

2072

M.Tech. (Material Science and Technology)

Second Semester

MT-202: Semiconductor Devices and Technology

Time allowed: 3 Hours

Max. Marks: 50

**NOTE:** Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

1. Attempt the following parts:

- When does an intrinsic semiconductor behave as an insulator?
- What is a load line for a transistor?
- What does the term work-function signify for an MOS structure?
- What is effective segregation coefficient?
- Differentiate between positive and negative photoresists.

(5×2)

Section A

- Mark the Fermi level for (i) an intrinsic semiconductor (ii) n-type semiconductor and (iii) p-type semiconductor. Describe the behaviour and properties of conductor, insulators and semiconductors on the basis of band theory.
  - Prove that the effective mass of an electron in a crystal is given by

$$m^* = \frac{\hbar^2}{\frac{d^2E}{dk^2}}$$

(6,4)

- Define h-parameters. Outline the method of obtaining h-parameters in CE configuration.
  - Describe the construction and working of Heterojunction bipolar transistor.

(6,4)

- Show the formation of accumulation layer, depletion layer, and inversion layer in a MOS structure formed on p-type semiconductor using suitable energy band diagram.
  - What do you understand by a depletion-type MOSFET?

(7,3)

Section B

- Briefly describe the metal organic chemical vapour deposition (MOCVD) processes to grow thin films of GaAs.
  - Describe the following processes (i) Polysilicon deposition (ii) Metallization.
- With suitable schematics, explain shadow printing and projection printing lithography methods. Cite the factors, which affect the resolution of photolithography.
  - Explain the process of aluminium etching. Write the chemical reaction involved in chemical etching process.
- Discuss the basic diffusion laws, common diffusion sources, and drive-in process in semiconductors.
  - Describe Ion implantation doping technique. Discuss its advantages.

(6,4)

(6,4)

x-x-x