Started on	Friday, 27 August 2021, 4:57 PM
State	Finished
Completed on	Friday, 27 August 2021, 6:26 PM
Time taken	1 hour 28 mins
Grade	**8.00** out of 20.00 (**40**%)

Question **1**

Not answered

Marked out of 3.00

Consider an n-type Si sample at room temperature doped with $10^{15}/cm^3$ arsenic atoms. The bar is excited with an electrical source which results into generation of excess EHP at the rate of $10^{18}/cm^3$-s. If it is found that the diffusion coefficient and the diffusion length of the minority carriers are $30/cm^2$-s and 100 μm respectively, then find the following:

(a) lifetime of the minority carrier

(b) excess carrier concentration as a function of time

(c) the position of the quasi-fermi energy levels w.r.t intrinsic fermi energy level after 100 ns

Answer:

Question **2**

Complete

Mark 2.00 out of 3.00

Consider a silicon crystal at 300 K, with the Fermi level 0.20 eV above the valence band. What type is the material? What are the electron and hole concentrations?

Answer: P-Type Semiconductor. Concentration of Hole is 4.541*10^15 /cm^3. Concent

Comment:

Question **3**

Complete

Mark 2.00 out of 2.00

Recall the relationship of intrinsic carrier concentration, n_i and temperature, T and plot n_i Vs T. Scan your answer and upload the same.

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Comment:

Question **4**

Complete

Mark 1.00 out of 2.00

If the electric field is directed from left to right in a semiconductor and the hole concentration increases from right to left. Indicate the direction of the drift current densities of electrons and hole. Also, indicate the direction of the diffusion current densities due to electrons and holes.

Answer: Drift current density of hole is directed towards left to right and for electron is

Comment:

Question **5**

Complete

Mark 2.00 out of 2.00

Calculate the average time taken by an electron to drift 1 µm in intrinsic Silicon under the effect of electric field with magnitude of 10 V/cm. Assume room temperature operation and the mobility of electrons is 1350 cm^2/V-s

Answer: 7.407*10^-9 seconds

Comment:

Question **6**

Complete

Mark 1.00 out of 2.00

A material is doped such that the electron concentration varies linearly across the sample, which is 0.5 µm thick. Donor concentration varies from 0 (at x = 0) to $10^{16}/cm^3$ (at x = 0.5 µm). Determine the electron and hole diffusion current densities, if the diffusion coefficient of electrons and holes are 30 cm^2/V-s and 12 cm^2/V-s respectively.

Answer: Diffusion current density of electron is 961.305 A/cm^2. Diffusion current den

Comment:

Question **7**

Complete

Mark 0.00 out of 2.00

If the bandgap of Silicon is 1.12 eV and that of Germanium is 0.67 eV. Find the ratio between the intrinsic carrier concentrations of Silicon and Germanium (n_i(Si)/n_i(Ge)). Assume the temperature to be room temperature and the N_c and N_v to be same for the two semiconductors.

Answer: 6*10^-4.

Question **8**

Complete

Mark 0.00 out of 2.00

A Silicon sample with $10^{15}/cm^3$ acceptor type dopant is uniformly optically excited at room temperature such that $10^{21}/cm^3$ excess charge carrier get generated per second. If the lifetimes of the charge carriers are 10 µs, what is the conductivity of the sample if the mobilities of electrons and holes are 1350 cm^2/V-s and 450 cm^2/V-s?

Answer: 2.23 S/cm^3

Question **9**

Not answered

Marked out of 2.00

Consider a Silicon bar doped with donor type dopants with a concentration of $10^{16}/cm^3$. Due to a constant applied voltage EHP is also getting generated, the steady state concentration being $10^{14}/cm^3$. If the lifetime of the carriers is 5 µs, plot concentration Vs time for both majority as well as minority charge carriers. Scan your answer and upload the same.

◄ p-n junctions fabrication steps

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Mid sem answer keys ►