ECE3312 Practice Exam 1

1. A silicon sample at room temperature has an intrinsic carrier concentration of $n_i = 5 \times 10^9$ cm^{-3}. It is doped with $N_D = 6.1 \times 10^{16}$ arsenic atoms/cm^3 and $N_A = 6 \times 10^{12}$ boron atoms/cm^3. The electron mobility is measured as $\mu_n = 1600$ $cm^2/V \cdot s$ and the hole mobility is $\mu_p = 480$ $cm^2/V \cdot s$.

   Is this material p or n-type?

   What is the hole concentration?

   If an external electrical field of E =90V/cm is applied across this silicon sample, what is the electron current density in this material?

2. Which figure above shows the correct sign convention for both positive diode voltage and positive diode current?

   a) $\quad$ b) $\quad$ c) $\quad$ d) $\quad$ e) None of these
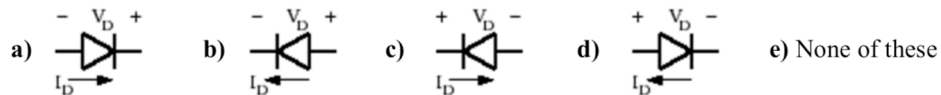
3. A diode has $I_S = 10^{-10}$A and the nonideality factor, n = 2. What is the diode voltage if the diode current is 40A? $V_T = 0.025V$ for room temperature.

4. Find the current in each diode in the circuit shown below using the constant voltage drop model with $V_{on} = 0.70$ V.

+6 V

22 kΩ

D_2

D_1

50kΩ

-9 V
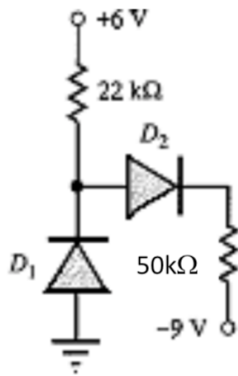
5. For the circuit shown below, if a sinusoidal wave is applied to the input, which one of the curves is the output voltage? (Assume $V_{on}=0.7$V)

5V

V_{out}

V_{in}

10k

(a) V_{out}

5.7V

t

(b) V_{out}

-5.7V

t

(c) V_{out}

10.7V

t

(d) V_{out}

5V

t

(e) V_{out}

4.3V

t

(f)

None of these