Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30510

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fifth Semester

Electronics and Communication Engineering

EC 8073 – MEDICAL ELECTRONICS

(Common to: Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. If a bio-potential electrode experiences poor skin contact, how might it affect ECG signal accuracy?

2. Identify one potential artifact that could distort bio-potential recordings and propose a method to mitigate it.

3. If a pH sensor is exposed to high temperatures, how might its accuracy in biochemical measurement be affected?

4. How might pulse measurement accuracy vary if a finger pulse oximeter is used on cold versus warm fingers?

5. How do ultrasonic imaging systems utilize sound waves to produce images of internal body structures?

6. Outline the role of defibrillation in the management of cardiac arrest.

7. Recall the fundamental principle behind biotelemetry.

8. Recall the frequency ranges used in microwave diathermy.

9. How does an insulin pump benefit diabetic patients?

10. Differentiate between endomicroscopy and traditional endoscopy.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Analyze the role of bio-potential electrodes in capturing accurate biopotentials. (7)

(ii) Compare different electrode materials and their applications in ECG, EEG, and EMG recordings. (6)

Or

(b) (i) Compare the signal characteristics of ECG, EEG, and EMG in terms of frequency, amplitude, and waveform patterns. (6)

(ii) In a scenario where both ECG and PCG signals are recorded concurrently, identify possible interferences and artifacts that could distort either signal. (7)

12. (a) Analyze the principles of measuring pH, PO2, and PCO2 in blood samples. Also, analyze the potential physiological and environmental factors influencing these measurements. (6+7)

Or

(b) Discuss the techniques available for cardiac output measurement. Also, analyze how environmental or physiological conditions, such as blood pressure fluctuations, might impact the accuracy of each method. (6+7)

13. (a) Discuss the operating principle of DC defibrillator and the physiological effects of defibrillation. (6+7)

Or

(b) Examine the design and function of dialyzers in maintaining biochemical homeostasis for renal failure patients. (9+4)

14. (a) Describe in detail the principle of shortwave and ultrasonic diathermy. (6+7)

Or

(b) Illustrate the process of using surgical diathermy in an operative setting and how surgical diathermy differs from non-surgical applications. (6+7)

15. (a) Describe the principle, components and applications of telemedicine in modern healthcare. (6+4+3)

Or

(b) Illustrate the technology behind radio pill devices. Explain their applications in gastrointestinal diagnostics. Explain how they transmit data for real-time monitoring. (5+4+4)

PART C — (1 × 15 = 15 marks)

16. (a) Consider the use of a multi-parameter monitor for cardiac output, respiratory rate, and temperature in an intensive care unit. Discuss the challenges and potential errors associated with continuous monitoring and propose a system of calibration checks and data interpretation protocols to ensure accuracy and timely patient intervention.

Or

(b) A 45-year-old patient with chronic obstructive pulmonary disease (COPD) is placed on a ventilator during an acute exacerbation.

(i) Analyze the ventilatory settings to be considered for this patient. (5)

(ii) Discuss the implications of these settings on the patient's gas exchange and respiratory mechanics. (5)

(iii) Evaluate how changes in the patient's condition might require adjustments to the ventilator settings. (5)

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