

CBCS SCHEME

USN

--	--	--	--	--	--	--	--	--	--

21EE742

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025 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 the mechanical structure for capacitive pressure sensor. (10 Marks)
- b. Derive the equation for inductance as a function of position of iron core for an inductive pressure sensor. (10 Marks)

OR

- 2 a. Derive the equation for pressure as a function of capacitance for a capacitive pressure sensor. (10 Marks)
- b. Explain the structural details of ultra high sensitive pressure sensor. (10 Marks)

Module-2

- 3 a. Derive the expression for conversion percentage of the reaction as a function of time for a gas sensor based on nano technology. (10 Marks)
- b. Explain with neat figure the principle of operation of the new acceleration sensor. (10 Marks)

OR

- 4 a. Explain the fundamental principle of operation of a gas sensor based on nano technology. (10 Marks)
- b. With the help of neat figure explain the principle of operation of the traditional α - particle. Smoke detector. (10 Marks)

Module-3

- 5 a. Explain the structural detail of a new moisture sensor. (10 Marks)
- b. Explain the results of following experiments on the new moisture sensor :
 - i) Conductivity of porous silicon slab as a function of relative humidity at different temperature
 - ii) Change in conductivity and capacitance in response to a unit step rise in relative humidity from 5% to 10%. (10 Marks)

OR

- 6 a. Derive the mathematical relation between capacitance of the ultra - capacitor and the conductivity at the electrolyte for the new moisture sensor. (10 Marks)
- b. Describe the mechanical structure of the integrated microphone assembly. (10 Marks)

Module-4

- 7 a. Explain the fundamental principle of operation of the magnetic field sensor. (10 Marks)
b. Discuss the response of magnetic sensor to DC magnetic field. (10 Marks)

OR

- 8 a. Discuss the general structure of "Lab on Chip" sensors with neat figure. (10 Marks)
b. Explain the working of the thermocouple based self heating RF power sensor. (10 Marks)

Module-5

- 9 a. Determine the conditions that are necessary for turning ON MOSFET transistor by means of a flow of positively charged particles. (10 Marks)
b. Explain the following for the α - particle icing detector :
i) Principle of operation
ii) Circuit used in the present prototype. (10 Marks)

OR

- 10 a. With the help of neat figure, explain the concept of a magnetic micro robot actuation in a micro-fluidic chip. (10 Marks)
b. Discuss the results of following tests with graph :
i) Testing with ice crystals
ii) Testing with dust particles on an aircraft icing detectors. (10 Marks)
