



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH/EE/SEM-8/EE-802B/2013

2013

SENSOR 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 × 1 = 10

- i) An inverse transducer converts
 - a) mechanical energy to electrical energy
 - b) electrical energy to light energy
 - c) electrical energy to mechanical form
 - d) all of these.



ii) The gauge factor is defined as

a) $\left(\frac{\Delta L}{L} \right) \left(\frac{\Delta R}{R} \right)$

b) $\frac{\left(\frac{\Delta R}{R} \right)}{\left(\frac{\Delta L}{L} \right)}$

c) $\frac{\left(\frac{\Delta R}{R} \right)}{\left(\frac{\Delta D}{D} \right)}$

d) $\frac{\left(\frac{\Delta R}{R} \right)}{\left(\frac{\Delta P}{P} \right)}$

iii) The smallest change in input that a transducer can sense is known as

a) sensitivity

b) resolution

c) precision

d) accuracy.

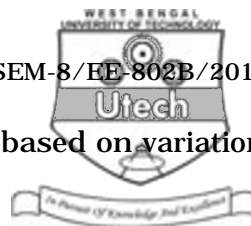
iv) Gauge factor of a strain gauge indicates its

a) accuracy

b) sensitivity

c) dead zone

d) none of these.



- v) The principle of operation of LVDT is based on variation of
- a) self inductance
 - b) mutual inductance
 - c) reluctance
 - d) permeance.
- vi) Which one of the following is a digital transducer ?
- a) Thermistor
 - b) LVDT
 - c) Encoder
 - d) RTD.
- vii) Radiation pyrometers are used in temperature range of
- a) 0 to 500°C
 - b) 500 to 2000°C
 - c) - 250 to 500°C
 - d) 1200 to 3000°C.
- viii) Load cell is a transducer which measures
- a) force
 - b) temperature
 - c) strain
 - d) pressure.



- ix) Residue voltage occurs due to
- a) Harmonics and stray capacitance
 - b) Hysteresis loss
 - c) Creeping error
 - d) Eddy current loss.
- x) Hall effect transducers are used for measuring
- a) magnetic field b) current
 - c) electric field d) pressure.
- xi) Angular velocity is measured by
- a) strain gauge
 - b) solar cell
 - c) A.C. tacho-generator
 - d) none of these.
- xii) Quartz and Rochelle salt belong to
- a) synthetic group of piezoelectric material
 - b) natural or synthetic group of piezoelectric materials provided properly polarised
 - c) natural group of piezoelectric materials
 - d) all of these.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is piezoelectric transducer ? Give the equivalent circuit. Derive an expression for the output voltage by making suitable simplifying assumptions. $1 + 1 + 3$
3. Explain the operating principle of photodiode. What is photomultiplier ? $3 + 2$
4. What is load cell ? Which pyrometer can be measured with it ? Explain working principle. $1 + 1 + 3$
5. Explain with example active and passive transducer.
6. Draw the diagram of capacitive microphone. Explain its working principle.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe the principle of operation of strain gauge for measurement of strain. 4
- b) What is gauge factor of a strain gauge ? Derive the expression of gauge factor. $2 + 4$
- c) How can a dummy gauge be used for temperature compensation for measurement using strain gauge ? 5



8. Describe the basic principle of a hall device. Show how it can be used for magnetic field sensor. How is hall effect transducer utilized for measurement of displacement ?

5 + 5 + 5

9. a) State the working principle of thermocouple. Name two IC type temperature sensors. Explain any of them with circuit diagram.

5 + 5

- b) Describe the construction and working principle of resistance thermometer. Describe the materials used for RTDs along with their properties.

5

10. a) What do you mean by Villary Effect and Wiedmann Effect ?

5

- b) Describe the working principle of Geiger-Müller counter.

5

- c) What are the advantages of IC type sensors over other types of thermal sensors ?

5



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

- a) Smart Sensor
- b) Proximity Sensor
- c) Ultrasonic Sensor
- d) LDR
- e) Thermistor.

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