



CBCS SCHEME

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18EE732

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Micro and Nano Scale Sensors and Transducers

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain with neat diagram the working principle and structure of capacitive pressure sensors. (08 Marks)
- b. Derive the expression for measuring pressure in terms of inductance for inductive pressure sensor. (08 Marks)
- c. Draw the block diagram of the interface circuit used to measure the capacitance 'C' of ultrahigh sensitivity pressure sensors. (04 Marks)

OR

- 2 a. Explain with neat diagram the working principle and structure of inductive pressure sensor. (08 Marks)
- b. Derive the expression of pressure 'P' acting on the mercury drop as a function of capacitance in capacitive pressure sensor. (08 Marks)
- c. Explain the graph of after – shock recovery time as a function of the applied pressure of ultra high sensitivity pressure sensors. (04 Marks)

Module-2

- 3 a. Explain with diagram the construction and working principle of acceleration sensor. (08 Marks)
- b. Determine the gate voltage V_{GS} and ON – OFF operating points of the smoke detector. (08 Marks)
- c. Analyze the following auxiliary experimental resultants of CO gas sensor.
 - i) Effect of temperature on the performance of sensor
 - ii) Effect of moisture on the performance of sensor. (04 Marks)

OR

- 4 a. Explain with neat diagram the working principle and structure of CO gas sensor. (08 Marks)
- b. Derive the expression for measuring acceleration in terms of capacitance of acceleration sensor. (08 Marks)
- c. Analyze with graph the experimental of sensor output as a function of the distance between the α - particle source and the MOSFET gate of smoke detector. (04 Marks)

Module-3

- 5 a. Explain with neat diagram the operating principle of the advanced optical microphone. (08 Marks)
- b. Develop the necessary mathematical relationship between the capacitance of the ultra-capacitor and conductivity of the electrolyte inside the moisture sensor. (08 Marks)
- c. Explain with graph the probability of error as a function of the image size in optical microphone. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. Explain with neat diagram the working principle and structure of moisture sensor. (08 Marks)
 b. Explain with flowchart that shows how the code is structured and executed in optoelectronic microphone. (08 Marks)
 c. Explain with graph the effect of contaminants like organic vapors and liquids on the performance of the moisture sensor. (04 Marks)

Module-4

- 7 a. Explain with neat diagram the principle operation of magnetic field sensor. (08 Marks)
 b. Explain with necessary graphs the response of the magnetic field sensor to DC magnetic fields and to ac magnetic fields. (12 Marks)

OR

- 8 a. Explain with necessary diagram the general structure of "Lab on chip". (08 Marks)
 b. Derive the expressions
 i) Bending radius of the generated free electrons
 ii) Deviation of the electrons path in the horizontal direction in magnetic field sensor. (12 Marks)

Module-5

- 9 a. Explain with diagram the principle of operation of the icing detector. (08 Marks)
 b. Determine the turn ON condition and operating points of MOSFET used in icing detector. (12 Marks)

OR

- 10 a. Explain interface circuit diagram used in icing detector prototype. (08 Marks)
 b. Analyze with proper graphs the following experimental results of icing detector.
 i) Results of testing with dry air moist air, and super, saturated water vapor
 ii) Results of testing with small crystal of ice
 iii) Testing under lightning strikes (12 Marks)
