U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

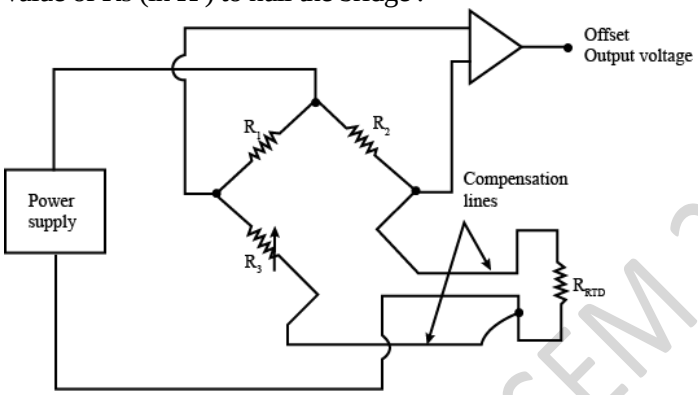
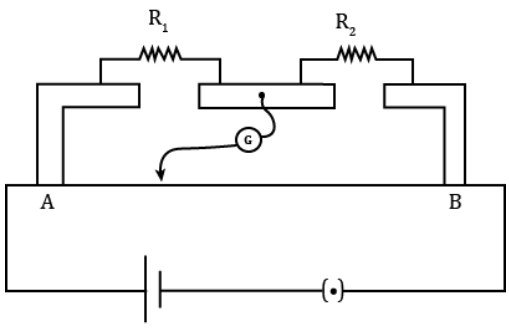
January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 22MD3PCBSM **Max Marks: 100**
Course: Biomedical Sensors and Measurements

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	Discuss the Classification of Instruments based on applications and explain the Performance Characteristics of measuring instruments.	CO2	PO2	**10**
	b)	Elaborate on Units of Measurement Quantities with reference to the Biomedical sensors.	CO2	PO2	**10**
		OR			
2	a)	Explain how measuring instruments are classified based on their application, giving an example for each type.	CO1	PO1	**08**
	b)	If a true value of 100 units is measured as 96 units by an instrument, determine its absolute and relative accuracies.	CO1	PO1	**04**
	c)	Discuss the step response of a First order measuring instrument.	CO1	PO1	**08**
		UNIT - II			
3	a)	Mention any one sensor to measure physiological pressure measurement and explain its working principle.	CO2	PO3	**10**
	b)	List the different Biomedical Signals with its Parameters, Typical ranges and Sensor types used to acquire them.	CO2	PO3	**10**
		OR			
4	a)	With examples, define to differentiate between (i) Mechanical and Electrical Sensors (ii) Active and Passive Sensors	CO1	PO1	**08**
	b)	Discuss the construction and working an LVDT for displacement measurement.	CO1	PO1	**08**
	c)	Two Strain gauges with GF1= 4.0 and GF2 = - 12.5 are subjected to a tensile strain of 10,000 microstrains. If their unstrained	CO3	PO3	**04**

			resistances are 360 Ω each, determine the changes in the resistances due to the applied strain.			
			UNIT - III			
	5	a)	With a diagram, explain the principle of RTD and mention its preferred application.	*CO3*	*PO3*	**07**
		b)	Mention a sensor for deep tissue temperature measurement with its working principle.	*CO3*	*PO3*	**07**
		c)	AD RTD has α_0=0.005(l/∘C), R=500Ω and a dissipation constant of P_D=30(mW/°C) at 20°C. The RTD is used in a bridge circuit as shown in figure 3C with R_1=R_2=500 Ω and R_3 a variable resistor used to null the bridge. If the supply is 10V and the RTD is placed in a bath at 0°c, find the value of R_3 (in Ω) to null the bridge .  Figure 3C	*CO3*	*PO3*	**06**
			OR			
	6	a)	Illustrate the application of Infrared radiation thermometers and its working principle.	*CO3*	*PO3*	**07**
		b)	At what conditions and situations Thermocouples and p-n junction diodes are preferred for temperature measurements?	*CO3*	*PO3*	**07**
		c)	In the experimental setup of metre bridge shown in the figure 4c, the null point is obtained at a distance of 40 cm from A. If a 10 Ω resistor is connected in series with R1 Ω, the null point is observed to shift by 10 cm from A. Find the resistance that should be connected in parallel with (R1+10) Ω such that the null point shifts back to its initial position  Figure 4c	*CO3*	*PO3*	**06**

			UNIT - IV			
	7	a)	With relevant diagram Illustrate generation of the action potential.	*CO3*	*PO3*	**10**
		b)	Discuss the different types of ECG Electrodes used to acquire ECG signal.	*CO3*	*PO3*	**10**
			OR			
	8	a)	Explain the EEG electrodes for acquiring EEG signal.	*CO3*	*PO3*	**10**
		b)	Illustrate the working principle of Fluxgate Magnetometer and mention its types.	*CO3*	*PO3*	**10**
			UNIT - V			
	9	a)	Mention the application of CO2 electrode and Zirconia oxygen sensor with its working principle.	*CO3*	*PO3*	**10**
		b)	"Under what conditions Immunosensors, and DNA sensors are preferred". Justify with examples.	*CO3*	*PO3*	**10**
			OR			
	10	a)	Discuss the construction and principle of an Ion-selective FET.	*CO2*	*PO2*	**08**
		b)	Explain the principle of a Zirconia Oxygen sensor.	*CO2*	*PO2*	**08**
		c)	Define a Biosensor with an example application.	*CO2*	*PO2*	**04**

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