

[This question paper contains 2 printed pages.]

Sr. No. of Question Paper : 2057

Your Roll No.....

Name of the Course : B. Sc.(H) Instrumentation (CORE)

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Name of the Paper : Sensors and Actuators

Unique Paper Code : 2512041202

Semester : II

Duration : 2 hour

Maximum Marks : 60

Instructions for Candidates

- **Question No. 1 is compulsory.**
- **Attempt Five questions in all.**
- **All Questions carry equal marks.**

Q.1 (a) What are primary and secondary transducers. Give examples for each. (3)

(b) A platinum thermometer has a resistance of 100Ω at 25°C . (3)

i) Find the resistance at 65°C if the platinum has a resistance temperature co-efficient of $0.00392/^\circ\text{C}$.

ii) If the thermometer has a resistance of 150Ω , calculate the temperature.

(c) Differentiate between active and passive transducers. Give examples for each. (3)

(d) Define electrical actuator and classify different types based on their motion. (3)

Q.2 (a) Explain the working principle of piezoelectric transducer with suitable diagram. Discuss why piezoelectric transducers are not suitable for static measurements? (6)

(b) A compressive force is applied to a structural member. The strain is 5micro-strain . Two separate strain gauges are attached to the structural member, one is a nickel wire strain gauge having gauge factor of “-12.” and the other is nichrome wire strain gauge having a gauge factor of 2. Calculate the value of both the strain gauges after they are strained. The resistance of strain gauges before being strained is 120Ω . (Also, $1\text{micro-strain} = 1\mu\text{m/m}$) (6)

- Q3. (a) Discuss the significance of Reynolds Number (Re) in flow sensing. (6)
Why do many flow sensors require a specific length of straight pipe before and after the sensor installation?
- (b) A capacitive displacement sensor consists of two parallel plates in the air ($\epsilon_r \approx 1.0$). Each plate has an area of 0.0001m^2 . Initially, the plates are separated by a distance of 1mm. If the top plate moves closer, reducing the distance to 0.5mm, calculate the change in capacitance (ΔC). Also, does the sensor become more or less sensitive as the plates get closer together? (6)
- Q4. (a) Discuss the methods of speed control in a dc motor. (6)
- (b) List any three applications of stepper motor in automation systems. (6)
A stepper motor with step angle of 0.9° is receiving a pulse frequency of 2kHz. What is its speed in RPM?
- Q5. (a) Explain the following; (6)
i) Inverse piezoelectric effect
ii) Why does electrostatic force become more dominant than electromagnetic force as device dimensions shrink to micro-meter scale.
- (b) List and explain all the selection criteria while selecting a sensor. (6)
- Q6. (a) What are the various materials used for modern sensors. Why is Silicon the 'gold standard' for sensors. Comment. (6)
- (b) Explain Chemical Vapor Deposition (CVD) technique with the help of a diagram. (6)
- Q7. (a) Write short notes on any two; (12)
i) LVDT
ii) Thermocouple
iii) Proximity sensor