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Your Roll No. ....

**B.Sc. Prog. / II**

**C**

**EL-202 – SEMICONDUCTOR DEVICES AND  
FABRICATION**

(Admissions of 2005 and onwards)

*Time : 3 Hours*

*Maximum Marks : 75*

*(Write your Roll No. on the top immediately  
on receipt of this question paper.)*

*Attempt any Five questions.*

*All questions carry equal marks.*

1. (a) Differentiate between Extrinsic and Intrinsic semiconductor. When an intrinsic semiconductor is doped to form an extrinsic semiconductor, how does its Fermi level change? Explain using Energy band diagram. (5)
- (b) What is law of mass-action? When an intrinsic semiconductor is doped to form a N-type semiconductor, with its hole concentration change? Explain. (4)

P.T.O.

- (c) What is Hall's Effect ? A sample of Si is doped with  $10^{23}$  boron atoms/ $m^3$ . If the mobility of hole is  $0.04 m^2/V\cdot S$ , find the resistivity of the sample. If the thickness of the sample is  $100 \mu m$  current  $I_x = 1 mA$  and  $B_z = 0.1$  tesla, find the Hall's voltage. (6)
2. (a) Derive an expression for hole concentration in valence band. (8)
- (b) How does the conductivity of an extrinsic semiconductor change with temperature ? (3)
- (c) What are direct and indirect band gap semiconductors ? Explain using E-K diagram. Also give example of each. (4)
3. (a) Derive the relation :

$$V_B = \frac{KT}{e} \ln \left( \frac{N_a N_d}{n_i^2} \right)$$

where  $V_B$  = potential barrier

$N_a$  = concentration of acceptor atoms

$N_d$  = concentration of donor atoms

$n_i$  = intrinsic carrier concentration

$K$  = Boltzmann constant

$T$  = Absolute temperature

$e$  = electronic charge (8)

- (b) What is depletion region ? Discuss how depletion region width changes with forward and reverse bias. (4)
- (c) What is reverse saturation current in a PN junction ? How does it change with temperature ? (3)
4. (a) Derive an expression for transition capacitance of a reverse biased P-N junction and hence discuss the working and uses of a varactor diode. (8)
- (b) Explain the working of a transistor. Can the emitter and collector of a transistor be interchanged ? Why ? (7)
5. (a) Draw the structure of a p-channel JFET. Give its circuit symbol. Discuss the working and hence explain the I-V characteristics of a JFET. (10)
- (b) What are the differences between FET and BJT. (5)
6. (a) What is enhancement type MOSFET ? Explain its construction, working and drain characteristics. Why is it called 'Normally OFF' MOSFET ? (10)
- (b) Explain how potential barrier arises in a Metal-semiconductor rectifying contact. (5)

7. (a) Explain briefly the processes of epitaxy and diffusion. (8)
- (b) Explain with diagram the steps involved in fabrication of a P-N junction diode. (7)
8. Write short note on any two of the following :
- (a) Ion Implantation
- (b) Varactor Diode
- (c) Thermal Oxidation of Si
- (d) Solar cell (7½, 7½)