Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 120020

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS –NOV. / DEC. 2025
Fifth Semester
Computer Science and Engineering
U23BMOE1 – INTRODUCTION TO MEDICAL INSTRUMENTATION
(Common to ECE, BT, IT and CST)
(Regulation 2023)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define action potentials .	2	K2	CO1
2.	How is a high Common-Mode Rejection Ratio (CMRR) typically achieved in differential amplifiers used for bioelectric measurements?	2	K2	CO1
3.	Differentiate between active and passive transducers with suitable examples.	2	K2	CO2
4.	State the working principle of a piezoelectric transducer.	2	K1	CO2
5.	Define tidal volume in respiratory physiology.	2	K1	CO3
6.	State the principle of an electroenzymatic glucose sensor .	2	K2	CO3
7.	State the function of the standby mode in an electrocardiograph and its purpose.	2	K2	CO4
8.	Identify the purpose of the refractory period in a demand pacemaker.	2	K2	CO4
9.	Define leakage current and state the maximum allowable limit for patient-contact medical equipment.	2	K1	CO5
10.	Mention the most preferred method for testing the ground wire of medical equipment and its purpose.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Outline the characteristics and clinical relevance of the Electrocardiogram (ECG) and the Electroencephalogram (EEG). Compare the signal acquisition and processing requirements necessary for handling these two distinct types of bioelectric signals.	13	K2	CO1
		(OR)			
	b)	Explain the importance of signal processing and noise rejection in measuring low-level bioelectric signals. Describe key design requirements such as frequency range, safety, and accuracy, using the Electromyogram (EMG) as an example.	13	K2	CO1
12.	a)	Classify biomedical electrodes and outline their construction and applications. Discuss the importance of the electrode-skin interface and the performance standards required for clinical use.	13	K2	CO2
		(OR)			
	b)	Explain the design and working principles of any two specialized biomedical electrodes. Discuss the causes and effects of motion artifacts, and describe engineering methods used in modern electrode and amplifier systems to minimize artifacts and ensure patient safety.	13	K2	CO2
13.	a)	Explain the principle and working of the oscillometric method used in indirect blood pressure measurement.	13	K3	CO3
		(OR)			
	b)	Describe the principles of blood gas analysis, focusing on the measurement of PO_2 and PCO_2 using specialized electrodes. Explain the principle of oximetry and the significance of the isobestic point in multi-wavelength oximeter design.	13	K2	CO3
14.	a)	Explain the working principle of Computed Tomography (CT) and describe how it improves upon conventional X-ray imaging. Discuss the concepts of voxels, CT numbers, and how window level and window width affect image contrast.	13	K3	CO4
		(OR)			
	b)	State the need for cardiac pacemakers and summarize their main components and operational modes. Describe cardiac defibrillator waveforms, comparing monophasic and biphasic types, and note why biphasic is preferred.	13	K3	CO4

15.	a)	Explain the physiological effects and hazards of macroshock and microshock in clinical settings. Discuss patient vulnerability and describe two engineering measures used in medical device design to reduce electrical shock risks.	13	K4	CO5
		(OR)			
	b)	Examine the regulatory framework governing biomedical equipment, differentiating between mandatory and voluntary safety standards. Outline the essential maintenance and testing procedures required to ensure safe and effective operation, including ground circuit verification and defect management.	13	K4	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	Pulmonary Function Tests (PFTs) are essential for assessing the functional integrity of the respiratory system. Discuss the core principles and instrumentation used to evaluate both the mechanics of breathing and the gas exchange status, focusing on the techniques that yield quantifiable volume, flow, and saturation data.	15	K3	CO3
		(OR)			
	b)	Analyze how NMR signal generation and relaxation mechanisms contribute to image contrast in MRI. Evaluate the role of T_1 and T_2 relaxation times in differentiating tissues and discuss the clinical advantages of MRI over CT.	15	K4	CO4