Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EIE-OLD)/SEM-4/EI-402/2012

2012

SENSOR & TRANSDUCERS

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Which one is not a transducer ?

a) RTD b) Thermistor

c) Thermocouple d) Cinical Thermometer.

ii) Which one is an active transducer ?

a) PZT b) Potentiometer

c) LVDT d) RTD.

iii) Magnetostriction property is noticed in

a) Copper b) Nickel

c) Iron d) Alluminium.

iv) Poison's ratio is defined as

a) stress/strain

b) lateral strain / longitudinal strain

c) lateral strain / longitudinal stress

d) Lateral stress longitudinal strain.

v) Proximity sensor is used to measure

a) speed of object

b) instantaneous closeness of object

c) frequency of movement of object

d) none of these.

vi) A poteniometer will be loading free if

a) $R_p / R_m = 1$ b) $R_p / R_m > 1$

c) $R_p / R_m < 0{\cdot}1$ d) none of these.

where R_p & R_m are resistance of potentiometer and voltmeter.

vii) Sensitivity of a resistive strain guage in full bridge configuration is

a) $G_f E_i$ b) $\frac{G_f E_i}{2}$

c) $\frac{G_f E_i}{4}$ d) $\frac{G_f E_i}{8}$,

where E_i is supply voltage and G_f is gauge factor.

viii) Rosette is a bunch of

a) RTD b) LVDT

c) Strain Gauge d) LDR.

ix) Negative temperature co-efficient of resistance is noticed in

a) RTD b) Thermocouple

c) Thermistor d) All of these.

x) Which one can be used as digital transducer ?

a) LDR b) LVDT

c) Tachometer d) Potentiometer.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain the loading effect of a resistive potentiometer. How can you make it free from loading error ? 4 + 1

3. What are positive and negative magnetostriction ? Explain with diagram. Mention the materials. 2 + 2 + 1

4. Derive an expression to relate between gauge factor and strain for a resistive strain gauge.

5. Explain with neat diagram the ferromagnetic plunger type inductive sensor.

6. What is a load cell ? Which parameter can be measured with it ? Explain the working principle. 1 + 1 + 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Explain thomson effect.
   b) Explain the basic principle of thermocouple.
   c) A copper-constantan thermocouple was found to have linear calibration between 0°C and 400°C with *emf* at max. temperature being equal to 20 mV. Determine the correction required to indicate *emf* if the cold junction temperature is 20°C. Also determine the temperature of hot junction if indicated *emf* is 8·90 mV. 4 + 5 + 6

8. a) Explain the working principle of LVDT with neat diagram.
   b) Write three advantages and three disadvantags of LVDT.
   c) The O/P of an LVDT is measured with a 5V voltmeter with resolution 1 mV. An output of 2 mV appears accross the terminal when 0·5 mm displacement occurred. Find the resolution of LVDT. Also find the O/P for displacement 1 cm. 6 + 6 + 3

9. a) Explain the basic principle of RTD.
   b) Also describe the lead compensation technique with proper diagram.
   c) A platinum RTD is used to measure temperature between 0° to 200°.
   R_0 = 100 Ω, R_{100} = 138·5 Ω, R_{200} = 175·83 Ω.
   Find non-linearity at 100°C as % FSD. 6 + 4 + 5

10. Write short notes on the following : 3 × 5
   a) LDR
   b) Total radiation pyrometer
   c) Hall effect sensor.