

**VIT**

Vellore Institute of Technology

(Approved by the Government of India, New Delhi, India)

**Continuous Assessment Test-1****Program Name & Branch: B. Tech-ECE(IoT)****Course Name & Code : ECE2023 Principles of Sensors and Data Acquisition****Class Number:** VL2019201003647**Slot:** B1/TB1**Exam Duration:** 1½ Hrs. **Max. Marks:** 50**Answer all Questions**

- 1.a) A linear force transducer has an output of 20mV when measuring 100 N and has an output of 100 mV when measuring 300 N. Find the zero offset in mV? (zero offset is the output voltage for zero input force) 4
- b) Following are the specifications of a displacement sensor: 6  
Measurement range:  $\pm 10$  mm, output range: 4 – 20 mA, accuracy:  $\pm 0.5\%$  FS, Resolution: 3  $\mu$ m.  
Find the (i) sensitivity in mA/mm (ii) error in the measurement when subjected to 5 mm displacement. (iii) Smallest change in the output current that can be produced during measurement.
- c) A temperature sensor having a time constant of 2.5 sec and static sensitivity of 0.05mV/°C is used to measure the temperature of a medium which changes from 20°C to 60°C (step change). Find the temperature indicated at 1.5 sec. Taking sensor output as zero at 20°C find the voltage indicated at 1.5sec. 7
- 2.a) A resistance strain gauge with  $R=160\ \Omega$  and gauge factor 2.25 is placed in an equal arm bridge in which all resistances are equal to 160 $\Omega$ . The bridge supply voltage is 6V. Calculate the voltage indication for a strain of 1 $\mu$ m/m when a high impedance detector is used for the 1 variable arm and 4 variable arms arrangements. 8
- b) In strain gauge based measurements ideally we would like the resistance of strain gauge to change only in response to applied strain. However, strain gage material also responds to changes in temperature causing error in the strain measurement. Discuss how the temperature effects can be minimized using Wheatstone bridge. 7
3. Show how a capacitive sensor could be used to measure displacement. Your solution should include the explanation of the physical principles and a diagram showing the measurement system and its dimensions. The solution should also include the calculation of nominal capacitance (capacitance when displacement is zero) and how the capacitance would vary with displacement. 8
4. i) List the materials commonly used for RTDs. Which one has the most linear characteristics? 6  
ii) If the resistance temperature coefficient of RTD is 0.004/°C at 20°C and  $R=106\ \Omega$  at 20°C, find the resistance at 25°C.  
iii) A thermistor is more suitable for measurement of temperature within a small range. Justify.
5. Devise a method to measure the position of an object using variable reluctance. 4



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