GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022
ADVANCED SENSORS
EI602B

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)	MEMS has an electronic part: a) always b) often c) sometimes d) never	1	CO1
	(ii)	MOEMS is used for a) optical systems b) pneumatic systems c) hydraulic systems d) all of the above	1	CO1
	(iii)	HARM is a type of a) bulk micromachining b) surface micromachining c) LASER based micromachining d) None of these	1	CO3
	(iv)	LIGA is a type of a) HARM b) Dry etching c) Wet etching d) Fusion bonding	1	CO3
	(v)	An airbag sensor contains a) Pressure sensor b) Temperature sensor c) Accelerometer d) Flow sensor	1	CO4
	(vi)	Smart sensors have a) Decision making capability b) Communication capability c) Range increasing capability d) All of the above	1	CO2

(vii)	A smart sensor has an electronic component a) Sometimes b) Often c) Always d) Never	1	CO2
(viii)	In the context of reliability engineering, MTTF is used for a) Any type of system b) Repairable system c) Non-repairable system d) None of these	1	CO4
(ix)	A failure mode of a sensor is a) Latching b) Ageing c) Hot-carrier d) All of the above	1	CO4
1(x)	Bath tub curve is used in a) Reliability analysis b) Ageing analysis c) Sensor stability d) None of these	1	CO4
(xi)	Failures in time (FIT) is generally used for a) Electric components b) Electronic components c) Mechanical components d) Optical components	1	CO2
(xii)	Hot-carrier injection is a method of a) Artificial ageing b) Failure analysis c) Sensor stability analysis d) None of these	1	CO2

GROUP – B
(Short Answer Type Questions)

(Answer any *three* of the following) **3 x 5 = 15**

		Marks	CO No.
2.	Compare MEMS and IC.	5	CO2
3.	What are the advantages and disadvantages of miniaturization?	5	CO3
4.	What is the role of smart sensors in the 4th industrial revolution?	5	CO4
5.	What are the key aspects of smart sensors?	5	CO2
6.	Compare MTBF and MTTF in the context of reliability engineering?	5	CO4

GROUP – C
(Long Answer Type Questions)
(Answer any *three* of the following) **3 x 15 = 45**

			Marks	CO No.
7.	a)	What is MEMS?	2	CO1
	b	What are the general components of MEMS?	5	CO1
	c)	Briefly describe photolithography with suitable diagrams.	8	CO3
8.	a)	Briefly discuss the basic architecture of a smart sensor.	5	CO2
	b)	Why are smart sensors often preferred to conventional sensors?	2	CO4
	c)	What is a screen printed electrode?	3	CO3
	d)	Briefly compare the physical vapour deposition and chemical vapour deposition methods.	5	CO3
9.	a)	What are the failure modes of a sensor?	5	CO4
	b)	What are the effects of ageing on a sensor?	1	CO4
	c)	What are the methods of artificial ageing?	2	CO4
	d)	What are MTTF, MTTR, and FIT (failures in time) in the context of reliability engineering?	5	CO4
	e)	What is stability of sensors?	2	CO2
10.		Answer any three from the following:	3X5=15	
	a)	Wet etching	5	CO3
	b)	Fusion bonding	5	CO3
	c)	SAW sensors	5	CO1
	d)	MEMS accelerometer	5	C01
	e)	Bath tub curve	5	CO4