[This question paper contains 3 printed pages.]

Your Roll No. .....

8282 **JS**

B.Sc. Prog./II

EL–202—SEMICONDUCTOR DEVICES AND FABRICATION

(Admissions of 2005 and onwards)

Time : 3 *Hours* *Maximum Marks* : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any **Five** *questions.*

All *questions carry equal marks.*

1. (a) What are intrinsic and extrinsic semiconductors ? Why at a high temperature, both extrinsic and intrinsic semiconductors behave alike ? 5

   (b) Give the energy band diagram of *n*-type and *p*-type semiconductors. 4

   (c) If a silicon sample with intrinsic concentration 1.5×10^{10} cm^{-3} is doped with 10^{17} As atoms cm^{-3}. What is the position of Ferm level (E_F) relative to intrinsic Fermi level (E_i) ? 3

   (d) Define drift velocity and mobility of a charge carrier. 3

2. (a) Discuss Kronig–Penney model for the motion of an electron in a crystal lattice. 12

P.T.O.

(b) What is the effective mass of an electron ? 3

3. (a) What is depletion region ? Derive an expression for the width of the depletion region in a PN junction. How does it vary with forward and reverse bias ? 12

(b) Draw an equilibrium energy band diagram for an unbiased PN junction diode. 3

4. (a) Discuss the structure, working and uses of Light Emitting diode. 6

(b) Explain why Zener breakdown voltage has a negative temperature coefficient, and Avalanche breakdown has positive temperature coefficient. 5

(c) Draw the energy band diagram of a bipolar transistor in Thermal equilibrium. 4

5. (a) Draw the structure of a *n*–channel JFET. Explain the terms, source, gate, drain, channel and hence discuss its working and drain characteristics. 10

(b) "A BJT is a current controlled device whereas FET is a voltage controlled device." Explain. 3

(c) When V_{gs} of a JFET changes from – 3.1 V to – 3.0 V. The drain current changes from 1 mA to 1.3 mA. What is the value of the transconductance ? 2

6. (a) What are the different types of MOSFETS ? Explain with diagram the structure and working of an enhancement type MOSFET. 10

(b) Draw the equilibrium energy band diagram of a metal–semiconductor junction for a *p*-type semiconductor and a metal whose work function is smaller than work function of semiconductor. 5

7. (a) Describe how integrated resistors and capacitors are fabricated. 10

(b) Compare diffusion and ion-implantation processes for doping during IC fabrication. 5

8. Write short notes on *any two* of the following : 7½ + 7½

(a) Hall Effect

(b) Tunnel Diode

(c) Photo lithography

(d) Moore's Law