



PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY/ JUNE 2025

Date: 02-06-2025

Time: 01:00 pm – 04:00 pm

School: SOE	Program: B. Tech-ECE/VLSI Design and Technology	
Course Code : ECE3034	Course Name : Biomedical Instrumentation	
Semester: IV	Max Marks: 100	Weightage: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	14	14	46	26	-

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.
- (iii) **Students should write the correct question number while answering.**

Part A

Answer ALL the Questions. Each question carries 2marks.

10Q x 2M=20M

1	Transducers are devices whose function is to convert physical signals to electric signals. List the active and passive transducers in biomedical instrumentation with examples.	2 Marks	L2	CO1
2	Biomedical transducers are transducers with specific uses in biomedical applications. Differentiate between analog and digital transducers.	2 Marks	L2	CO1
3	Name the apparatus that measures how much air you can breathe in and out of your lungs, as well as how easily and fast you can the blow the air out of your lungs.	2 Marks	L2	CO2
4	The sounds coming from the valves shutting on the blood inside the heart are lub and dub sounds. Name the diagnostic technique that creates a graphic record of the sounds and murmurs produced by the contracting heart, including its valves, and associated great vessels.	2 Marks	L2	CO2
5	In origin of bioelectric signals, Name the relation/ equation which gives the chemical potential gradient due to differing concentrations between the inside and outside of the cell.	2 Marks	L2	CO3
6	Bioelectric potentials generated in the body are ionic potentials produced by ionic current flow. Name the device that convert ionic potentials into electronic potentials.	2 Marks	L2	CO3
7	In brain waves, Which rhythm is the principal component of the EEG that indicates the alertness of the brain?	2 Marks	L2	CO3
8	In medical Recorders, name a medical device that monitors the foetal heart rate and uterine contractions during pregnancy and labor.	2 Marks	L2	CO4

9	A common medical device is used to measure the oxygen saturation level in a patient's blood. Name the method used in measurement of the degree of oxygen saturation of the blood.	2 Marks	L2	C04
10	Larmor Frequency refers to the frequency at which the magnetic moments of nuclei or electrons precess when placed in an external magnetic field. What would be the Larmor frequency of hydrogen nuclei in a 1.5 Tesla MRI scanner if γ for hydrogen is 42.58 MHz/T.	2 Marks	L2	C04

Part B

Answer the Questions

Total 80 Marks.

11.	a.	Inductive transducers are a type of transducers that operate on the principle of electromagnetic induction. Explain the operating principle of a Linear Variable Differential Transformer (LVDT) with the help of suitable diagrams. Illustrate how the displacement of the core affects the output voltage, and provide the equivalent circuit diagram to support your explanation.	10 Marks	L2	C01
	b.	Blood flow measurement is an essential aspect of monitoring cardiovascular health. Discuss the various techniques used for measuring blood flow in blood vessels. Provide a detailed explanation of the working principle of an electromagnetic flow meter, supported by a clear diagram to illustrate its operation.	10 Marks	L2	C02

or

12.	a.	In medical engineering, temperature sensors play a critical role in monitoring and maintaining the body temperature of patients. Describe the working principle of NTC and PTC thermistors. How do their resistance-temperature characteristics differ, and in what types of applications would each be used? A Thermistor exhibits a resistance of 10 k Ω at 25°C and 4 k Ω at 100°C. Using this data, calculate the β for the Thermistor. Explain the significance of the β in characterizing the thermistor's temperature response.	10 Marks	L3	C01
	b.	Blood cell counting refers to the process of counting the number of different types of blood cells in a blood sample. What is an Oximeter? A nurse measures the SpO ₂ of a patient every 30 minutes using a pulse oximeter. If the initial reading of the SpO ₂ was 92%, and the target is to bring it above 95% through oxygen therapy, calculate: If the SpO ₂ increases by 1% every 30 minutes, how long will it take for the patient to reach an SpO ₂ level of 95%? After the treatment, the SpO ₂ reaches 94% after 60 minutes. If the patient's oxygen level continues to improve at the same rate, how much time will it take to reach 95%?	10 Marks	L3	C02

13.	a.	Leads are the electrodes or sensor placements that help measure the electrical activity from different angles and views. Classify different types of Lead configurations in ECG.	20 Marks	L2	C03
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		In a certain measurement of ECG using bipolar electrodes, the following potentials were observed. The right arm = -0.2 mV The left arm = 0.3 mV The left leg = 1 mV Find the lead voltages developed. Verify Einthoven's Law.			
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or

14.	a.	Bio electric potentials are the electrical signals generated by living cells, tissues, or organs, as a result of the movement of ions across cell membranes. What is an Electrocardiograph?. Illustrate and explain the block diagram of an electrocardiograph.	20 Marks	L3	C03
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15.	a.	Diagnostic Radiology is a medical specialty that uses imaging techniques to create visual representations of the internal structures of the body. Illustrate the working of an X-ray machine with the help of a block diagram.	20 Marks	L3	C04
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Or

16.	a.	MRI uses strong magnetic fields and radio frequency waves to generate the images. Describe the working principle of a nuclear magnetic resonance imaging system and illustrate it with appropriate diagrams.	20 Marks	L3	C04
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17.	a.	Bio electric signals originate from the movement of ions across the cell membrane, leading to changes in the membrane potential. Explain the process of signal transmission in neurons. Describe the role of ion channels and the propagation of action potentials along the axon, including the concepts of depolarization, repolarization, and refractory periods.	20 Marks	L2	C03
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Or

18.	a.	An electroencephalogram (EEG) is a recording of brain activity. Explain how the 10-20 electrode system can be used for recording of EEG signal also with circuit diagrams illustrate different EEG montages.	20 Marks	L2	C03
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