Vidyavardhini's College of Engineering and Technology, Vasai (West)

First Year Engineering

Academic Year: 2024-2025

Question Bank: Internal Assesment-II

Subject/Code: Elective Physics/BSC2023 **Date: 30/03/2025**

Mod-4: Solid State Sensors [CO4]

1. Explain the Hall effect and derive expressions for the Hall voltage, Hall coefficient, and charge carrier concentration (3 Marks)
2. What is the inverse Piezoelectric effect. Explain how it is used as a source in ultrasonic systems. (3 Marks)
3. Explain the working of Doppler effect and transit time flow meters. (4 Marks)
4. Describe the application of piezoelectric ultrasonic systems in an ultrasonic distance meter. (3 Marks)
5. A Hall sensor is placed in a 0.5 T magnetic field. If the current through the conductor is 3 A and the thickness of the material is 2 mm, determine the Hall voltage given that the charge carrier density is 5×10^{22} electrons/m^3. (2 Marks)
6. In an ultrasonic distance meter, an ultrasonic pulse is sent and received after 0.02 s. If the speed of sound in air is 343 m/s, determine the distance to the object. (2 Marks)

Mod-5:Temperature and its Measurements [CO5]

1. Define heat and temperature. Explain different methods of heat transfer with one example for each. (2 Marks)
2. Explain the construction and working of bimetallic thermometers. (3 Marks)
3. What is the Seebeck effect. Explain the working of a thermocouple as a thermometer with one example. (3 Marks)
4. Write short notes on the factors influencing the selection of a thermometer based on temperature range and specific applications. (3 Marks)
5. Distinguish between the following thermometers: (2 Marks)
   (a) Bimetallic and Platinum Resistance (PT-100)
   (b) Bimetallic and Thermoelectric

6. Explain the calibration process of a PT-100 thermometer for temperature measurement. (3 Marks)

Mod-6: Nanotechnology [CO6]

(a) Explain any one of the following properties of the nano-materials: (2 Marks)
   i. Optical
   ii. Electrical
   iii. Structural
   iv. Mechanical

(b) Why is the surface-to-volume ratio important at nano scale? How does this property affect the mechanical, optical, and electrical characteristics of nano-materials? Support your explanation with relevant examples. (5 Marks)

(c) What is the working principle of a Scanning Electron Microscope (SEM), and how is it constructed? Explain its operation and mention two advantages and two disadvantages. (5 Marks)

(d) What is the working principle of a Transmission Electron Microscope (TEM), and how is it constructed? Explain its operation and mention two advantages and two disadvantages. (5 Marks)

(e) What is the working principle of a Atomic Force Microscope (AFM), and how is it constructed? Explain its operation and mention two advantages and two disadvantages. (5 Marks)

(f) Explain the working of gas sensing capacitors and give two applications. (3 Marks)

(g) Write a short note on different types of lithography and explain how they are applied in water purification. (4 Marks)