Roll No.											

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 10- 12- 2025 **Time:** 1.00pm to 04.00pm

School: SOE	**Program:** B. Tech	
Course Code: EEE3046	**Course Name:** Sensors and Transducers	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**26**	**14**	**32**	**12**	**16**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Compare the performance of thermocouple and RTD sensors for temperature monitoring in milk tanks.	**2 Marks**	**L2**	**CO3**
2.	Identify two applications of optical sensors.	**2 Marks**	**L1**	**CO2**
3.	Analyze the impact of environmental vibrations on transducer readings in an industrial conveyor system. Suggest some mitigation methods.	**2 Marks**	**L1**	**CO1**
4.	Explain how a pressure gauge works in a milk storage tank.	**2 Marks**	**L1**	**CO1**
5.	List four types of sensors that can be used for detecting liquid level in industrial tanks.	**2 Marks**	**L1**	**CO4**
6.	Analyze the limitations of smoke sensors in high-humidity environments and suggest some mitigation measures.	**2 Marks**	**L2**	**CO5**
7.	Explain how smoke reduces the ionization current in an ionization smoke detector.	**2 Marks**	**L1**	**CO5**
8.	Name two types of gauges used in industrial monitoring.	**2 Marks**	**L1**	**CO1**
9.	There are some potential errors in a photoelectric sensing system caused by ambient light. Propose some solutions.	**2 Marks**	**L1**	**CO2**
10.	List two medical sensors used to monitor patient health.	**2 Marks**	**L1**	**CO5**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	An RTD has $R_0 = 100\ \Omega$ at 0°C and temperature coefficient $\alpha = 0.00385/°C$. Calculate its resistance at 75°C.	**5 Marks**	**L3**	**CO3**
	b.	Explain the working principle of a thermocouple.	**2 Marks**	**L2**	**CO3**
	c.	Describe the principle of operation of RTD. How it differs from a thermistor?	**3 Marks**	**L1**	**CO3**
		Or			
12.	**a.**	Differentiate between a thermistor and a bolometer.	**3 Marks**	**L2**	**CO3**
	b.	List two applications of a bolometer.	**2 Marks**	**L1**	**CO3**
	c.	If the bolometer's resistance changes by 0.5 Ω per °C, calculate the temperature change if the resistance increases from 100 Ω to 125 Ω.	**5 Marks**	**L3**	**CO3**

13.	**a.**	Define a fiber optic sensor and its key components.	**3 Marks**	**L1**	**CO2**
	b.	In a milk industry, a fiber optic sensor has input power of 2 mW. If 20% of light is reflected due to milk presence, calculate the reflected power.	**5 Marks**	**L3**	**CO2**
	c.	Compare intrinsic vs extrinsic fiber optic sensors for liquid level detection.	**2 Marks**	**L1**	**CO2**
		Or			
14.	**a.**	Describe how ambient light interference affects photoelectric sensor performance in stainless-steel environments.	**2 Marks**	**L2**	**CO2**
	b.	A photoelectric sensor produces 8 mA in light state and 1 mA in dark state. Calculate the percentage drop in current when the beam is blocked.	**4 Marks**	**L3**	**CO2**
	c.	An LDR has: 1. 5 kΩ resistance in bright light, 2. 50 kΩ resistance in darkness. If it is placed in a 5 V voltage divider with a 10 kΩ resistor on top (LDR at bottom), calculate the output voltage in bright light.	**4 Marks**	**L3**	**CO2**

15.	**a.**	Explain how an inductive proximity sensor detects metallic objects.	**3 Marks**	**L1**	**CO4**
	b.	A conveyor moves at 0.5 m/s. The sensor detects bottles with a detection range of 0.1 m. Calculate the minimum response time needed.	**5 Marks**	**L3**	**CO4**
	c.	How does viscosity affect the readings of flow sensor?	**2 Marks**	**L2**	**CO4**

Or					
16.	**a.**	Compare the performance of Coriolis and thermal mass flow sensors for milk pipelines by considering accuracy, maintenance, and temperature effects.	**4 Marks**	**L1**	**CO 4**
	b.	Explain how ultrasonic sensors measure distance using echo time.	**4 Marks**	**L1**	**CO4**
	c.	Mention two industrial applications of ultrasonic sensors.	**2 Marks**	**L1**	**CO4**

17.	**a.**	Mention two key components of an ionization smoke detector.	**2 Marks**	**L1**	**CO5**
	b.	Describe the role of signal conditioning in converting sensor current to a readable voltage.	**3 Marks**	**L2**	**CO5**
	c.	If the initial ionization current is 2 nA and drops to 1.2 nA, calculate the percentage reduction.	**5 Marks**	**L3**	**CO5**
Or					
18.	**a.**	Compare the performance of ionization and photoelectric smoke detectors for detecting fires in a dusty dairy warehouse.	**2 Marks**	**L4**	**CO5**
	b.	If the threshold voltage of a smoke detector's alarm is 8 mV, at what amplifier gain should the alarm trigger for a 0.5 nA current drop?	**5 Marks**	**L3**	**CO5**
	c.	Explain why a low-pass filter is often included in the signal conditioning circuit of an ionization smoke detector.	**3 Marks**	**L2**	**CO5**

19.	**a.**	A yogurt manufacturing plant uses fermentation tanks where milk is incubated at 42°C for 6–8 hours to allow bacterial culture growth. List five temperature sensors suitable for this fermentation tanks.	**5 Marks**	**L3**	**CO3**
	b.	Explain why precise temperature control is crucial for yogurt fermentation.	**10 Marks**	**L2**	**CO3**
	c.	If the tank temperature rises to 46°C, which sensor would detect this first? Explain with proper reasoning.	**5 Marks**	**L4**	**CO3**
Or					
20.	**a.**	A chemical processing plant uses a bolometer to detect infrared radiation emitted from heated equipment to monitor overheating and prevent accidents. The bolometer has a resistive sensing element whose resistance changes with temperature. The plant wants to calibrate it to measure temperatures accurately between 25°C and 200°C. Name the main components of a bolometer that can sense this radiation.	**10 Marks**	**L1**	**CO3**

	b.	Describe the effect of ambient temperature on bolometer readings.	**5 Marks**	**L1**	**CO3**
	c.	Explain why bolometers are more suitable for detecting infrared radiation rather than visible light.	**5 Marks**	**L2**	**CO3**

21.	**a.**	A strain gauge has gauge factor of 2 and measures strain of $\mathbf{0.001}$. Calculate the fractional change in resistance.	**6 Marks**	**L3**	**CO1**
	b.	Describe how a capacitive solid-state displacement sensor works.	**4 Marks**	**L2**	**CO1**
	c.	Analyze the factors causing nonlinearity in LVDT readings and propose the calibration methods.	**10 Marks**	**L4**	**CO1**
		Or			
22.	**a.**	A piezoresistive pressure transducer has sensitivity 5 mV/kPa. If the applied pressure is 120 kPa, calculate the output voltage.	**10 Marks**	**L3**	**CO1**
	b.	Compare piezoelectric vs piezoresistive transducers for vibration detection.	**5 Marks**	**L1**	**CO1**
	c.	Explain how LVDTs provide contactless displacement measurement.	**5 Marks**	**L2**	**CO1**