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Question Paper Code:R4B04

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Biomedical Engineering

R21UBM404 BIOMEDICAL INSTRUMENTATION

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What is meant by the resting and action potential of a cell? CO1- U
2. Estimate the different properties of Electrode in skin interface. CO1- U
3. Define Latency in EMG. CO1- U
4. Name the electrodes used for EEG measurement CO1- U
5. Explain the need for Bio-amplifier. CO1- U
6. Write the effect of power line interference in bio signal recording. CO1- U
7. Write down the significance of korotkoff sound. CO1- U
8. It is given that 1.2 litre of air remains in the lungs despite of forceful expiration. The man can expire 1.1 litre by forceful expiration at the end of tidal volume. The inspiratory capacity is 3.5 litre. Find total lung volume and vital capacity. CO2- App
9. Define the value of partial pressure of oxygen (PaO₂) in arterial blood and explain its clinical relevance. CO1- U
10. Distinguish between Flame Photometer and spectrophotometer. CO1- U

PART – B (5 x 16= 80 Marks)

11. (a) With a neat diagram, explain in detail about the cell potential and also discuss how the sodium-potassium pump contributes to the generation and maintenance of the resting membrane potential in a neuron. CO1-U (16)

Or

- (b) Describe in detail about the various electrodes used for bio signal measurement. CO1-U (16)
12. (a) Determine how a biomedical engineer will design an ECG amplifier. Identify the functional blocks, components and their characteristics, design assumptions, complete circuit diagram and working of an ECG amplifier. CO2-App (16)
- Or
- (b) Illustrate a clinical condition and analysis, how would you choose between unipolar, bipolar or average reference modes for an EEG using the 10-20 system? CO2-App (16)
13. (a) Design and implement a right-leg driven ECG amplifier to improve signal quality and minimize common-mode interference in cardiac monitoring. CO2-App (16)
- Or
- (b) Implement a noise reduction strategy for a bio-signal recording system by applying appropriate techniques to eliminate power line interference. CO2-App (16)
14. (a) Analyze the differences between electromagnetic, ultrasound and plethysmography-based blood flow measurement techniques. Discuss their suitability for different medical conditions. CO4-Ana (16)
- Or
- (b) Compare non-invasive and invasive methods for measuring blood pressure, cardiac output and respiration rate. Analyze the factors influencing the choice of these techniques in different clinical scenarios. CO4-Ana (16)
15. (a) A hospital laboratory needs to measure blood gas parameters (pH, PO₂, PCO₂). Identify the relevant instrument, explain its function and its clinical significance. CO3-App (16)
- Or
- (b) A hospital plans to automate blood and biochemical analysis. Identify the relevant instrument, explain its function and discuss its benefits in efficiency, accuracy and large-scale testing. CO3-App (16)