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Paper Code : OE- EEE-801D/OE-EE 801D Sensors and Transducers

UPID : 008286

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following : [1 x 10 = 10]

(I) The thermocouple is based on the principle of
a. Faraday's law b. Lenz's law c. Seeback effect d. Gauss Law

(II) Which one is the application of sensor?
A. Home appliances B. Automobiles C. Manufacturing D. All the above

(III) The smallest change in input that a transducer can sense is known as
a) sensitivity b) resolution c) precision d) accuracy.

(IV) Gauge factor of a strain gauge indicates its
a) accuracy b) sensitivity c) dead zone d) none of these.

(V) The principle of operation of LVDT is based on
a) self inductance b) mutual inductance c) reluctance d) permeance

(VI) Pressure measurement devices make use of _____
a) non-elastic member b) elastic member c) bendable member d) non-bendable member

(VII) Dummy strain gauges are used for
a. calibration of strain gauges b. compensation of temperature variations
c. increasing bridge sensitivity d. all of the above

(VIII) What is the use of the LDR Sensor?
a) Monitors Motion b) Monitors air pressure c) Monitors Light Intensity d) Monitors heartbeat

(IX) In Hall Effect sensor, the magnitude of the voltage generated depends on the _
A. Strength of the magnetic field B. Strength of the current C. Property of the conductor D. All the above

(X) A thermocouple temperature indicator with reference junction at room temperature has a time constant 1s. It is dipped in a hot bath 120°C. If the room temperature is 20°C, after 1s. the thermocouple type temperature indicator will read
a. 63.2°C b. 100°C c. 140°C d. 120°C

(XI) Poisson's ratio for a metal is 0.35 Neglecting piezo-resistance effect, the gauge factor of a strain gauge made of this metal is
A) 0.65 B) 1 C) 1.35 D) 1.70

(XII) If linear variable differential transformers (LVDTs) are mounted at x =1/2m and x =1/4m on the cantilever to measure the effect of time varying forces, the ratio of their output is
A) 12/7 B) 40/11 C) 176/23 D) 112/15

Group-B (Short Answer Type Question)

Answer any three of the following : [5 x 3 = 15]

2. Discuss briefly the use of platinum in metal resistance thermometric sensor. [5]
3. Explain the working principle of L.D.R. What is photo-multiplier ? [5]
4. What are primary & secondary signals in sensor or transducer classification? Give examples. [5]
5. What are the different materials used in the resistance non- wire wound potentiometer ? What are the relations between linearity and sensitivity of a potentiometer ? [5]
6. Derive the expression of gauge factor of a strain gauge. [5]

Group-C (Long Answer Type Question)

Answer any three of the following : [15 x 3 = 45]

7. (a) Explain the principle of sensors & transducers. [5]
   (b) Classify sensors based on different criteria. [5]
   (c) [5]

What do you mean by the terms: “Accuracy”, “Precision” and “Resolution” in case of sensors having static characteristics?

8. (a) Explain the working principle of LVDT and how the magnitude and direction of the displacement of core of an LVDT detected ? [8]
   (b) Derive the expression of error for resistive potentiometer when connected across a load of finite resistance. [5]
   (c) Why the sensitivity and linearity are two conflicting requirements in a resistive potentiometer. [2]
9. (a) Describe how the error due to temperature is compensated in a strain gauge by using a dummy strain gauge. [5]
   (b) Describe the principle of operation of strain gauges for measurement of strain. [5]
   (c) What are the materials of thermo emf sensors? What is longitudinal piezoresistance co-efficient in connection with strain gauge? [5]
10. (a) How is optical fibre used for stress sensing? Discuss operation of microbend sensor. [5]
   (b) What is standard hydrogen electrode utility in instrumental analysis? What is junction potential? [5]
   (c) What are PZT and PLZT? Why are they gaining importance in sensor technology? [5]
11. (a) What are the different types of capacitive sensors used for displacement measurement? How do they differ in operating principles? [8]
   (b) Does the sensitivity of an inductive transducer vary? If yes how does it vary? [7]

*** END OF PAPER ***