

Sl. No. of Ques. Paper : 1353 F-7
Unique Paper Code : 2511507
Name of Paper : Biomedical Instrumentation – I
Name of Course : B.Tech. (Instrumentation)
Semester : V
Duration : 3 hours
Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt five questions in all. Question No. 1 is compulsory. All questions carry equal marks.
Non-programmable scientific calculator is allowed.

1. (a) Suggest an instrument for the measurement of physical performance characteristics of a patient suspected with cardiovascular disease. 3
- (b) Why are floating metal body surface electrodes immune to motion artefacts? 3
- (c) Differentiate between cardiac pacemaker and defibrillator. Are the levels of voltage for internal defibrillator same as external defibrillator? Justify your answer. 3
- (d) What are the advantages of square wave electromagnetic blood flow meter over sine wave electromagnetic blood flow meter? 3
- (e) What are the possible causes of wandering baselines in an electrocardiogram? 3
2. (a) Name and explain one respiratory instrument using photoelectric transducer with a neat diagram. 5
- (b) A patient is diagnosed with prolonged R-R interval frequently. Name the problem and suggest the type of pacemaker required for correcting this condition. Also explain its principle of an operation. 5
- (c) What is a thermotone? Describe the various detectors used in thermal imaging systems. 5
3. (a) Illustrate the term Forced Vital Capacity, Forced Expiratory Volume and Maximum Mid Expiratory Flow with the help of a neat diagram. 5
- (b) How does a charge cross the interface of electrode and electrolyte? What makes Ag/AgCl a preferred choice for electrodes? 5
- (c) Explain with block diagram various parts of ECG machine. How is the 60 Hz interference noise signal eliminated from the recording? 5

4. (a) What is 10-20 electrode placement system? Name the bioelectric instrument with which it is used. Explain with the help of a diagram. 5
- (b) What is montage? Describe the frequency analysis of an EEG wave. 5
- (c) What is the difference between collimator and grids? Given the energy level of 6.624×10^{-18} Joule imparted to an electron stream by an X-ray device, calculate the frequency in MHz and wavelength in metres and angstrom. 2+3
5. (a) What is dead space volume? Explain the technique used for its measurement. 5
- (b) Find the open circuit (no load) voltage across the patient paddle electrodes of a defibrillator using a $16 \mu\text{F}$ capacitor that is charged to 200 W-s both before and after pressing of discharge button. Assume a patient resistance of 50Ω and an internal resistance of 20Ω . 5
- (c) Differentiate between ventilation and respiration. Explain different types of ventilators available. 5
6. (a) Differentiate between in-vitro and in-vivo oximetry. Explain any one method of in-vivo measurement of oxygen saturation in the blood. 5
- (b) What is the significance of input impedance and signal to noise ratio in determining the performance of a biomedical instrument? 5
- (c) Explain any direct blood pressure measurement method citing its advantages and disadvantages over the indirect method. 5
7. (a) What are the advantages of ultrasonic flow meter over electromagnetic flow water? 3
- (b) Describe the unipolar and bipolar leads of ECG. Why is sensitivity of augmented leads more as compared to original unipolar leads? 6
- (c) Explain the major sections of a fluoroscopy machine with the help of a neat diagram. 6