



(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 131313**

Roll No.

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## B. Tech.

(SEM. III) (ODD SEM.) THEORY

EXAMINATION, 2014-15

FUNDAMENTAL OF ELECTRONIC DEVICES

Time : 3 Hours]

[Total Marks : 100

Notes : Attempt all questions.

1 Attempt any four questions : 4×5=20

- a. Describe briefly lattice structure of silicon.
- b. Si sample is doped with  $10^{20}$  As atoms/cm<sup>3</sup>. what is equilibrium concentration of holes at 300 K? Where is  $E_f$  (i.e. Fermi level). Draw the energy band diagram to show the position of  $E_i$  and  $E_f$ . Take  $n_i = 1.5 \times 10^{10}$  cc.
- c. Explain the effect of temperature and doping on mobility.
- d. Show that the minimum conductivity of a semiconductor sample occur when

$$n_0 = n_i \sqrt{\frac{\mu_p}{\mu_n}} \text{ . What is the expression for minimum}$$

conductivity.

- e. Explain high field effect.

2 Attempt any two questions :  $2 \times 10 = 20$

- a. Derive the expression for current density in terms of diffusion length.
- b. Explain the process of diffusion. Derive the expression of continuity equation.
- c. Explain absorption coefficient. A 0.46 micrometer thick sample of Ga-As is illuminated with monochromatic light of  $h\nu = 3\text{eV}$ . The absorption coefficient is  $6 \times 10^4/\text{cm}$ . the power incident on the sample is 11 mW.
  - i. Find the total energy absorbed by the sample per second.
  - ii. Find the rate of excess thermal energy given up by the electrons to the lattice before recombination.

3 Attempt any four questions :  $4 \times 5 = 20$

- a. Write down the difference between Zener and avalanche breakdown.
- b. Derive the expression for contact potential of a p-n junction.
- c. Define junction capacitance and its types.
- d. Write a short note on :
  - i. Varactor diode
  - ii. Switching diode
- e. Consider a silicon abrupt P-N junction at 300 K with  $N_a = 10^{18} \text{ cc}$  and  $N_d = 10^{15} \text{ cc}$ . Taking  $n_i = 1.5 \times 10^{10} \text{ cc}$ , calculate the value of contact potential. Calculate the width of depletion region.

4 Attempt any two questions.  $2 \times 10 = 20$

- a. Explain the working of HEMT and also discuss its advantages.
- b. Discuss briefly the principle of operation of depletion and enhancement type MOSFET.
- c. Explain ebers-moll model.

5 Attempt any two questions :  $10 \times 2 = 20$

- a. Write a short note on:
  - i. SCR
  - ii. Gunn diode
- b. Write a short note on:
  - i. Double heterojunction LED
  - ii. Working principle of laser.
- c. Explain the working of solar cell. Discuss open circuit output voltage characteristic and short circuit current characteristic.