



OR

- 8 a. Based on Quantum free electron theory derive the expression for electrical conductivity in Metals. (10 Marks)
- b. Discuss any three polarization mechanism in dielectric materials. (06 Marks)
- c. The resistivity of intrinsic germanium (Ge) at 27°C is equal to 0.68 ohm-meter. Taking the electron and hole mobilities as 0.48 and 0.08 m<sup>2</sup>/V-s respectively. Calculate the intrinsic carrier concentration of charge carriers in Ge. (04 Marks)

**Module-5**

- 9 a. Write a brief note on nano-materials along with the dimensional effects on physical properties. Mention its few applications. (05 Marks)
- b. With a neat instrumental sketch, explain the principle, construction and working of Scanning Electron Microscope (SEM). (10 Marks)
- c. Determine the crystallite size of a material, given the wavelength of X-ray beam is 10 nm, the peak width 0.5° and peak position 25° for a cubic crystalline structure, given K = 0.94. (05 Marks)

OR

- 10 a. Write a brief note on Nano-composite. Mention its few application. (05 Marks)
- b. With a neat instrumental sketch explain the principle, construction and working of X-ray Photoelectron Spectroscopy (XPS). (10 Marks)
- c. The first order Bragg's reflection occurs when a monochromatic beam of X-rays of wavelength 0.675 Å is incident on a crystal at a glancing angle of 4°. What is the glancing angle for third order Bragg's reflection to occur? (05 Marks)

\*\*\*\*\*