



(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/cm³. 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

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

- e. Explain high field effect.

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

- Derive the expression for current density in terms of diffusion length.
- Explain the process of diffusion. Derive the expression of continuity equation.
- 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.
 - Find the total energy absorbed by the sample per second.
 - Find the rate of excess thermal energy given up by the electrons to the lattice before recombination.

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

- Write down the difference between Zener and avalanche breakdown.
- Derive the expression for contact potential of a p-n junction.
- Define junction capacitance and its types.
- Write a short note on :
 - Varactor diode
 - Switching diode
- 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. $2 \times 10 = 20$

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

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

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