

Reg. No.

Question Paper Code

13184

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Seventh Semester

Electrical and Electronics Engineering

20EEEL705 - MEDICAL INSTRUMENTATION

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (20 × 1 = 20 Marks)**

Answer ALL Questions

Marks *K-  
Level* CO

1. The device that converts ionic potentials into electronic potentials are called as  
(a) transducer (b) electrodes (c) amplifier (d) signal conditioning equipment 1 K1 CO1
2. -----is used to transport the sodium ions quickly to outside the cell.  
(a) All or nothing law (b) Nernst equation (c) sodium pump (d) conductivity 1 K1 CO1
3. \_\_\_\_ is the time duration in which another action potential can be triggered but a higher stimulus is required to reinitiate the action potential and the subsequent contraction of muscles.  
(a) absolute refractory period (b) relative refractory period  
(c) conduction velocity (d) action potential. 1 K1 CO1
4. Regardless of the method of excitation of cells or by the intensity of the stimulus, the action potential is always the same for any given cell is referred as  
(a) sodium pump process (b) all or nothing law (c) Refractory period (d) conductivity 1 K1 CO1
5. The treatment for epilepsy can be given by measuring  
(a) ECG (b) EMG (c) EEG (d) EOG 1 K1 CO2
6. In which lead system, voltage is taken between a single exploratory electrode and the central terminal.  
(a) Bipolar lead system (b) unipolar lead system  
(c) unipolar chest lead (d) none of the above 1 K1 CO2
7. The 'P' wave in an ECG represents -----  
(a) Ventricular depolarization (b) Ventricular repolarization  
(c) Atrial depolarization (d) Atrial repolarization 1 K1 CO2
8. ---value is located between the right atrium and right ventricle prevents the backward blood flow from right ventricle to right atrium.  
(a) Tricuspid value (b) Bicuspid valve (c) Pulmonary valve (d) Aortic value 1 K1 CO2
9. \_\_\_\_\_ are commonly used for providing protection against leakage currents.  
(a) Isolation amplifiers (b) Differential amplifiers  
(c) Instrumentation amplifiers (d) Inverting amplifiers 1 K1 CO3
10. -----is a physiological response to the current applied to the surface of the body that produces unnecessary stimulation like muscle contractions or tissue injury.  
(a) macro shock (b) micro shock  
(c) both macro and micro shock (d) none of the above 1 K1 CO3
11. -----protects against the shock that occurs if a person touches the hot lead with one hand and the ground with the other.  
(a) isolation amplifier (b) isolation transformer  
(c) Ground fault interrupter (d) none of the above 1 K1 CO3
12. -----is not the type of current  
(a) pain current (b) continuous current (c) Let go current (d) threshold current 1 K1 CO3
13. Which of the following devices is used to measure blood pressure?  
(a) ECG (b) EEG (c) Sphygmomanometer (d) spirometer 1 K1 CO4

- |  |   |    |     |
|--|---|----|-----|
| 14. Which of the following instrument is used for hearing internal sounds of a human body?   | 1 | K1 | CO4 |
| (a) Microscope (b) Stethoscope (c) Spectrometer (d) Thermometer  |   |    |     |
| 15. The method in which cardiac output is calculated by continuously infusing oxygen into the blood and removing it from the blood and measuring the amount of oxygen in the blood before and after its passage. | 1 | K1 | CO4 |
| (a) Ficks method (b) Indicator dilution method   |   |    |     |
| (c) Impedance change method (d) temperature change method.   |   |    |     |
| 16. What is the working principle of a sphygmomanometer?   | 1 | K1 | CO4 |
| (a) It uses sound waves to measure blood pressure  |   |    |     |
| (b) It uses an inflatable rubber cuff, which is used to compress the artery and measure blood pressure   |   |    |     |
| (c) It uses a magnetic field to measure blood pressure   |   |    |     |
| (d) It uses electrical signals to measure blood pressure   |   |    |     |
| 17. In the case of stable total AV block, a pacemaker is chosen  | 1 | K1 | CO5 |
| (a) with constant frequency  |   |    |     |
| (b) that is atrial synchronous   |   |    |     |
| (c) that is ventricular synchronous  |   |    |     |
| (d) with variable frequency and synchronization with ventricular action  |   |    |     |
| 18. How does a ventilator work?  | 1 | K1 | CO5 |
| (a) It uses sound waves to assist or replace spontaneous breathing   |   |    |     |
| (b) It uses a magnetic field to assist or replace spontaneous breathing  |   |    |     |
| (c) It uses electrical impulses to assist or replace spontaneous breathing   |   |    |     |
| (d) It uses positive pressure to assist or replace spontaneous breathing   |   |    |     |
| 19. In biotelemetry, FDM refers to   | 1 | K1 | CO5 |
| (a) Frequency division modulation (b) Fourier domain modulation  |   |    |     |
| (c) Frequency division multiplexing (d) Fesimle Distance Modulation  |   |    |     |
| 20. What is the purpose of an endoscope in biomedical instrumentation?   | 1 | K1 | CO5 |
| (a) To monitor the heart's activity (b) To image the exterior of the body  |   |    |     |
| (c) To view the internal structures of the body (d) To deliver drugs into the body   |   |    |     |

**PART - B (10 × 2 = 20 Marks)**

Answer ALL Questions

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|---|---|----|-----|
| 21. What is All or None Law?  | 2 | K1 | CO1 |
| 22. Outline the Sodium Pump process.                                    | 2 | K2 | CO1 |
| 23. What is the use of E MG?  | 2 | K1 | CO2 |
| 24. Classify the various lead systems used in ECG recording.            | 2 | K2 | CO2 |
| 25. Define Leakage current.   | 2 | K1 | CO3 |
| 26. Outline the need of isolation amplifier in medical Instrumentation. | 2 | K2 | CO3 |
| 27. Summarize the use of blood gas analyser.                            | 2 | K2 | CO4 |
| 28. What is Cardiac output?   | 2 | K1 | CO4 |
| 29. Compare radiographic and fluoroscopic techniques.                   | 2 | K2 | CO5 |
| 30. List the medical applications of thermography.                      | 2 | K1 | CO5 |

**PART - C (6 × 10 = 60 Marks)**

Answer ALL Questions

- |  |    |    |     |
|--|----|----|-----|
| 31. (a) Outline the structure of the human cell. | 10 | K2 | CO1 |
| <b>OR</b>  |    |    |     |
| (b) Summarize various microelectrodes.           | 10 | K2 | CO1 |

32. (a) Explain the working principle of an ECG machine with a neat block diagram. 10 K2 CO2
- OR**
- (b) Explain the working principle of an EEG machine with a neat block diagram. 10 K2 CO2
33. (a) A catheter of resistance  $10\text{ k}\Omega$  is inserted into cardiac patient and rest on the heart. The patient's left hand earthed. The catheter is coming from an electronic circuit which has a strong capacitive coupling of  $1000\text{ pF}$  between the power line of frequency  $50\text{ Hz}$  and voltage  $220\text{ volts}$  and the patient lead. Assume the skin resistance has  $10\text{ k}\Omega$  and viscera resistance has  $200\text{ k}\Omega$ . Identify the leakage current that passes through the patient's heart. Comment on the state of the cardiac patient. 10 K3 CO3
- OR**
- (b) Make use of ground fault interrupter circuit and explain to provide protection against electrical shock. 10 K3 CO3
34. (a) Outline the indirect method of blood pressure measurement. 10 K2 CO4
- OR**
- (b) Explain any two methods used to measure cardiac output. 10 K2 CO4
35. (a) Explain the operation of computer tomography by using the mathematical basis of image construction. 10 K2 CO5
- OR**
- (b) Summarize the working of Heart Lung Machine with a neat diagram. 10 K2 CO5
36. (a) i) Explain the working of Apnoea monitor with neat diagram. 5 K2 CO4  
Outline the working of any one pacemaker. 5 K2 CO5  
ii)
- OR**
- (b) i) Explain the circuit diagram for the computation of Bicarbonate  $\text{HCO}_3^-$  used in the blood gas analyser. 5 K2 CO4  
ii) Explain the working of hemodialysis. 5 K2 CO5