SENSORS & TRANSDUCERS
(AEIE 2202)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) _____ is a digital transducer.
(a) Pirani gauge (b) Thermistor
(c) Photovoltaic (d) Encoder

(ii) _____ is not a self-generating type of transducer.
(a) RTD (b) Thermocouple
(c) Piezo-electric crystal (d) Photo-voltaic cell

(iii) A piezo-electric type transducer requires a/an _____ for signal conditioning.
(a) charge amplifier (b) differential amplifier
(c) instrumentation amplifier (d) none of the above

(iv) A capacitive microphone transducer is used for
(a) Thickness measurement (b) liquid level measurement
(c) velocity measurement (d) speech, music and noise measurement

(v) Strain gauge is used to measure
(a) stress (b) force
(c) pressure (d) all of the above

(vi) Which of the followings is not a type of thermocouple?
(a) K (b) T
(c) M (d) J

(vii) Thermopiles are generally a collection of _____
(a) RTDs (b) thermistors
(c) thermocouples (d) all of the above

(viii) A dummy strain gauge is used to
(a) improve the stability of the sensor system
(b) increase the sensitivity of measurement
(c) compensate ambient temperature variation
(d) all of the above

(ix) The RTD, assigned PT_{100}, refers to
(a) 100Ω at 100°C (b) 100Ω at 0°C
(c) 0Ω at 0°C (d) 0Ω at 100°C

(x) Hall effect is clearly visible in _____
(a) pure conductors (b) semiconductors
(c) super conductors (d) non-metals

Group – B

2. Differentiate between the followings:
   i. Transducers and inverse transducers
   ii. Active and passive transducers
   iii. Primary and secondary transducers
   iv. Analog and digital transducers

(4 × 3) = 12

3. (a) What is the full form of LVDT? Draw the transfer characteristic of a LVDT.
   (b) Derive the expression for the gauge factor of a metal strain gauge.
   (c) Suggest one sensor/transducer for each of the measurement listed below:
      i. Force measurement
      ii. Motion
      iii. Positional
      iv. Optical
      v. Magnetic field strength

(1 + 2) + 4 + (5 × 1) = 12

Group – C

4. (a) What is Hall Effect? Draw a scheme to measure current using a Hall Effect Transducer.
   (b) What is the function of a Tachometer?
   (c) With a neat diagram describe the operation of a Differential Push-pull arrangement of capacitive sensor.

(2 + 2) + 2 + 6 = 12

5. (a) Draw the equivalent circuit of a piezo-electric transducer.
   (b) State two materials that show piezo-electric properties.

(c) Define charge and voltage sensitivities of piezoelectric transducer and find the relation between them.

4 + 2 + 6 = 12

Group – D

6. (a) A platinum resistance thermometer has a resistance of 120Ω at 30°C. The temperature co-efficient of resistance of platinum is 0.004/°C. Find the resistance at 135°C. Assume linear approximation between resistance and temperature.

(b) List the factors which are responsible for the development of emf by a thermocouple.

(c) With a neat and labelled diagram, explain the working of a disappearing filament type optical pyrometer.

4 + 2 + 6 = 12

7. (a) State the Thermoelectric laws.

(b) What is cold junction compensation? Explain a method to realize the cold junction compensation.

(c) Differentiate between extension and compensating cables.

3 + 5 + 4 = 12

Group – E

8. (a) What are the different types of optical sensors?

(b) Draw a neat and labelled diagram to measure the rpm of a rotating motor using LED-LDR pair and find the expression for RPM.

3 + (6 + 3) = 12

9. (a) What type of transducer a Photomultiplier tube is? Name the different electrodes used in a Photomultiplier tube.

(b) How does a scintillation detector work?

(c) Explain the working of a proximity sensor.

(1 + 2) + 4 + 5 = 12

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/MzA1OTkwNTI4OTA3/a/MzA1OTkwNTI4OTQy/details