

SSP Exercise 7

To be handed in by 4pm, Thursday 15th March.

1. How does the reverse current $J_e^{drift}(p-n)$ of a Si $p-n$ junction change if the temperature raises from 20 to 50 $^{\circ}\text{C}$? Find the same for a Ge $p-n$ junction. Band gaps of Si and Ge are 1.12 and 0.66 eV, respectively. Hint: Express the change as a ratio of reverse currents $J_e^{drift}(T_2)/J_e^{drift}(T_1)$.

[10 marks]

2. Find the height of the potential barrier for a Au-n-Ge metal-semiconductor (Schottky) contact at room temperature ($T = 300\text{ K}$) if $\rho = 1\ \Omega\ \text{cm}$, work function $\Phi_{\text{Au}} = 5.1\ \text{eV}$, and $\chi_{\text{Ge}} = 4.0\ \text{eV}$. Electron mobility in Ge is $3900\ \text{cm}^2\ \text{V}^{-1}\ \text{s}^{-1}$, density of the states in the conduction band is $N_C = 1.98 \times 10^{15} \times T^{3/2}\ \text{cm}^{-3}$.

[10 marks]