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205EI001

Ph.D./M.S. (Engg.) by Research Degree Examination, April/May 2024
Modern Medical Instrumentation

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Discuss the various sources from which the biological signals originate. **(10 Marks)**

b. What are the important factors which determine the design of medical measuring instrument? Discuss the additional constraints to be considered while designing measurement system. **(10 Marks)**

OR

2 a. Discuss the performance characteristics of body surface electrodes. **(08 Marks)**

b. Explain the primary characteristics of typical bioelectric signals. **(05 Marks)**

c. Differentiate between Polarizable and Non – polarizable electrodes. Explain the construction and working of Ag/Ag Cℓ electrode. **(07 Marks)**

Module-2

3 a. Distinguish between Unipolar and Bipolar leads of ECG. How do we get augmented leads? **(08 Marks)**

b. Discuss the characteristics of amplifiers with commonly employed filters in phonocardiography. **(08 Marks)**

c. Explain the basic heart sounds in a typical phonocardiogram recording. **(04 Marks)**

OR

4 a. Describe the 10 – 20 system of EEG electrode placement. What are implications and significance of biological and environmental artifacts in EEG? **(10 Marks)**

b. Discuss about the preamplifier circuit in an EMG machine and how does it affect electrical interference and microphonic artifacts , strategies to mitigate these issues. **(10 Marks)**

Module-3

5 a. Explain with a block diagram the microprocessor based bed side patient monitoring system. **(10 Marks)**

b. Based on matched QRS filter, describe the performance of cardiotachometer. **(10 Marks)**

OR

6 a. Write the block diagram for processing plethysmographic signal and explain its operation. **(04 Marks)**

b. Explain the circuit for measurement of systolic and diastolic blood pressure. **(06 Marks)**

c. Provide a detailed analysis of the performance of an ear oximeter by mathematical statements and expressions. **(10 Marks)**

Module-4

7 a. Discuss the working of Laser Doppler system for blood flow measurement in skin. **(08 Marks)**

b. Describe the various pacing modalities in demand pacemakers. **(08 Marks)**

c. Outline the essential criteria that must be met when designing an implantable circuit for use in the human body. **(04 Marks)**

OR

8 a. Elaborate on packing and sensing functionalities in ventricular synchronous demand pacemaker. **(10 Marks)**

b. Discuss the types of electrodes used in defibrillator. **(04 Marks)**

c. Explain the operational performance of DC defibrillator in terms of current waveform I(t) versus patient impedance Rp. **(06 Marks)**

Module-5

9 a. Explain the operation of ultrasonic spirometer and derive the expression for average gas velocity v through the flow tube in ultrasonic spirometer. **(08 Marks)**

b. Discuss the technique involved in the measurement of volume of gas by Nitrogen washout method. **(08 Marks)**

c. List and briefly explain the basic types of pulmonary function measurements. **(04 Marks)**

OR

10 a. Explain the basic functions of haemodialysis machine with schematic diagram. **(10 Marks)**

b. With the block diagram, explain the operation of programmable volumetric infusion pump. **(10 Marks)**

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