

Total No. of Questions : 6]

SEAT No. :

**P2222**

[Total No. of Pages : 2

**[5331] - 204**

**M.Sc. -I**

**ELECTRONIC SCIENCE**

**EL 2 UT08: Foundation of Semiconductor Devices**

**(2013 Pattern) (Credit System) (Semester - II)**

*Time : 2½ Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *Answer any four questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of non-programmable calculator is allowed.*

**Q1)** Attempt the following:

- a) Explain Eber-moll model of BJT. **[4]**
- b) Why the electron generation rate and recombination rate equal in thermal equilibrium? Comment. **[3]**
- c) Assume that in an n-type GaAs semiconductor at  $T = 300\text{K}$ , the electron concentration varies linearly from  $1 \times 10^{18}$  to  $7 \times 10^{17} \text{ cm}^{-3}$  over a distance of 0.1 cm. Calculate the diffusion current density if the electron diffusion coefficient is  $D_n = 225 \text{ cm}^2$ . **[3]**

**Q2)** Attempt the following:

- a) What is Hall effect? Derive the relation for Hall coefficient. **[4]**
- b) Define any three performance parameters of JFET. **[3]**
- c) Calculate the De Broglie wavelength of an electron which has kinetic energy 15eV. **[3]**

**P.T.O.**

**Q3)** Attempt the following:

- a) Explain the working principle of heterojunction bipolar Transistor. [4]
- b) Explain the concept of effective mass of electron. [3]
- c) How p-n junction is formed? What is meant by potential barrier? [3]

**Q4)** Attempt the following:

- a) Explain the difference between SC, FCC and BCC. [4]
- b) What is meant by complete ionization of donor states and acceptor states? [3]
- c) What is Miller Indices? What are Miller indices of plane making intercepts 2a, 3b and 6c on three axes? [3]

**Q5)** Attempt the following:

- a) What is Schrodinger equation? Derive time independent schrodinger equation for a free particle. [5]
- b) Draw band diagram and show variation of Fermi distribution function for [5]
  - i) intrinsic
  - ii) n-type
  - iii) p-type semiconductor at thermal equilibrium.

Show that product of electron and hole concentration is given by  
 $n_o p_o = n_i^2$ .

**Q6)** Attempt the following:

- a) Explain ideal current voltage relation for n-channel MOSFET for [5]
  - i) enhancement mode
  - ii) depletion mode
- b) Explain the Czochralski methods for semiconductor crystal growth. [5]

*EEE*