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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech Integrated

SEM: VII - THEORY EXAMINATION (2025 - 2026)

Subject: Sensor Technologies

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C**. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

20

1. Attempt all parts:-

- 1-a. A device converting one form of energy to another is identified as(CO1,K1) 1
- (a) Resistor
- (b) Transducer
- (c) Diode
- (d) Relay
- 1-b. Following is true about sensors and transducers?(CO1,K1) 1
- (a) All sensors are transducers
- (b) All transducers are sensors
- (c) Both are same
- (d) None
- 1-c. Silicon is widely used in sensors because it has _____. (CO2,K1) 1
- (a) Low thermal conductivity
- (b) High mechanical strength
- (c) Poor electrical properties
- (d) High cost
- 1-d. Following material is best suited for high-temperature sensors? (CO2,K1) 1
- (a) Silicon
- (b) GaAs
- (c) SiC
- (d) PVC
- 1-e. Thermistors work on the principle of change in ____ with temperature. (CO3,K1) 1

- (a) Capacitance
 - (b) Resistance
 - (c) Inductance
 - (d) Voltage
- 1-f. Following sensor has the widest temperature measurement range? (CO3,K2) 1
- (a) Thermistor
 - (b) RTD
 - (c) Thermocouple
 - (d) Thermopile
- 1-g. The smallest detectable analog change by an ADC is called _____. (CO4,K1) 1
- (a) Accuracy
 - (b) Sensitivity
 - (c) Resolution
 - (d) Drift
- 1-h. Full-bridge strain gauge improves _____. (CO4,K2) 1
- (a) Range
 - (b) Sensitivity
 - (c) Drift
 - (d) Power consumption
- 1-i. What does an accelerometer primarily measure? (CO5,K1) 1
- (a) Velocity
 - (b) Force
 - (c) Rate of change of velocity
 - (d) Angular displacement
- 1-j. MEMS accelerometers are widely used because they are (CO5,K2) 1
- (a) Large and expensive
 - (b) Low power and compact
 - (c) Only suitable for heavy machinery
 - (d) Only measure temperature
2. Attempt all parts:-
- 2.a. Distinguish between analog and digital sensors with examples. (CO1,K2) 2
- 2.b. Give the main advantage of NEMS sensors is _____. (CO2,K2) 2
- 2.c. Define a thermistor and state its two main characteristics. (CO3,K1) 2
- 2.d. Define input impedance in interface circuits and state its importance. (CO4,K2) 2
- 2.e. Explain how an accelerometer measures acceleration. (CO5,K2) 2

SECTION-B

30

3. Attempt all parts:-

3.a. Answer any one of the following:-

- 3.a.(i) Discuss the different selection criteria for sensors and justify their importance in industrial applications. (CO1,K3) 6

3.a.(ii)	Describe the static characteristics of sensors such as accuracy, precision, sensitivity, linearity, resolution, drift, and hysteresis. (CO1,K2)	6
3.b.	Answer any one of the following:-	
3.b.(i)	Explain in detail the classification of sensor materials with suitable examples of passive and active materials. (CO2,K3)	6
3.b.(ii)	Compare silicon, polysilicon, and SiC materials in terms of sensor performance, temperature tolerance, and fabrication compatibility. (CO2,K4)	6
3.c.	Answer any one of the following:-	
3.c.(i)	Explain the construction, working principle, and characteristics of NTC thermistors with suitable diagrams. (CO3,K3)	6
3.c.(ii)	Explain the working of RTDs and describe how lead-wire compensation is applied in industrial systems. (CO3,K3)	6
3.d.	Answer any one of the following:-	
3.d.(i)	Explain the architecture of a digital signal processing system used in smart sensors. Highlight filtering and compression techniques. (CO4,K4)	6
3.d.(ii)	Compare SPI, UART, and I ² C communication protocols based on speed, topology, data integrity, and applications. (CO4,K4)	6
3.e.	Answer any one of the following:-	
3.e.(i)	Explain the working principle of a MEMS accelerometer with a neat diagram. Describe its applications in modern IoT devices. (CO5,K3)	6
3.e.(ii)	Explain in detail the factors affecting the accuracy and sensitivity of acceleration sensors in industrial applications. (CO5,K4)	6
SECTION-C		50
4.	Answer any <u>one</u> of the following:-	
4-a.	Explain in detail the classification of sensors based on operating principle, output type, input quantity, and technology. Include diagrams and examples. (CO1,K4)	10
4-b.	Discuss in depth the sensor selection criteria for industrial automation including sensitivity, range, accuracy, environmental conditions, and dynamic response. (CO1,K4)	10
5.	Answer any <u>one</u> of the following:-	
5-a.	Explain the different types of sensor materials in detail with working principles, applications, advantages, and limitations. (CO2,K4)	10
5-b.	Elaborate on the complete fabrication sequence of a MEMS accelerometer or pressure sensor using bulk and surface micromachining. (CO2,K5)	10
6.	Answer any <u>one</u> of the following:-	
6-a.	Explain the construction, working, calibration techniques, and error analysis of RTDs. Discuss industrial applications with diagrams. (CO3,K5)	10
6-b.	Compare RTD, Thermocouple, Thermistor, and IR thermometer on all major performance parameters. (CO3,K5)	10
7.	Answer any <u>one</u> of the following:-	
7-a.	Compare UART, SPI, I ² C, and CAN communication protocols with a detailed comparison table. (CO4,K5)	10

- 7-b. Explain CAN bus architecture, message arbitration, error handling, and use in automotive smart sensors. (CO4,K4) 10
8. Answer any one of the following:-
- 8-a. Discuss the various types of acceleration sensors used in industry. Compare their advantages, limitations, bandwidth, accuracy, and suitability in different environments. (CO5,K4) 10
- 8-b. Provide a detailed comparison between LVDT pressure sensors and piezoelectric pressure sensors in terms of construction, dynamic/static response, accuracy, and industry usage. (CO5,K4) 10

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