Code No: 183CB **R22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, February - 2024
SENSORS AND SIGNAL CONDITIONING
(Electronics and Instrumentation Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a) What are the factors influencing the selection of a sensor for a specific application. [1]
b) How does quantization affect the quality of analog-to-digital conversion? [1]
c) What are the main challenges in installing and using strain gauges in real-world? [1]
d) Define resistive hygrometers and what parameter it senses. [1]
e) Outline the practical thermocouple laws, highlighting the relationship between temperature and voltage output. [1]
f) List the characteristics of materials commonly used in piezoelectric sensors. [1]
g) Compare absolute and incremental position encoders in terms of accuracy. [1]
h) What are the limitations of quartz digital thermometers? [1]
i) What is common-mode rejection ratio in instrumentation amplifiers? [1]
j) What are the key challenges associated with the use of piezoelectric sensors in high-temperature environments? [1]

PART - B

(50 Marks)

2.a) Classify sensors based on the physical quantity they measure. Provide examples for each type.
b) What are the common methods for error correction in digital measurement systems? [5+5]

OR

3.a) Explain the concept of hysteresis in measurement. How does it affect the performance of a measuring instrument?
b) Describe the working principle of a piezoelectric sensor with neat sketches. [5+5]

4.a) How can a potentiometer be employed to measure linear displacement? Provide an example.
b) Explain the working principle of a variable capacitor in capacitive sensing applications. [5+5]

OR

5.a) Explain how mutual capacitance and self-capacitance are utilized in capacitive touchscreens.
b) Describe the working principle of a Linear Variable Differential Transformer. [5+5]

6.a) Explain the concept of cold junction compensation in thermocouple circuits. Why is it Necessary.

b) Discuss the relationship between radiation laws (Planck, Wien, Stefan-Boltzmann) and the operation of pyroelectric sensors. [5+5]

OR

7.a) Explain the Hall effect and how it is employed in Hall effect sensors.

b) Discuss how the piezoelectric effect is utilized in accelerometers for vibration measurements. [5+5]

8.a) Explain how quadrature encoding is implemented in incremental position encoders.

b) How can the resolution of an incremental position encoder be increased? [5+5]

OR

9.a) Explain how temperature changes are converted into frequency variations in quartz digital Thermometers.

b) How are SAW sensors utilized in gas and chemical sensing applications? [5+5]

10.a) Explain how the output voltage is calculated in a resistive voltage divider.

b) Discuss the advantages and limitations of using a voltage divider in signal conditioning. [5+5]

OR

11.a) Explain how the Wheatstone bridge is used for strain gauge measurements.

b) Describe synchros and explain their applications in measurement systems. [5+5]

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