



Name : .....  
Roll No. : .....  
Invigilator's Signature : .....

**CS/B.TECH(EEE-NEW)/SEM-4/EI(EEE)-401/2012**

**2012**

**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.*

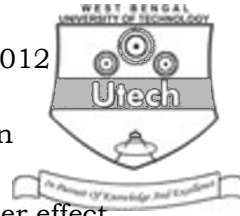
**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) Which of the following is an active transducer ?
  - a) Strain gauge
  - b) LVDT
  - c) Piezoelectric transducer
  - d) None of these.
  
- ii) The strain gauge should have low
  - a) gauge factor
  - b) resistance temperature coefficient
  - c) resistance
  - d) all of these.



- iii) Operation of thermocouple is based on
- a) Seebeck effect
  - b) Peltier effect
  - c) Thomson effect
  - d) none of these.
- iv) LVDT means
- a) Linear Variable Differential Transducer
  - b) Low Value Direct Transformer
  - c) Linear Variable Differential Transformer
  - d) none of these.
- v) Which of the following is used for measurement of temperature ?
- a) Strain gauge
  - b) Thermocouple
  - c) Photodiode
  - d) None of these.
- vi) Which of the following is a passive transducer ?
- a) Photovoltaic cell
  - b) LVDT
  - c) Piezoelectric transducer
  - d) None of these.



vii) Which of the following is not a piezoelectric material ?

- a) Quartz
- b) Barium titanate
- c) Cadmium sulphate
- d) None of these.

viii) Piezoelectric Accelerometer is

- a) sensitive to temperature changes
- b) sensitive to voltage changes
- c) sensitive to velocity changes
- d) sensitive to acceleration changes.

ix) A Hall effect transducer can be used to measure

- a) power
- b) current
- c) displacement
- d) all of these.

x) Capacitive transducer are normally used for

- a) static measurement
- b) dynamic measurement
- c) both (a) and (b)
- d) Transient measurement.



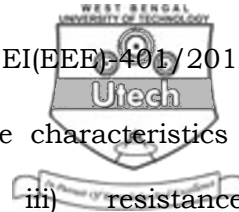
- xi) A thermistor exhibits
- a) only a  $-ve$  change of resistance with increase in temperature
  - b) only a  $+ve$  change of resistance with increase in temperature
  - c) can exhibit either a  $-ve$  or,  $+ve$  change of resistance with increase in temperature depending upon the type of material
  - d) none of these.
- xii) The photo-diode as compared to a photo-transistor has
- a) faster switching time
  - b) lower sensitivity
  - c) higher size for the same value of output current
  - d) all of these.

**GROUP - B**

**( Short Answer Type Questions )**

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

2. Derive the output voltage expression of linear POT when its output terminal connected across a meter of finite impedance.



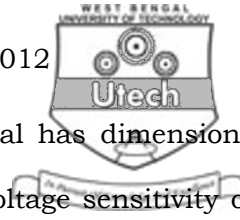
3. Draw and explain — i) the current time characteristics ,  
ii) voltage-current characteristics and iii) resistance-  
temperature characteristics of thermistor.
4. Briefly explain the construction and principle of operation of  
Geiger-Müller counter.
5. Explain the principle of operation and construction of  
ultrasonic flow meter. What are the advantages of ultrasonic  
flow meter ?
6. Explain Hall Effect Transducer with neat diagram.

**GROUP – C**

**( Long Answer Type Questions )**

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

7. a) What do you mean by piezoelectric transducer ? Derive  
the expression of output voltage of piezoelectric  
transducer.
- b) Briefly explain the loading effect and frequency response  
of piezoelectric transducer.



- c) A barium titanate piezoelectric crystal has dimensions of  $6 \text{ mm} \times 6 \text{ mm} \times 1.5 \text{ mm}$  and a voltage sensitivity of  $0.012 \text{ Vm/N}$ . Relative permittivity of barium titanate is 1400 and modulus of elasticity of the barium titanate is  $12 \times 10^{10} \text{ N/m}^2$ . Force applied is 10N. Determine
- the output voltage
  - charge sensitivity
  - strain
  - charge generated. 5 + 5 + 5
8. a) How capacitive transducer can be used for measurement of displacement using variation of dielectric constant ?
- b) What are the advantages and disadvantages of capacitive transducer ?
- c) Briefly describe the pyroelectric effect.
- d) Draw and explain how thermocouple can be used for measurement of temperature. 4 + 3 + 3 + 5
9. a) What is strain gauge ? What are the various types of strain gauge ?
- b) Derive the expression of gauge factor.



- c) Briefly explain semiconductor strain gauge and state the advantage and disadvantage of this type of strain gauge.
- d) Explain the function of dummy gauge.  $2 + 6 + 5 + 2$
10. a) Describe the working principle of variable inductance transducer.
- b) What is residual voltage ? Describe the input-output relationship of LVDT.  $7 + 8$
11. Write short notes on any *three* of the following :  $3 \times 5$
- a) Total radiation pyrometer
  - b) Photomultiplier tube
  - c) RTD
  - d) Load cell
  - e) Proximity sensor
  - f) Scintillation counter.

=====