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Mid Term Examinations - October 2026

Date: 07/10/2026 **Time:** 11:45 AM - 01:15 PM

Course Code: EEE3104 **Course Name:** Smart Sensors for Engineering Applications

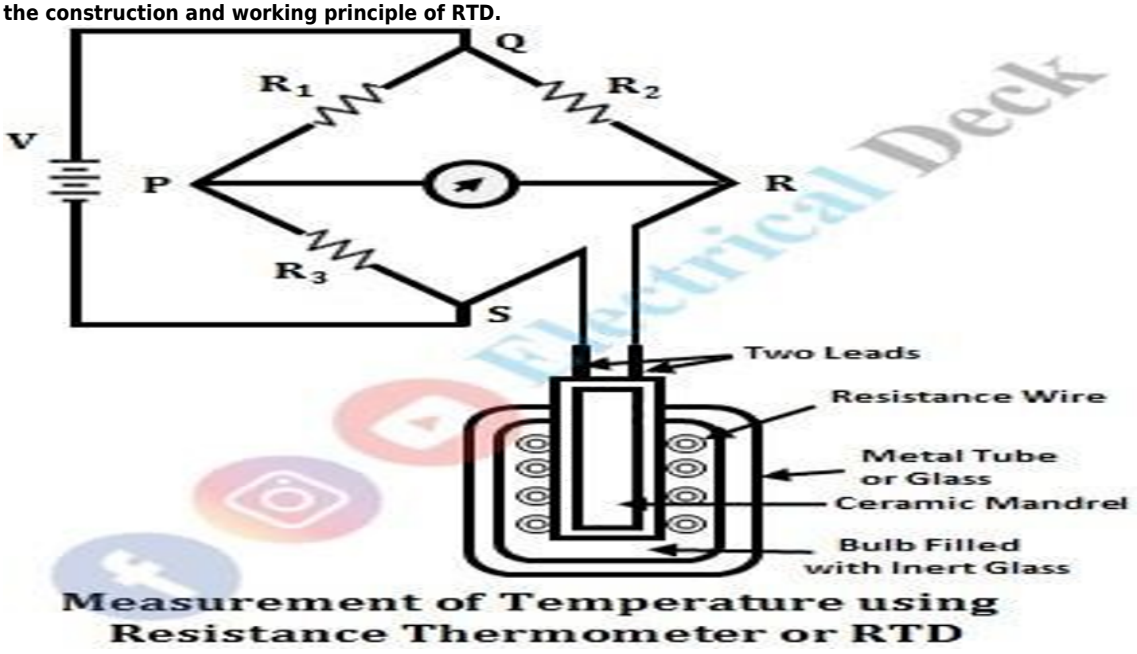
Semester: Seventh Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2
Marks	44	46

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	**Explain the working principle of Resistive Transducer**	2	CO1	BT2
2	**A piezoelectric crystal has a thickness of 2 mm and a voltage sensitivity (g) of 0.055 V·m/N. It is subjected to a uniform pressure of 3 MN/m². Calculate the output voltage generated.**	2	CO1	BT3
3	Define the terms accuracy and precision	2	CO2	BT1
4	List various types of motion sensors used in the industry	2	CO2	BT1
5	List different types of proximity sensors used for object detection	2	CO2	BT1

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	**In pharmaceutical or chemical process reactors, maintaining exothermic reaction temperatures within a narrow band (e.g.,) is critical to prevent product degradation or thermal runaway. A 3-wire Pt100 RTD is inserted into a protective thermowell inside the vessel. With neat sketch explain the construction and working principle of RTD.** 	10	CO1	BT2
7	**An LVDT (Linear Variable Differential Transformer) is used as a displacement transducer in an industrial automated manufacturing system to measure the linear position of a moving machine component. With the help of a neat labelled sketch: Explain the construction and working principle of an LVDT**	10	CO1	BT2

PART C: Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT

PTO (Please Turn Over)

8	**A linear resistance potentiometer is used as a position transducer in an industrial robotic arm to measure the linear displacement of a moving component. The potentiometer is 50 mm long and is uniformly wound with a wire having a total resistance of 10Kohm . The resistance corresponding to the displacement is measured using a Wheatstone bridge.** **a) Determine the linear displacement of the robotic arm for resistance values of and .** **b) If the minimum resistance change that can be measured using the arrangement is , determine the resolution of the position transducer.** **c) Mention two other industrial applications of linear potentiometers as displacement transducers.**	10	CO1	BT3
9	**A piezoelectric crystal with dimensions of 10 and a voltage sensitivity of is used in an industrial force sensor for monitoring the force applied to a machine component. If the voltage developed across the crystal is 2 , calculate the force applied to the sensor. Mention the industrial applications of piezoelectric force transducers.** **The force applied to a piezoelectric sensor is calculated by rearranging the piezoelectric voltage output equation:**	10	CO1	BT3

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	Selecting the right sensor depends on balancing technical performance with the practical constraints of your application. Explain the five main categories of selection criteria of sensors.	10	CO2	BT3
11	In an automated manufacturing plant, a robotic arm must identify the presence of metallic workpieces before performing an operation. Suggest an appropriate sensor and explain its working principle and suitability.	10	CO2	BT2

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	An Autonomous Emergency Braking (AEB) system has to detect pedestrians and obstacles under different atmospheric conditions. Apply suitable light-based, proximity, and motion-sensing technologies and explain how sensor selection can be made based on detection range, response time, and environmental conditions.	10	CO2	BT3
13	An automated warehouse uses conveyor belts, robotic arms, and pneumatic actuators for material handling. Apply suitable sensors for object detection, position detection, actuator monitoring, and motion detection. Explain the working principle and role of each selected sensor.	10	CO2	BT3