Indraprastha Institute of Information Technology
Department of ECE
Physics of Semiconductor Devices (ECE-210)
Assignment 2, Deadline: April 22, 2025

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Q.1. (a) For a MS junction, the following Electric field V/s distance profile is given in Figure 1. The dopant concentration in the semiconductor is $3.5 \times 10^{15} cm^{-3}$; determine if the semiconductor is n-type or p-type.

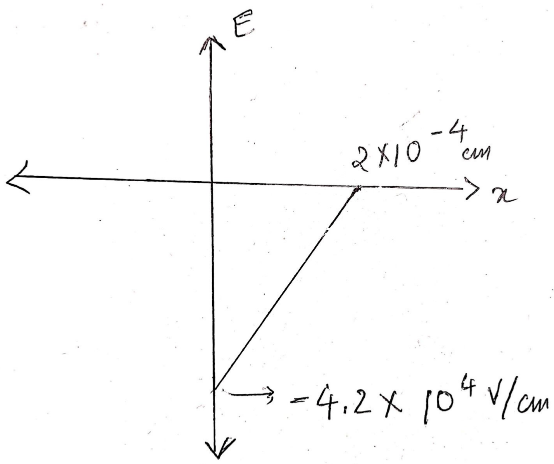

Figure 1:

(b) A Schottky barrier is formed on n-type Si, which has $N_d = 2.5 \times 10^{15} cm^{-3}$, and Φ_B= 0.55V and electron affinity as 4.01V. Determine V_{bi}? If the doping concentration is increased to $3 \times 10^{16} cm^{-3}$, what would be the change in V_{bi}?

[5 marks]

Q.2. The hole concentration in p-type GaAs is given by $p(x) = 10^{16}(1 + x/L)^2$ cm^{-3} for $-L \leq x \leq 0$ where L = 12 μm. The hole diffusion coefficient is $D_P = 10$ cm^2/s. Calculate the hole diffusion current density at x = 0 μm. **[5 marks]**

Q.3. Consider the uniformly doped GaAs junction at $T = 300\,\mathrm{K}$. At zero bias, only 20 percent of the total space charge region is to be in the p-region. The built-in potential barrier is $V_{\mathrm{bi}} = 1.20\,\mathrm{V}$ and the relative permittivity $\varepsilon_r = \varepsilon_0 = 8.85 \times 10^{-14}\,\mathrm{F/m}$. Calculate the acceptor impurity concentration, N_a. **[5 marks]**