VIT

Vellore Institute of Technology

REG.NO.:

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - I
WINTER SEMESTER 2024-2025

SLOT: B1+TB1

Programme Name & Branch	**: B.Tech (CSE & Specializations)**
Course Code and Course Name	**: BCSE311L and Sensors and Actuator Devices**
Faculty Name(s)	**: Common for all**
Class Number(s)	**: Common for all**
Date of Examination	**: 28.01.2025**
Exam Duration	**: 90 minutes**

Maximum Marks: 50

General instruction(s):

- Answer **All** Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- **CO1**: Classify different Sensors & Actuators based on various physical phenomena and differentiate their performance characteristics.
- **CO2.** Analyze the working principles of thermal, optical & electric sensors and actuators to interpret their mathematical model.

Q. No	Question	M	CO	BL
1.	**Investigate** the following terms precisely based on given criteria:- ➢ Vision ➢ Touch **Given Criteria:** ★ What ★ Why ★ How ★ Where ★ When Based on your investigation, analyze whether the loss of vision or touch would create more challenges and issues. Provide enough justifications with real life scenarios. **Note:** - You should narrate complete investigation as well as suitable real-life sub-scenarios for vision & touch in your answer.	10	CO 1	BL 3
2.	**Elucidate using a real life scenario how calibration and reliability plays a major role in choosing sensors for any critical application.** **A temperature sensor** is calibrated using a reference temperature of 150°C. During the calibration, the sensor gives a reading of 154°C. The sensor has a **measurement range of 0°C to 240°C** with a specified **accuracy of ±2°C** and a **drift rate** of **0.6% per year and is cumulative every year.** ✓ What is the **calibration error** in terms of **percentage error** relative to the reference temperature? ✓ Calculate the **reliability** of the sensor after 12 years, considering the drift rate. ✓ Compute the sensor's output if the actual temperature is 160°C for year 3, 6, 9, 12, 15. ✓ Plot a graph for year vs sensor output and state your observations. Suggest remedies to reduce calibration errors.	10	CO1	BL 2

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3.	**Explain** the effect of sensor non-linearity on the accuracy and reliability of measurements. How does non-linearity impact systems that require precise control, such as industrial automation or temperature monitoring? Discuss methods to compensate for non-linearity and improve sensor performance.	10	CO1	BL 2
4.	**Provide** a in-depth analysis with detailed explanation for the following sensors by applying the given terms:- • Optical thermo-mechanical Sensors • Acoustical thermo-mechanical Sensors Given terms: ➢ Sensitivity and Accuracy ➢ Speed of Response ➢ Environmental Effects ➢ Energy Efficiency ➢ Application selectivity **Design and develop** a data acquisition system using your analysis as per the guidelines:- ✓ Scenario – post earthquake ✓ Need to schedule unmanned rescue cart ✓ Highest priority for rescuing live people trapped inside the collapsed structures **Note: - You must provide appropriate illustrations, sensors and actuator selection as well as relevant validations in your answer.**	10	CO2	BL 3
5.	A spool of magnet wire (copper wire insulated with a thin layer of polyurethane) contains **400 m** of wire with a diameter of **0.2 mm**. It is proposed to use the spool as a temperature sensor to sense the temperature in a freezer. The proposed range is between- **50°C and +15° C**. A milliammeter is used to display the temperature by connecting the sensor directly to a **1.2 V** battery and measuring the current through it. [**conductivity as** $\sigma_{0=} 5.8 \times 10^7$ **S/m at 20° C** $TCR\ of\ copper\ \alpha = 0.0039$] • Calculate the resistance of the sensor and the corresponding currents at the minimum and maximum temperatures. • Calculate the maximum power the sensor dissipates. • Discuss various factors that influence the response time of a Resistance Temperature Detector (RTD).	10	CO2	BL 2

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