TRANSDUCERS & SENSORS
(ELEC 4111)

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) Change in output of sensor with change in input is
(a) Threshold (b) Slew rate
(c) Sensitivity (d) None of the mentioned

(ii) Thermocouple generate output voltage according to input
(a) Circuit parameters (b) Humidity
(c) Temperature (d) Voltage

(iii) LVDT has
(a) one primary coils and two secondary coils
(b)one primary coil and one secondary coil
(c)Two primary coils and one secondary coil
(d) Two primary coils and two secondary coils

(iv) Platinum is used for industrial applications because _____
(a) it is cheap (b) it is available readily
(c) it is a noble metal (d) it gives accurate measurements

(v) Most metallic conductors have a
(a) neutral temperature coefficient of resistance
(b) negative temperature coefficient of resistance
(c) positive temperature coefficient of resistance
(d) zero temperature coefficient of resistance

(vi) Hall sensor is used to measure the following
(a) position of shaft (b) angular velocity
(c) strength of magnetic field (d) all of the above

(vii) Which transducer measures changes in acceleration, pressure, strain and temperature?
(a) photoelectric sensor (b) capacitive sensor
(c) piezoelectric sensor (d) inductive sensor

(viii) Due to variation of venturimeter constant, venturimeters are not suitable for
(a) low velocity (b) high velocity
(c) low pressure (d) high pressure

(ix) Main advantage of fibre optic cable over co-axial cable is
(a) Easy handling (b) Less weight
(c) Easy testing (d) Low loss

(x) MEMS stand for
(a) micro electromechanical system (b) macro electromechanical system
(c) micro electromagnetic system (d) macro electromagnetic system

Group - B

2. (a) Why is a solid dielectric medium used for variable distance capacitive type sensors? [(CO3) (Evaluate/HOCQ)]

(b) Describe the operation of an LVDT for measuring displacement. [(CO2) (Understand/LOCQ)]

(c) Calculate gauge factor of a strain gauge, if the value of the resistance is 100 ohm whichchanges by 10 Ω for 14000 micro strains. [(CO1) (Apply/IOCQ)]

4 + 5 + 3 = 12

3. (a) Describe the function of a resistive potentiometer as a sensor. [(CO2) (Remember/LOCQ)]

(b) Derive the Gauge factor of a strain gauge. [(CO2) (Analyse/IOCQ)]

(c) "SemiconductorStrain Gauge has some disadvantage over metal Strain Gauge" Justify the statement. [(CO4) (Evaluate/HOCQ)]

5 + 4 + 3 = 12

Group - C

4. (a) List the advantages and disadvantages of Ultrasonic Flow meters. Mention its application. [(CO4) (Remember/LOCQ)]

(b) What is an Electromagnetic flowmeter and explain how is it different from other obstruction type flow meters? [(CO2) (Evaluate/HOCQ)]

(c) Analyse how the direction of flow is measured by Hotwire anemometer? [(CO1) (Analyse/IOCQ)]

4 + 3 + 5 = 12

5. (a) Draw and explain the two possible methods of working of Hotwire anemometer. [(CO2) (Analyze/IOCQ)]

(b) What is 'Hall coefficient' and state the factors on which it depends? [(CO3) (Remember/LOCQ)]

(c) The magnetic field applied to an electromagnetic flowmeter is not constant, but time varying. Justify. [(CO3) (Evaluate/HOCQ)]

5 + 4 + 3 = 12

Group - D

6. (a) Discuss why the reference junction is needed in thermocouples. [(CO3) (Create/HOCQ)]

(b) How does a thermistor differ from a thermocouple as a temperature sensor? [(CO1) (Understand/LOCQ)]

(c) With a neat circuit diagram explain the function of 3- wire RTD. [(CO2) (Analyse/IOCQ)]

3 + 4 + 5 = 12

7. (a) Justifywhy 3-wire RTD is preferred over 2- wire RTD. [(CO3) (Evaluate/HOCQ)]

(b) How does conductivity change in a metal or in a semiconductor with change in temperature? [(CO3) (Analyze/IOCQ)]

(c) If at 25 °C,a platinum wire has a resistance of 100Ω, what length would be required for a wire of diameter 0.005cm? The resistivity is 10.6μ Ω-cm.What would be the resistance at 500°C.?Consider for platinum α= 0.00397/°C. [(CO1)(Analyze/IOCQ)]

3 + 4 + 5 = 12

Group - E

8. (a) Explain how a fibre optic sensor may be used to measure temperature. [(CO2) (Evaluate/HOCQ)]

(b) Draw and explain the function of remote sensing configuration for air pollution [(CO2) (Analyse/IOCQ)]

(c) List the advantages of smart sensors over conventional sensors. List the application of smartsensors. [(CO4) (Remember/LOCQ)]

3 + 5 + 4 = 12

9. (a) List the techniques available for tomography and discuss the merits of each. [(CO3) (Remember/LOCQ)]

(b) Briefly discuss Biosensor structure. [(CO3) (Analyze/IOCQ)]

(c) Explain what is meant by 'ultrasonic' or 'ultrasound' scanning. [(CO2) (Evaluate/HOCQ)]

4 + 5 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	31.25%	42.70%	26.04%

Course Outcome (CO):

After the completion of the course students will be able to

- Relate the concepts for converting a physical parameter into an electrical quantity
- Explain the working principles, characteristics of sensors and transducers used for measuring physical quantities
- Understand the operational conditions, range and limitations of sensors and transducers
- Select the best fit sensors and their use in medical and other applications

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
EE	https://classroom.google.com/c/NDA0OTI4NTYzMzE0/a/NDYzMDE0MDMxNjk1/details