In a p-type semiconductor with donor concentration $N_D$ and acceptor concentration $N_A$, where $N_A > N_D$.

a. State and explain the charge neutrality equation.

b. State the mass action law and explain what it represents.

c. Solve the above stated two equations to find $n$ and $p$ as functions of $n_i$, $N_D$ and $N_A$ only (no numbers.)

2. Numerical application: for $N_D = 2 \times 10^{14}$ cm$^{-3}$ and $N_A = 2.75 \times 10^{14}$ cm$^{-3}$.

a. Calculate $n$ and $p$ using the exact solutions found above at $T = 200$ K, 300 K, 400 K, and 600 K.

b. Calculate $n$ and $p$ using the approximate solutions given in the lecture at $T = 200$K, 300K, 400K and 600K.

c. Using MATLAB draw $n$ and $p$ vs $T$ for both cases, exact and approximate, for $T = 200$ K to 600 K.

d. What is your conclusion?

3. Problems: 2-5, 2-7, 2-24 and 2.43