Name: Student ID:

1. Consider silicon at $T = 300$ K with doping concentrations of $N_d = 8 \times 10^{15}$ cm^{-3} and $N_a = 5 \times 10^{15}$ cm^{-3}. Determine the position of the Fermi energy level with respect to the donor level E_d, as well as the Fermi energy level with respect to the acceptor level E_a.

2. Assume the donor concentration in an n-type semiconductor at $T = 300$ K is given by $N_d(x) = 10^{16} e^{-x/L}$ where $L = 2 \times 10^{-2}$ cm. Determine the induced electric field in the semiconductor at (a) $x = 0$ and (b) $x = 10^{-4}$ cm. Please provide the process of derivation.