Printed Pages : 4 EEC301

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

PAPER ID : 0322 Roll No.

B.Tech

(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10
FUNDAMENTALS OF ELECTRONICS DEVICES

Time : 3 Hours] *[Total Marks : 100*

Note : *Attempt **all** the questions. All questions carry **equal** marks.*

1 Attempt any **four** parts of the following :

(a) Derive the formula for Density and lattice constant.

(b) What is atomic radius and atomic packing factor ? Calculate it for simple cubic structure.

(c) What do you mean by mobility of carrier ? How does it depend on temperature and doping concentration ?

(d) Explain the basic crystal growth techniques.

(e) What is Hall effect and Hall angle ? Show that $Q_H = \tan^{-1}\left(\mu_n B_z\right)$ where symbols have their usual meaning.

(f) In an intrinsic semiconductor the effective mass of the electron is 0.07 m_0 and that of the hole is 0.4 m_0, where m_0 is the rest mass of the electron. Calculate the intrinsic concentration of change carriers at 300°K given by E_g = 0.7 eV.

2 Attempt any **four** parts of the following :

(a) Find the diffusion coefficients of electrons and holes of a silicon single crystal at 27°C if the mobilities of electrons and holes are 0.17 and 0.025 m^2 $V^{-1}\rho^{-1}$ respectively at 27°C.

(b) Design a $5\,\mu M$ cds photoconductor with $10\,M\Omega$ dark resistance, 0.5 cm square. Assume $\tau = 10^{-6} s$ and $N_d = 10^{14} cm^{-3}$.

(c) Obtain relationship between photoconductivity and mobility of carriers.

(d) Define mobility of a change carrier. Show that

$$\frac{\mu}{D} = \frac{e}{KT}.$$

(e) Using the concept of diffusion and drift of carriers establish Einsteins relation and modified from of Ohm's law.

(f) Define :

(i) Photoconductivity

(ii) Luminescense.

3 Attempt any **two** parts of the following :

(a) What do you mean by zener diode ? Explain how zener diode maintains constant voltage across the load.

(b) Consider a Ge diode with $N_D = N_A$ and with impurity concentration of $8 \times 10^{14} / cm^3$. Assume $\eta_i = 2 \times 10^{13} / cm^3$. At room temperature of 300 K calculate the height of the potential barrier under open-circuit conditions. Assume Boltzmann's constant K = 8.61×10^{-5} eV/k and electron charge $\rho = 1.6 \times 10^{-19} C$. Describe the Schotky diode in detail.

(c) What do you mean by reverse bias break down ? Calculate the thermal equilibrium electron and hole concentration in a compensated P-type silicon semiconductor at 300°K in which

$N_A = 10^{16} cm^{-3}$, $N_D = 3 \times 10^{15} cm^{-3}$ and

$\eta_i = 1.6 \times 10^{10} cm^{-3}$.

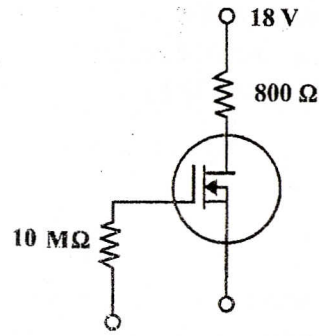
Attempt any **two** parts of the following :

(a) Prove that the transconductance g_m of JFET is given by

$$g_m = \frac{2}{|V_P|} \sqrt{I_{DS} I_{DSS}}$$

(b) What is a MOSFET ? How many types of MOSFETs are there ? Point out the basic difference between the FET and BJT ?

(c) For the N-channel zero biased D-MOSFET circuit of figure below calculate the V_{DS} if $J_{DSS} = 10\ mA$ and $V_{GS(off)} = -6V$



5 Attempt any **two** parts of the following :

(a) What is a photodetector ? Describe the working of solar cell. What are the applications of these devices ?

(b) Explain the tunnel diode in detail. What are its applications ?

(c) Describe the characteristics and application of SCR and P-N-P-N diode.