ECE 320 - Homework #2

Semiconductors, PN Junction, Diode VI Characteristics. Due Wednesday, September 5th, 2018

Semiconductors

1) Why does the resistance of silicon decrease as temperature goes up?

2) What doping do you need to make an 0603 resistor have a resistance of 1000 Ohms? The dimensions of an 0603 resistor are

L = 1.6mm, W = 0.8mm, H = 0.45mm

3) A thermistor has the following resistance - voltage relationship

$$R = 1000\left(\frac{3905}{T} - \frac{3905}{298}\right)\Omega$$

where T is the temperature in degrees Kelvin. What is the resistance you'll read at

- -70C (dry ice)
- 0C (freezing point of water)
- 100C (boiling point of water)

PN Junction

4) Why can current flow p to n but not n to p?

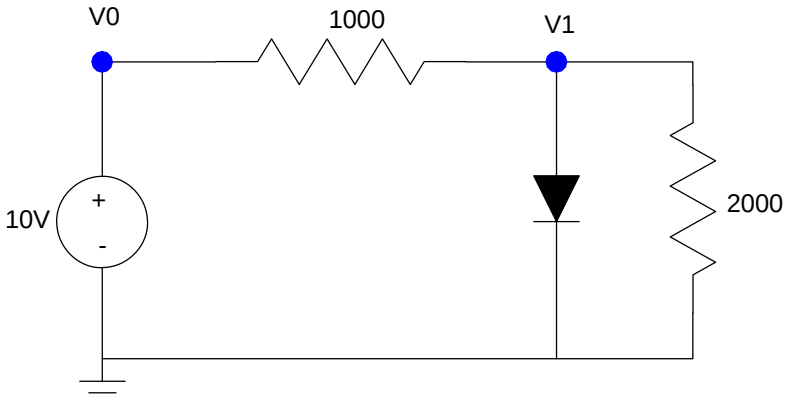
Diode VI Characteristics

Assume the VI characteristics for a diode are

$$V_d = 0.052 \cdot \ln\left(\frac{I_d}{10^{-8}} + 1\right) \qquad I_d = 10^{-8}\left(\exp\left(\frac{V_d}{0.052}\right) - 1\right)$$

5) Write the voltage node equations for the following circuit. Solve for V1

6) Check your answer in PartSim. (use Fairchild, Rectifier Diode, 1N4007)



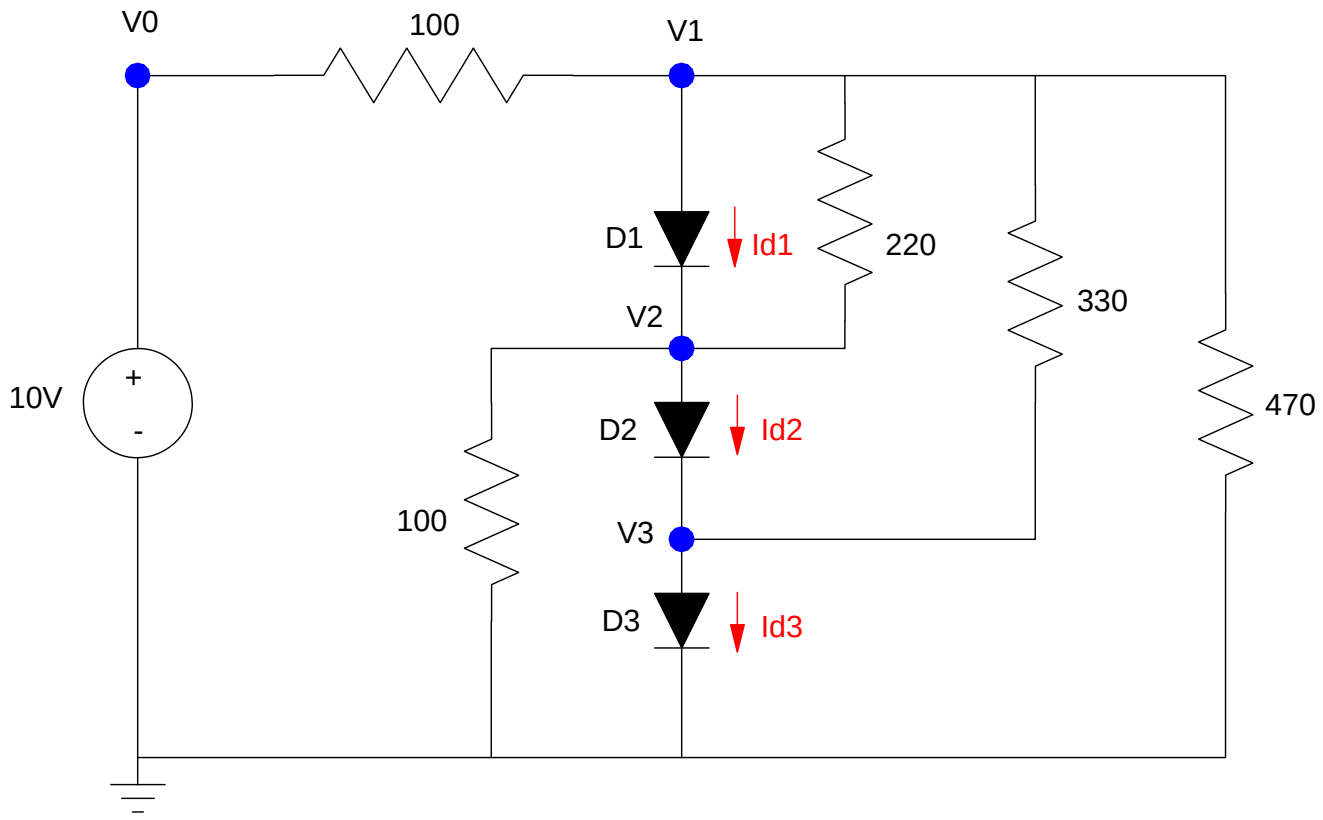
Problem 5 & 6

7) Write the voltage node equations for the following circuit. Solve for V1, V2, and V3

8) Check your results in PartSim. (use Fairchild, Rectifier Diode, 1N4007)

Lab

9) Build this circuit and measure the voltages V1, V2, and V3. Use a 4004 diode (in room 211)



Problem 7, 8, 9