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# PRESIDENCY UNIVERSITY

BENGALURU

## Make Up Examinations – December 2025

Date: 26 – 12- 2025

Time: 9:30am – 12:30pm

School : SOE	Program: B.Tech		
Course Code : ECE3034	Course Name : Biomedical Instrumentation		
Semester: MK	Max Marks: 100	Weightage: 50%	

CO - Levels	C01	C02	C03	C04	C05
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. Explain the classification of transducers into active and passive types. Provide at least three examples for each, specifically used in biomedical applications.	2 Marks	L2	C01
2	Biomedical transducers are transducers with specific uses in biomedical applications. Compare the working principles of analog and digital transducers. Illustrate their advantages and limitations with examples.	2 Marks	L2	C01
3	The sounds coming from the valves shutting on the blood inside the heart are lub and dub sounds. What is the diagnostic method that records and analyzes the sounds generated by the heart's contractions, including those from its valves and large blood vessels?	2 Marks	L2	C02
4	Identify the instrument designed to assess respiratory function by measuring airflow, lung volumes, and the speed of air expelled from the lungs.	2 Marks	L2	C02

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	C03
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	C03
7	In brain waves, Which rhythm is the principal component of the EEG that indicates the alertness of the brain?	2 Marks	L2	C03
8	In medical Recorders, name a medical device that monitors the foetal heart rate and uterine contractions during pregnancy and labor.	2 Marks	L2	C04
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 $\gamma$ 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. Describe the working principle of the Linear Variable Differential Transformer with appropriate diagrams and equivalent circuit diagram.	10 Marks	L2	C01
	b.	Blood flow measurement is an essential aspect of monitoring cardiovascular health. Summarize the different methods of flow monitoring techniques in flow meters. Explain the principle of an electromagnetic flow meter with the help of a neat diagram.	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. Explain the working principle of thermistors. Include the relationship between resistance and temperature.  A Thermistor exhibits a resistance of 10 k $\Omega$ at 25°C and 4 k $\Omega$ at 100°C. Using this data, calculate the $\beta$ for the Thermistor. Explain the significance of the $\beta$ in characterizing the thermistor's temperature response.	10 Marks	L3	C01
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	<p>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?</p> <p>A nurse measures the SpO<sub>2</sub> of a patient every 30 minutes using a pulse oximeter. If the initial reading of the SpO<sub>2</sub> was 92%, and the target is to bring it above 95% through oxygen therapy, calculate:</p> <p><b>b.</b> If the SpO<sub>2</sub> increases by 1% every 30 minutes, how long will it take for the patient to reach an SpO<sub>2</sub> level of 95%?</p> <p>After the treatment, the SpO<sub>2</sub> 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%?</p>	<b>10 Marks</b>	<b>L3</b>	<b>C02</b>
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<b>13.</b>	<p>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.</p> <p>In a certain measurement of ECG using bipolar electrodes, the following potentials were observed.</p> <p><b>a.</b> The right arm = -0.2 mV</p> <p>The left arm = 0.3 mV</p> <p>The left leg = 1 mV</p> <p>Find the lead voltages developed. Verify Einthoven's Law.</p>	<b>20 Marks</b>	<b>L2</b>	<b>C03</b>
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**or**

<b>14.</b>	<p><b>a.</b> 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, and Paraphrase how does it function to record the electrical activity of the heart?</p>	<b>20 Marks</b>	<b>L2</b>	<b>C03</b>
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<b>15.</b>	<p><b>a.</b> Diagnostic Radiology is a medical specialty that uses imaging techniques to create visual representations of the internal structures of the body. Illustrate the functioning of an X-ray machine, and illustrate its components with a block diagram.</p>	<b>20 Marks</b>	<b>L3</b>	<b>C04</b>
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**Or**

<b>16.</b>	<p><b>a.</b> MRI uses strong magnetic fields and radio frequency waves to generate the images. Illustrate the principle of nuclear magnetic imaging system with the help of appropriate illustrations.</p>	<b>20 Marks</b>	<b>L3</b>	<b>C04</b>
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<b>17.</b>	<p>Bio electric signals originate from the movement of ions across the cell membrane, leading to changes in the membrane potential.</p> <p>a. Explain the concept of resting membrane potential and the processes that contribute to its establishment. Discuss how changes in membrane potential lead to the generation of bio electric signals.</p>	<b>20 Marks</b>	<b>L2</b>	<b>C03</b>
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**Or**

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