GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2021
SENSORS AND TRANSDUCERS
EI401

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)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No
1.	(i)	Potentiometric resistance transducer measures _____ a) linear displacement b) rectangular displacement c) square displacement d) triangular displacement	1	CO1
	(ii)	Self-generating type transducers are _____ transducers. a) Active b) Passive c) Secondary d) Inverse	1	CO1
	(iii)	Capacitive transducers are normally employed for_____ measurements a) Static b) Dynamic c) Transient d) Both static and dynamic	1	CO2
	(iv)	Which of the following is not a type of radiation detector? a) Geiger Muller counter b) Proportional counter c) Semiconductor detector d) Flame emission detector	1	CO4
	(v)	Strain gauge is a _____ a) inductive transducer b) resistive transducer c) capacitive transducer d) mechanical transducer	1	CO1
	(vi)	The transducers that converts an input signal into an output signal and which is a discrete function of time is known as _____ transducer. a) Active b) Analog c) Digital d) Pulse	1	CO1

(vii)	When nuclear radiations pass through, gas ionization (Townsend discharge) is produced.' This is the principle of which of the following detectors? a) Proportional counter b) Flow counter c) Geiger Muller counter d) Scintillation counter	1	CO4
(viii)	Dummy strain gauge is used a) to increase sensitivity b) to measure tensile strain c) for temperature compensation d) to measure compressive strain	1	CO4
(ix)	Which of the following represents output of Hall Effect transducer? a) Hall potential b) Emf c) Applied voltage d) Lorentz Voltage	1	CO3
(x)	Resistance potentiometer consists of _____ a) capacitive element b) resistive element c) inductive element d) no elements	1	CO1
(xi)	The sensitivity factor of strain gauge is normally of the order of a) 1 to 1.5 b) 1.5 to 2.0 c) 0.5 to 1.0 d) 5 to 10	1	CO1
(xii)	The principle of operation of LVDT is based on the variation of a) Self-inductance b) Mutual inductance c) Reluctance d) Permanence	1	CO3

GROUP – B
(Short Answer Type Questions)

Answer any ***three*** from the following: **3×5=15**

			Marks	**CO No**
2.		What is pneumatic load cell- Explain its working with proper diagram.	5	CO1
3		What are the static characteristics of a sensor? How to calculate the sensitivity of linear and non-linear sensors?	5	CO1
4.	(a)	Describe how voltage is produced in a piezo crystal due to the application of Tension and compression.	3	CO3
	(b)	What are bimorphs and multimorphs?	2	CO3
5.		How Stroboscope is used for the measurement of rpm of a moving shaft?	5	CO2
6.	(a)	What is Scintillation Counter?	2	CO4

	(b)	Draw a neat sketch of it and explain its function.	3	CO2

GROUP – C
(Long Answer Type Questions)
Answer any ***three*** from the following: **3×15=45**

			Marks	CO No
7.	(a)	Draw the schematic diagram of an LVDT and explain its electro-mechanical transfer characteristics.	3	CO1,CO2
	(b)	Why the output of a LVDT is amplitude modulated? Explain also why the two secondary coils of an LVDT are connected in a series opposition manner.	6	CO2
	(c)	How the direction sensitivity of a LVDT is realized using phase sensitive demodulation technique?	6	CO2
8.	(a)	A linear resistive POT is of 50 mm length & uniformly wound with the wire of resistance 10,000 Ω. Under normal condition the wiper is at the center of the POT. Find the displacement if the resistance of the POT is recorded i) 3975 Ω ii) 7500 Ω. iii) In both of these two cases what are the direction of displacements? iv) If it is possible to measure the minimum value of 10 Ω resistance with the above arrangement, find resolution of the POT in mm.	7	CO3
	(b)	Describe Strain sensing principle and derive the expression of gauge factor of a resistive strain gauge.	6	CO2
	(c)	What is Poison's bridge?	2	CO2
9.	(a)	Draw a suitable diagram of a capacitor microphone and describe the principle.	5	CO2
	(b)	Derive the sensitivity of a Half bridge, Full bridge and Quarter Bridge.	6	CO3
	(c)	Why temperature compensation is important in strain gauge measurements? Mention two methods.	4	CO3
10.	(a)	Describe the basic principle of a Hall sensor.	3	CO4
	(b)	How this sensor is used for measurement of current through a conductor?	5	CO3
	(c)	Derive the expression of Hall voltage & show what are the factors and parameters of the sensors. Does the Hall voltage output depend for a given field condition?	7	CO4
11.	(a)	Answer any **three** of the following**:-** Yolk coil torque transducer	5	CO3
	(b)	SMART Sensors	5	CO2
	(c)	Magnetostriction	5	CO3
	(d)	Tachometer	5	CO4
	(e)	MEMS	5	CO4