



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (EE-NEW)/SEM-8/EE-802B/2011
2011
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 × 1 = 10

i) Which of the following gives gauge factor of a strain gauge ?

- a) $(\Delta L/L)/(\Delta R/R)$ b) $(\Delta R/R)/(\Delta L/L)$
c) $(\Delta R/R)/(\Delta D/D)$ d) $(\Delta R/R)/(\Delta \rho/\rho)$.

ii) LVDT can be used for

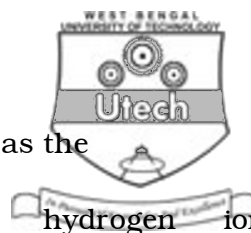
- a) vibration measurement
b) angular velocity measurement
c) force measurement in a beam
d) load measurement on a column.



- iii) Hall effect transducers are used for measuring
- a) magnetic field
 - b) current
 - c) electric field
 - d) pressure.
- iv) The strain gauges should have low
- a) gauge factor
 - b) resistance temperature coefficient
 - c) resistance
 - d) all of these.
- v) The sensitivity factor of strain gauge is normally of the order
- a) 1 to 1.5
 - b) 1.5 to 2.0
 - c) 0.5 to 1
 - d) 5 to 10.
- vi) Which one of the following is digital transducer ?
- a) Thermistor
 - b) Encoder
 - c) LVDT
 - d) RTD.
- vii) Which of the following is an inverse transducer ?
- a) LVDT
 - b) Load cell
 - c) Piezoelectric crystal
 - d) Radiation pyrometer.



- viii) In optical pyrometers temperature is measured by
- a) The thermocouple effect
 - b) Photocell principle
 - c) Comparison of brightness of the source with that of standard source
 - d) None of these.
- ix) Venturimeter transducer works on the principle of
- a) Pressure difference between two points of flowing fluid
 - b) Temperature difference in two points in fluid
 - c) Resistance change in fluid flow
 - d) Electrical potential gradient between two points in flow line.
- x) A quartz resonator is effective in measuring
- a) Speed
 - b) Flow of fluid
 - c) Force
 - d) Temperature.
- xi) Residue voltage occurs due to
- a) Harmonics and stray capacitance
 - b) Hysteresis loss
 - c) Creeping error
 - d) Eddy current loss.



- xii) The 'pH' value of a solution is defined as the
- a) Negative logarithm of the hydrogen ion concentration
 - b) Negative logarithm of the hydroxyl ion concentration
 - c) Logarithm of the product of hydrogen and hydroxyl ion concentrations
 - d) Logarithm of the hydrogen ion concentration.

GROUP – B
(Short Answer Type Questions)

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

- 2. Explain how a Geiger-Muller counter is used for measurement of radioactive radiation. 5
- 3. Draw the diagram of capacitive microphone. Explain its working principle. 2 + 3
- 4. Describe the operating principle of photodiode. What is photomultiplier ? 3 + 2
- 5. Describe the function of piezoelectric transducer. 5
- 6. a) Derive the expression for the loading error of a resistance type potentiometer.
- b) Draw typical curves to show the variation of output with input displacement for different values of load resistance. 3 + 2



GROUP – C

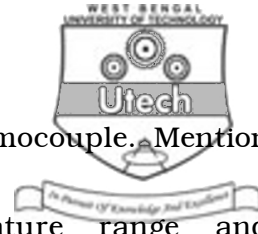
(Long Answer Type Questions)

Answer any *three* of the following.

3 × 15 = 45

7. a) Describe the principle of operation of strain gauges for the measurement of strain. 4
- b) What is gauge factor ? Derive the equation of gauge factor of a strain gauge. 2 + 4
- c) Describe how the error due to temperature is compensated in a strain gauge by using a dummy strain gauge. 5
8. Draw the schematic diagram of an LVDT and explain its electro-mechanical transfer characteristics. How does frequency response of the LVDT depend on excitation frequency ? Explain.

Design and explain a pressure gauge using LVDT capable to measure pressure both above and below atmospheric pressure (P_0). Also draw the necessary signal conditioning ckt. to indicate +ve for pressure above P_0 and – ve for pressure below P_0 . 3 + 3 + 3 + 3 + 3



9. a) State the working principle of Thermocouple. Mention name along with their temperature range and composition of two commonly used thermocouples.
- b) Name two IC type temperature sensors. Explain any of them with circuit diagram.
- c) Describe the working and construction of resistance thermometer. Describe the materials used for RTDs along with their properties. 5 + 5 + 5
10. a) Describe the basic principle of a Hall device.
- b) Show how it can be used for magnetic field sensor.
- c) On what factors and parameters of the sensors, does the Hall voltage output depend for a given field condition ?
- d) How is Hall effect transducer utilized for measurement of displacement ? 4 + 4 + 3 + 4



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

- a) Proximity sensor
 - b) Photovoltaic cell
 - c) LDR
 - d) Ultrasonic sensor
 - e) Smart sensor
 - f) Sensors and transducers.
-