

EE 207, Quiz 2

(Total marks: 10, Closed book exam)

Roll Number:

In case of any apparent ambiguity or inconsistency or missing parameters, DON'T ASK. State your assumptions and solve the problem accordingly.

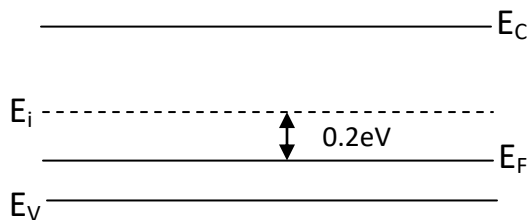
Question 1.

(a) Write down the Fermi-Dirac distribution for the occupation probability of an electron and also define/mention the variables involved (1 mark).

(b) Plot the above distribution for $T=0K$. Also plot for two different non-zero temperatures, T_1 and T_2 , where $T_1 > T_2$ (2 marks).

Question 2.

(a) The band diagram shown below represents a Si sample (assume $n_i = 10^{10} \text{ cm}^{-3}$ at $T=300K$). Find the effective doping density and type of dopants (2 marks).



(b) Draw the energy band diagram if the above sample is further doped with $5 \times 10^{17} \text{ cm}^{-3}$ donor impurities. Assume complete ionization of dopants (2 marks).

(c) At what temperature does the above sample (i.e., the sample in part (b)) become intrinsic? You can neglect the temperature dependence of the effective density of states (N_c, N_v), or rather, assume $n_i \propto e^{-E_G/2kT}$ (3 marks).