BP measurement method.
    - (ii) Chemical sensor.
    - (iii) Application of Piezo-electric transducer in Bio medical-instrumentation. [[CO1](Understand/LOCQ)]
  - (b) Describe with diagram a convenient method for instantaneous blood flowrate measurement. Explain the operating principle of sensor used for this measurement. [[CO1](Explain/IOCQ)]
- ( 2 × 4 ) + 4 = 12**

## Group - C

4. (a) What do you mean by bioelectric potential? [[CO2](Remember/LOCQ)]  
 (b) Draw the standard ECG waveform and mark the regions in the waveform. [[CO2](Create/HOCQ)]  
 (c) Classify the various types of Bio-electrodes. [[CO2](Analyze/IOCQ)]  
**3 + (3 + 1) + 5 = 12**
5. (a) Name the electrodes used for EEG measurement. [[CO2](Remember/LOCQ)]  
 (b) Point out three types of lead systems used to record ECG. [[CO3](Analyze/IOCQ)]  
 (c) Summarize LATENCY in EMG. [[CO3](Evaluate/HOCQ)]  
**3 + 5 + 4 = 12**

## Group - D

6. (a) What do you mean by CT Scan? [[CO3](Remember/LOCQ)]  
 (b) Explain with neat diagram the principle of operation and working of MRI system. [[CO3](Remember/LOCQ)]  
 (c) Explain the advantages of Ultrasound technique. [[CO3](Evaluate/HOCQ)]  
**4 + 4 + 4 = 12**
7. (a) Summarize different applications of X-ray examination. [[CO4](Remember/LOCQ)]  
 (b) Discuss the applications of biotelemetry. [[CO4](Analyze/IOCQ)]  
 (c) Evaluate the working of multichannel biotelemetry system. [[CO4](Evaluate/HOCQ)]  
**4 + 5 + 3 = 12**

## Group - E

8. (a) Explain defibrillator and its disadvantages. [[CO5](Remember/LOCQ)]  
 (b) Explain the working of hearing aids with a neat block diagram. [[CO5](Remember/LOCQ)]  
 (c) Discuss about the tests to be carried out to ensure safety of medical equipments. [[CO6](Understand/LOCQ)]  
**4 + 4 + 4 = 12**
9. (a) Explain how the electrical hazards protection can be provided in the biomedical instrumentation systems. [[CO6](Remember/LOCQ)]  
 (b) What is a pacemaker? [[CO5](Analyze/IOCQ)]  
 (c) Distinguish between Acoustic transducer and temperature sensor. [[CO5](Evaluate/HOCQ)]  
**5 + 4 + 3 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	48.95	28.12	22.93

**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.*