Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (ICE-NEW)/SEM-4/EI(IC)-401/2013

2013

SENSORS AND 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 any *ten* of the following : $10 \times 1 = 10$

   i) Which of the following is a passive transducer ?

      a) Photovoltaic cell

      b) LVDT

      c) Piezoelectric transducer

      d) None of these.

   ii) A Hall effect transducer can be used to measure

      a) power b) current

      c) displacement d) all of these.

iii) Seismic transducer is used for measurement of

a) linear velocity b) angular velocity

c) acceleration d) pressure.

iv) LVDT is a

a) capacitive transducer

b) resistive transducer

c) inductive transducer

d) none of these.

v) Piezoelectric crystals produce an *emf*

a) when external mechanical force is applied

b) when external magnetic field is applied

c) when radiant energy simulated the crystal

d) none of these.

vi) Dummy strain gauge are used for

a) calibration of strain gauge

b) compensation of temperature variation

c) increase bridge sensitivity

d) all of these.

vii) Small linear displacement may be measured by

a) Capacitive level gauge

b) LVDT

c) RVDT

d) None of these.

viii) The material which shows the magnetostrictive effect is

a) Force b) Flow

c) Temperature d) Displacement.

ix) The output of current transducer is

a) 0 mA — 20 mA b) 4 mA — 20 mA

c) 3 mA — 20 mA d) none of these.

x) Rosette is a

a) Rotating device b) RTD

c) Strain gauge d) None of these.

xi) The photo diode as compared to a photo transistor has

a) lower sensitivity

b) faster switching time

c) higher size for the same output

d) all of these.

xii) Pyrometer is used for

a) low temperature measurement

b) medium temperature measurement

c) high temperature measurement

d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Define gauge factor. Deduce the expression for the gauge factor. 1 + 4

3. Explain with diagram, operation of LVDT with I/O curve. 3 + 2

4. State the difference between active and passive transducer with example.

5. Explain with diagram, how to measure the non-conducting liquid level by using change of dielectric constant.

6. Calculate the charge sensitivity for piezo electrical material.

GROUP – C

(Long Answer Type Questions)

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

7. a) Briefly explain the different working principle of capacitive transducer. 3

   b) Calculate the sensitivity for differential arrangement type by using capacitive transducer. 5

   c) What do you mean by transducer ? Describe it with block diagram. What is difference between sensor and transducer. 1 + 4 + 2

8. a) Describe the working principle of RTD with diagram. 6

   b) Compare the different types of material used for RTD with graph. 3

   c) Explain the working principle of Total radiation pyrometer with diagram. 6

9. a) State the working principle of Thermocouple. Mention name along with their temperature range and composition of two commonly used thermocouples. 5

b) Name two IC type temperature sensors. Explain any *one* of them with circuit diagram. 5

c) What is temperature compensation ? Explain dummy gauge. 5

10. a) Discuss the below difference : 3 × 3

i) RTD and Thermistor

ii) Primary and secondary transducer

iii) Seeback effect and Peltier effect.

b) Discuss proximity transducer. 3

c) A metallic strain gauge has a resistance of 120 Ω and a gauge factor of 2. It is installed on a aluminium structure which has a field point stress of 0·2 GN/m^2, determine the change in resistance of the gauge what would be caused by loading the material to field point. 3

11. Write short notes on any *three* of the following : 3 × 5

a) Rossettes

b) Stroboscope

c) Smart sensor

d) Ultrasonic sensor

e) Burdon Tube.