Q1. Describe behaviour of Semiconductor in an electric field by E-K diagram and E-Verses Position bad diagram. (4)

Q2. Derive an expression for determining the effective mass of a charge carrier in a band. (2)

Q3. Describe how Fermi-distribution function leads to p- and n-type semiconductors. (4)

Q4. A Si bar of 0.1 cm long 100 μm^2 cross-sectional area is doped with $10^{17}/cm^3$ phosphorus. Find current at 300K with 10V applied. Given μ_n = 700 cm^2/ V-S (3)

Q5. Consider a semiconductor bar of length 5 mm, width 0.1 mm and thickness 10 µm placed in a magnetic field of strength 10 KG. The direction of the magnetic field is pointing up-words to the plane of the bar. A current of 1 mA is passing through the bar when a voltage of 100 mV is applied. Under these conditions the observed Hall voltage is -2mV. Find the type, concentration mobility of majority charge carriers. (4)

Q6. Derive an expression for minimum conductivity of a semiconductor. (3)

Q7. A 0.46 µm thick GaAs sample is illuminated with a monochromatic light of hν= 2eV. The absorption co-efficient is 5 x 10 4 /cm. The power incident on the sample is 10 mW. (3)

i) Find the total energy absorbed by the sample per second.
ii) Find the rate of excess thermal energy given-up by the electrons to the lattice before recombination.

Q8. How can you understand the mechanisms of recombination and trapping experimentally? (4)

Q9. Derive an expression to determine the diffusion co-efficient given mobility of the charge carrier or vice-versa. (3)

Q10. Briefly explain the principle of experiment to determine the parameters of minority charge carriers in a semiconductor. (3M)

Q11. A Si sample with 10 16/cm 3 donors is optically excited such that 10 19/cm3 electron-hole pairs are generated per second uniformly in the material. Find the quasi fermi levels and change in conductivity upon shining. Given that $\tau_p = \tau_n$ = 10 µSec., , D_p = 12 cm 2/ sec., D_n = 36 cm 2/ Sec. What is the change in conductivity upon shining? (5)

Q12. Why quasi Fermi levels are also called Electro-chemical potentials? (2)

Q13. Explain minority charge carrier currents in the PN- junction and derive expression for total diode current. (5)

Q14. Explain charge storage effects in PN diode under transient conditions. (3)

Q15. Find an expression for electron current in n-type material of forward biased PN junction. (2)