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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, January 2015
(2008 Scheme)
08.302 : SOLID STATE DEVICES (TA)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Prove that the charge carrier "hole" has positive charge.
2. Show that $f(E_F + \Delta E) = 1 - f(E_F - \Delta E)$, where f(E) is the fermi function.
3. A silicon sample is doped with 10^{16} boron atoms per cm^3 and a certain number of donors. If the fermi level is 0.36 eV above Ei at 300 K, what is the donor concentration N_d ?
4. What are quasi Fermi levels ? Explain their significance.
5. Derive an expression for the diffusion capacitance in a p^+n Junction.
6. Draw the Energy Band diagram of an ideal hetero junction between a p type wide band gap semiconductor and n type narrower band gap semiconductor at equilibrium.
7. Explain base width modulation in a BJT, How does it affect various parameters of the BJT.
8. A P channel Si JFET has channel doping $Na = 10^{15}\ cm^{-3}$ and gate doping $Nd = 10^{17}\ cm^{-3}$ and width of the channel 2a = 4 microns. Determine pinch off voltage.

P.T.O.

9. Draw the structure of a MOS capacitor in which the semiconductor is p type silicon. Draw its Energy Band diagram when it is in depletion condition.

10. Draw the structure of a UJT. What is intrinsic stand off ratio. Write one application of UJT. **(10×4=40 Marks)**

PART – B

Answer **any two** questions from **each** Module. **Each** question carries **10** marks.

Module – I

11. Derive the steady state continuity equation. Assume that the only carrier transport mechanism is diffusion.

12. Derive expressions for the equilibrium carrier concentrations in an extrinsic semiconductor.

13. What is Hall effect ? Explain how the carrier concentration in a semiconductor and carrier mobility can be found out experimentally.

Module – II

14. Explain Zener and Avalanche break down mechanisms with the help of relevant diagrams. Explain why a zener diode can be used for regulation application.

15. Derive expressions for
    a) Electric field distribution in the depletion region
    b) Width of the depletion region and
    c) Built-in-potential of a linearly graded pn junction at equilibrium.

16. Derive expressions for the terminal currents of a pnp transistor. State the approximations used.

Module – III

17. Derive expressions for the drain current of a JFET. What are the approximations used ?

18. a) Derive an expression for the threshold voltage of an ideal MOS capacitor.

    b) Draw the structure of :

    i) n channel enhancement MOSFET and

    ii) p channel depletion MOSFET.

19. With the help of suitable diagrams explain the principle of operation of

    i) SCR and

    ii) IGBT.

    [Given KT = 0.0259 eVat 300 K $\epsilon_r = 11.8\ \epsilon_o = 8.85 \times 10^{-14}$ F/cm, $n_i = 1.5 \times 10^{10}\ cm^{-3}$ at 300 K] $q = 1.6 \times 10^{-19}$ C.
