PAPER ID-310946

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM V) THEORY EXAMINATION 2024-25
SENSORS AND TRANSDUCERS

TIME: 3 HRS **M.MARKS: 70**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 07 = 14**

Q no.	Question	CO	Level
a.	Define transducers and classify them.	1	K1
b.	Explain the working of an LVDT for displacement measurement.	1	K2
c.	Describe the role of Hall effect sensors in position measurement.	2	K2
d.	What are CCD and CMOS sensors?	3	K1
e.	What is data acquisition system.	4	K1
f.	What are the characteristics of smart sensors?	5	K1
g.	Why is signal amplification needed in signal conditioning?	4	K2

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

a.	Explain the working principles of Potentiometer and LVDT for displacement measurement with suitable diagram.	1	K3
b.	Explain the principles of temperature measurement using Thermistors, Thermocouples and RTD.	2	K3
c.	Explain the difference between machine vision and computer vision. Discuss the components and applications of a typical machine vision system.	3	K2
d.	What are the main functions of signal conditioning equipment? Explain the types of amplifiers used in instrumentation systems.	4	K3
e.	Describe the general structure and components of smart sensors. Discuss the characteristics of smart sensors, including self-calibration, self-testing and self-communication.	5	K2

SECTION C

3. Attempt any *one* part of the following: **07 x 1 = 07**

a.	A Strain Gauge having a Resistance of 120Ω gauge factor of 2 is connected in serieswith a ballast resistance of 120 Ω across a 12v supply. Calculate the difference betweenthe output voltage (voltage across strain gauge) with no stress applied & with a stress of140 MN/m^2, Modulus of elasticity of the member undergoing strain is200GN/ m^2.	1	K5
b.	How are force and pressure measured using strain gauges, load cells and piezoelectric sensors?	1	K4

4. Attempt any *one* part of the following: **07 x 1 = 07**

a.	What are the principles of operation for flow sensors (Ultrasonic and Laser) and level sensors (Ultrasonic and Capacitive)?	2	K4
b.	A thermocouple has a sensitivity of 0.05 mV/°C. The reference junction is maintained at 0°C, and the thermocouple generates an output voltage of 4.5 mV. 1. Calculate the temperature of the measurement junction. 2. If the reference junction is now raised to 25°C, and the thermocouple still generates 4.5 mV, calculate the new temperature of the measurement junction.	2	K5

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5. Attempt any *one* part of the following: 07 x 1 = 07

a.	Describe the role of CCD and CMOS sensors in imaging. Compare their functionalities in terms of sensitivity, resolution, and power consumption.	3	K4
b.	How does a machine vision system assist a pick-and-place robot? Describe the sensing, digitizing, image processing, and training steps involved.	3	K3

6. Attempt any *one* part of the following: 07 x 1 = 07

a.	Describe the configuration and objectives of a data acquisition system (DAS). How do analog and digital I/O, counters, and timers contribute to the DAS?	4	K4
b.	Explain the importance of data conversion in modern instrumentation systems. Discuss the principles of analog-to-digital (ADC) and digital-to-analog (DAC) converters.	4	K3

7. Attempt any *one* part of the following: 07 x 1 = 07

a.	Explain the applications of smart sensors in smart cities, industrial robots, and electric vehicles. How do they enhance the efficiency and reliability of these systems?	5	K4
b.	Discuss the working of smart sensors for body temperature and blood oxygen measurement. Explain their integration into wearable devices.	5	K4