

Duration: 2:30Hrs.

Total Marks:60

- N.B.:**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Symbols have their usual meanings.
  - 4) Use of non-programmable calculator is allowed.

- Q.1**
- A) Attempt any ONE. 08**
1. Describe briefly the types of semiconductor. Gives application of each.
  2. Discuss the various types of recombination processes occurring in the semiconductor.
- B) Attempt any ONE. 04**
1. What is difference between intrinsic and extrinsic semiconductor?
  2. Write a short note on the Hall Effects and state its two applications.
- Q.2**
- A) Attempt any ONE. 08**
1. With the help of diagrams describe the fabrication process of pn junction.
  2. Derive an expression for Ideal current- voltage characteristics of pn junction.
- B) Attempt any ONE. 04**
1. Explain the concept of avalanche reverse junction breakdown.
  2. For a Silicon one-sided abrupt junction with  $N_A = 2 \times 10^{19} \text{ cm}^{-3}$  and  $N_D = 8 \times 10^{15} \text{ cm}^{-3}$ . Calculate the junction capacitance at zero bias.
- Q.3**
- A) Attempt any ONE. 08**
1. Explain the working principle of BJT.
  2. Describe schottky barrier with neat and clean diagram
- B) Attempt any ONE. 04**
1. Explain the terms emitter injection efficiency and base transport factor of a BJT.
  2. Draw and label the minority carrier distribution curve of a BJT in active mode.

- Q.4**    **A) Attempt any ONE.** **08**
1. Draw and explain the C-V Characteristics of an Ideal MOS capacitor. Derive the expression for threshold voltage.
  2. Explain working principle of MOSFET.

- B) Attempt any ONE.** **04**
1. Draw and explain the subthreshold characteristics of an n-channel MOSFET.
  2. Explain IV characteristics of MEOFET.

- Q.5**    **Attempt any FOUR.** **12**
1. Find the room temperature resistivity of an n-type silicon doped with  $10^{16}$  phosphorous atom/cm<sup>3</sup>.
  2. A silicon ingot is doped with  $10^{16}$  arsenic atom/cm<sup>3</sup>. Find the carrier concentration and the Fermi level at room temperature 300k.
  3. Write a short note on
    - 1) Mobility.
    - 2) Drift velocity.
    - 3) Drift current.
  4. Write a short note on diffusion.
  5. Write down the difference between conductor semiconductor and insulator in terms of band gap energy.
  6. Find the (E, K) relationship for free electron and relate it to the electron mass.
  7. Write a short note on p-type semiconductor.
  8. Write a short note on effective mass of a semiconductor.

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