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: EIE   **Duration: 3 hrs.**
Course Code: 22EI3PCSMT   **Max Marks: 100**
Course: Sensors and Measurements Techniques

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

<div style="margin-left:2em">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.</div>
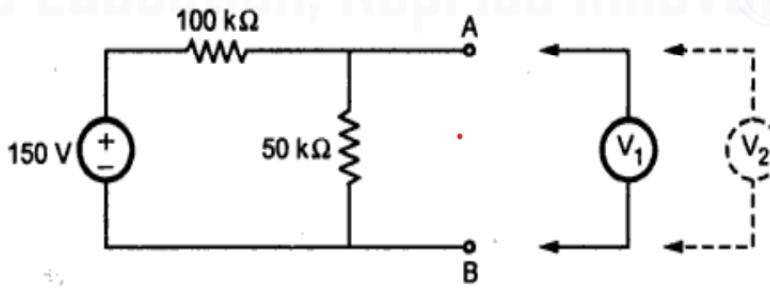
			UNIT - I	CO	PO	Marks
1	a)		What is a measurement system? Differentiate direct and indirect type of sensing in measurement systems.	CO1	PO1	**06**
	b)		A velocity measuring instrument has a faulty zero marking of by +0.02 m/s, and it is used to measure very small displacements. Identify the type of error in this measurement also discuss about other type of possible errors in measurement.	CO1	PO1	**06**
	c)		The Fig 1C shows circuit diagram for measurement of Voltage. Determine the voltage reading expected on the voltmeter V1, if the voltmeter sensitivity is 1kΩ/volt. If the voltmeter V1 is replaced by another voltmeter V2, having sensitivity 25kΩ/volt, find the new reading on V2. Write the inference. Fig 1C	CO1	PO1	**08**
			OR			
2	a)		Discuss the key benefits of electronic instrumentation compared to traditional mechanical and electrical methods.	CO1	PO1	**10**
	b)		What are the various sources of error in measurement, and how can these errors be categorized and distinguished?	CO1	PO1	**10**
			UNIT – II			
3	a)		How the principle of capacitance be applied for water level sensing? Explain the related concept and obtain the expression	CO2	PO2	**06**

				CO	PO	
			for sensor capacitance with relevant sketches			
		b)	Derive the voltage developed between electrodes in piezoelectric sensor formed by applying electrodes to a polled crystalline material. Explain the thermal polling of a piezoelectric material	CO3	PO2	08
		c)	Explain Hall Effect sensing mechanism used for detecting position and displacement of objects	CO4	PO4	06
			OR			
4		a)	Define mono-axial acceleration. Discuss the principle of measurement of mono-axial acceleration, based on the mechanical model of the Seismic mass, using the free-body diagram and relevant derivations	CO2	PO2	10
		b)	With the help of a neat diagram, explain how displacement is measured using an LVDT, mention its advantages and applications	CO4	PO4	10
			UNIT - III			
5		a)	Analyze a suitable sensor required for Direct acoustic measurements in hostile environments, such as rocket engines, which can withstand high heat and strong vibrations	CO4	PO4	08
		b)	Explain the working of Chilled-mirror dew-point sensor with an optical bridge and also mention its application.	CO3	PO2	08
		c)	Analyze the effects of Relative Humidity on electronic components. If the actual vapor density is 10 g/m3 at 20°C compared to the saturation vapor density at that temperature of 17.3 g/m3, calculate its Relative Humidity	CO4	PO4	04
			OR			
6		a)	Describe the absolute humidity sensor with self-heating thermistors.	CO2	PO2	06
		b)	Narrate the working principle of Radiation Ionization detector, mention its advantages and application	CO2	PO2	08
		c)	Show that Photo Diode and a Detector combination can be applied in a digital encoder	CO4	PO4	06
			UNIT – IV			
7		a)	Calculate the constant, beta value, of a Thermistor for temperature changing from 100°c to 50°c and resistances at T1 and T2 are 4700 Ω and 1000 Ω respectively.	CO3	PO2	04
		b)	Differentiate RTD, Thermistor from Thermocouple. Describe the selection criteria to use these transducers for applying them for temperature measurement	CO3	PO2	08
		c)	Describe the static and dynamic heat exchange in a temperature sensor with relevant diagrams and expressions	CO2	PO2	08

			OR			
8	a)	What are pyroelectric effect and explain how it is employed in temperature sensing.	*CO2*	*PO2*	**10**
	b)	Explain the laws of thermocouples that establish the fundamental rules for proper connection of the thermocouples.	*CO2*	*PO2*	**10**
			UNIT – V			
9	a)	With suitable example and circuit diagram explain the characteristics of signal conditioning unit with relevant expressions.	*CO5*	*PO4*	**10**
	b)	With circuit diagram describe the working of charge and current to voltage converters, justify why conversion of current to voltage is required in sensor-interface electronic unit.	*CO5*	*PO4*	**10**
			OR			
10	a)	Describe the four-wire resistance measurement technique and explain how it overcomes the challenges associated with measuring the resistance of a remote sensor when the connecting wires exhibit significant resistance.	*CO5*	*PO1*	**06**
	b)	Critically analyse the limitations of the driven shield method and propose potential improvements in reducing leakage current.	*CO5*	*PO1*	**06**
	c)	Analyze the impact of noise and interference on an interface circuit and propose the need between a sensor and a processing device?	*CO5*	*PO1*	**08**

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