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Question Paper Code : 91063

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Computer Science and Engineering

OMD 551 — BASICS OF BIOMEDICAL INSTRUMENTATION

(Common to : Computer and Communication Engineering/Electrical and Electronics Engineering/Electronics and Communication Engineering/Electronics and Telecommunication Engineering/Artificial Intelligence and Data Science/Information Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Action Potential?
2. State the need for Right leg drive in bio-potential recording.
3. What is the heart rate in beats per minute of a patient with an R to R interval of 856ms?
4. Define: Einthoven triangle.
5. Why are Operational amplifiers preferred to design bio-amplifiers?
6. What is the need for using a band pass filter in ECG amplifier?
7. What is mean pressure?
8. Define Korotkoff sound.
9. What is the use of a colorimeter in parameter measurements?
10. State the difference between the continuous-flow method and the discrete sample method of automated clinical chemistry equipment.

PART B — (5 × 13 = 65 marks)

11. (a) With neat diagrams, explain the different types of electrodes used to measure Bioelectric events. (13)

Or

- (b) Explain the electrical action of the sinoatrial node. How are the potentials in muscle fibers measured. (6 + 7)
12. (a) Draw the 10-20 electrode EEG system and describe the blocks of EEG machine for the acquisition of brain activity. (13)

Or

- (b) Needle electrodes give more precise signal for EMG measurement, but it is not the most common electrode used for EMG, why? Describe in detail about the origin of myoelectric signal and instrumentation for EMG recording. (13)
13. (a) Describe an isolation amplifier? Explain how transformer coupled isolation amplifier acts as a safety circuit with a neat schematic diagram? (13)

Or

- (b) Explain how the common mode voltage can be reduced in the right leg driven ECG amplifier with neat circuit diagram. (13)
14. (a) With suitable diagram discuss how CO₂ is detected in the expired air for continuous monitoring of respiration rate. (13)

Or

- (b) With suitable diagram illustrate how transmission and reflectance method can be used for measurement of pulse rate. (13)
15. (a) Propose a gas analyzer technique that determines the quantitative composition of complex gas mixture in the respired gas. Sketch the arrangement and elaborate its operation to measure the same. (13)

Or

- (b) When counting red blood cells with one of the automatic counting methods, you will, by necessity, also count the white blood cells in the process. Why is the error introduced by this negligible? Why must the blood be diluted for all the automatic blood cell counters? How do the automatic cell counters avoid counting the platelets? (13)

PART C — (1 × 15 = 15 marks)

16. (a) A differential amplifier has a positive input terminal, a negative input terminal, and a ground connection. ECG electrodes from a patient are connected to the positive and negative terminals, and a reference electrode is connected to ground. A disturbance signal develops on the patient's body. This will appear as a voltage from the positive terminal to ground and a similar voltage from the negative terminal to ground. How does the differential amplifier amplify the ECG signal while not essentially amplifying the disturbance signals? Draw a sketch showing the patient connected to the amplifier. (15)

Or

- (b) You are employed by a hospital research unit on a certain project to measure the blood pressure and blood flow in the femoral artery of an anesthetized dog lying on an operating table.

Design a system to do this by

- (i) describing the transducers, if any, you would use;
 - (ii) specifying all necessary instrumentation;
 - (iii) discussing surgical or medical methods used to ensure that your physiological measurements are taken correctly—for example, catheterization, implantation, and so on. (15)
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