

**RAJ KUMAR GOEL INSTITUTE OF TECHNOLOGY & MANAGEMENT, GZB**  
**1st Sessional Examination 2017-18 ( Odd Semester)**

**Roll No.:**  
**Year/Branch: 2/ EC**  
**Max Time: 1Hours 30 Minute**

**Subject Name: EDC**  
**Subject Code: REC 302**  
**Max Marks: 50**

**SECTION-A**

**Q.1 Attempt all parts carry equal marks. Write answer of each part in short. (2x5=10)**

- a) Discuss about the quasi Fermi level.
- b) Differentiate between N-type & P-type semiconductors.
- c) State law of mass action.
- d) Explain the temperature dependence of carrier concentration.
- e) A n-type semiconductor is to have a resistivity 10 ohm-cm. Calculate the number of donor atoms which must be added to achieve this. Given that  $\mu_d = 500 \text{ cm}^2/\text{V-s}$ .

**SECTION-B**

**Note: Attempt any five questions from this section. (5x5=25)**

**Q.2** Explain the various bonding forces in solids in detail.

**Q.3** Discuss the Direct recombination of electrons & holes in detail.

**Q.4** Define fermi level.

In an N-type semiconductor, the Fermi-level lies 0.3 eV below the conduction band at room temperature. If the temperature is increased to 330 K, find the position of Fermi-level.

**Q.5** State about the optical absorption. Explain the three situations which normally arise with photon energy conditions.

**Q.6** Discuss diffusion of carriers. Find the diffusion coefficients of electrons & holes of a silicon Single crystal at 27°C if the mobilities of electrons & holes are 0.17 & 0.025m<sup>2</sup>/V-s, respectively at 27°C.

**Q.7** Describe the construction & working of solar cell.

**Q.8** Consider a Si abrupt P-N junction at 300 K with  $N_a = 10^{18}/\text{cm}^3$  &  $N_d = 10^{15}/\text{cm}^3$ , Taking  $n_i = 1.5 \times 10^{10}/\text{cm}^3$ , calculate the value of  $V_B$ . For Si, permittivity =  $1.05 \times 10^{-12} \text{ F/cm}$ . Also calculate the zero bias depletion width.

**Q.9** Explain the V-I characteristics of a photodiode. Also differentiate PIN & Avalanche photodiode.

**SECTION-C**

**Note: Attempt any two questions from this section. (7.5x2=15)**

**Q.10** Prove that the concentration of holes in an intrinsic semiconductor is given by

$$P = N_V e^{-(E_F - E_v)/KT}$$

**Q.11** Develop expression to establish relation between diffusion coefficient & mobility of carrier

$$D/\mu = kT/q$$

**Q.12** Show that the built in potential voltage in a P-N junction can approximately be given by

$$V = kT/q \cdot \log_e(N_a N_d / n_i^2)$$