[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5533 **J**

Unique Paper Code : 2512042401

Name of the Paper : Biomedical Instrumentation

Name of the Course : **B.Sc. (H) Instrumentation**

Semester : IV

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all.
3. Question No. **1** is compulsory.
4. **All** questions carry equal marks.
5. Use of non-programmable scientific calculator is allowed.

1. (a) Identify any three variables from a human body which can be given to a Man-instrument system. Suggest a transducer to convert these non-electrical signals to electrical signals. (3)

   (b) Define tidal volume and its significance in pulmonary function testing. (3)

   (c) What is the heart rate in beats per minute of a patient with an R-to-R interval of 856 ms? (3)

   (d) What is the role of contrast agents in medical imaging? (3)

   (e) What is an action potential, and how is it generated in neurons? (3)

   (f) Explain the role of infrared detectors in thermal imaging systems. (3)

2. (a) Which medical device is used in case of abnormal heart beats. Discuss different types of such devices. (6)

   (b) Describe the working principle of a spirometer with a neat diagram. What are the advantages and limitations of spirometry in clinical diagnosis? (6)

   (c) Classify different types of blood pressure measurement instruments. Explain the principle and working of an automatic blood pressure measurement device. (6)

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3. (a) What are brain waves? How are they classified based on frequency? Which types of waves represent an alert brain. (5)

   (b) Explain the construction and working of a reference electrode commonly used to pick a biopotential. (6)

   (c) Draw a block diagram of single channel ECG machine. Briefly explain the function of each of its components. (7)

4. (a) List two types of pulmonary function tests and briefly describe their objectives. (6)

   (b) Explain any two biomedical applications of a piezoelectric transducer. (6)

   (c) Explain the characteristics of an Instrumentation amplifier that makes it a perfect choice as a bio amplifier. (6)

5. (a) How is EEG used in diagnosing neurological disorders like epilepsy and sleep disorders? Explain its instrumentation in detail. (7)

   (b) What are the key components of an X-ray tube? Explain the basic principle of X-ray generation? (7)

   (c) List eight major organs of respiration. (4)

6. (a) Explain a method of estimation of residual volume. (6)

   (b) Explain the working principle of any pneumotachometer, including its components and functioning. (6)

   (c) Explain the process of depolarization and repolarization of a myocardial cell with the help of a neat diagram. (6)

7. (a) Explain the radiation hazards associated with X-ray imaging and the safety precautions taken. (5)

   (b) Explain the role of thermal imaging in cancer detection. (5)

   (c) With the help of suitable diagram define different terminologies used to explain the function of an individual's physical characteristics and the condition of breathing mechanism. (8)