P214/Homework #9 - Due 4/21 by 5 PM **Professor Lynn Cominsky**

Problems are from Tipler Chapter 25:

(1) 8 The power dissipated in a resistor is P when the potential drop across it is V. If the voltage drop is increased to $2V$ (with no change in resistance), what is the power dissipated? (a) P (b) $2P$ (c) $4P$ (d) $P/2$ (e) $P/4$

(2) 28 An automobile jumper cable 3 m long is constructed of multiple strands of copper wire that has an equivalent cross-sectional area of 10 mm^2 (a) What is the resistance of the jumper cable? (b) When the cable is used to start a car, it carries a current of 90 A. What is the potential drop that occurs across the jumper cable? (c) How much power is dissipated in the jumper cable?

(3) 54 A diode is a circuit element with a very nonlinear IV curve. In a diode, $I = I_o(e^{V/(25\text{mV})} - 1)$, where $I_o \sim 2 \times 10^{-9}$ A. Using a spreadsheet program (Excel is recommended), make a graph of I versus V for a typical diode, for both forward biasing ($V > 0$) and back-biasing ($V < 0$). Show that a plot of ln(I) versus V for forward biasing (using $V > 0.3$ V is nearly a straight line. What is the slope of the line?

(4)62 A toaster with a Nichrome heating element has a resistance of 80Ω at 20° C and an initial current of 1.5 A. When the heating element reaches its final temperature, the current is 1.3 A. What is the final temperature of the heating element?

(5) 76 A space heater in an old home draws a 12.5 A current. A pair of 12-gauge copper wires carries the current from the fuse box to the wall outlet, a distance of 30 m. The voltage at the fuse box is exactly 120 V. (a) What is the voltage delivered to the space heater? (b) If the fuse will blow at a current of 20 A, how many 60 W bulbs can be supplied by this line when the space heater is on? (Assume that the wires from the wall to the space heater and to the light fixtures have negligible resistance.) **(Hint: first you have to calculate the resistance of the wire from the fuse box to the wall outlet. This is not negligible, and will produce a voltage drop.)**

(6) 79 Find the equivalent resistance between point a and point b in Figure 25-49. (b) If the potential drop between point a and point b is 12 V, find the current in each resistor.

(7) 89 A length of wire has a resistance of 120 Ω. The wire is cut into N identical pieces that are then connected in parallel. The resistance of the parallel arrangement is 1.875 Ω. Find N.

(8) 98 In the circuit shown in Figure 25-60, the batteries have negligible internal resistance. Find (a) the current in each resistor (b) the potential difference between point a and point b and (c) the power supplied by each battery.

(9) 102 For the circuit shown in Figure 25-62, find (a) the current in each resistor (b) the power supplied by each battery and (c) the power dissipated in each resistor.

(10) 116 Consider the circuit shown in Figure 25-66. From your knowledge of how capacitors behave in circuits, find (a) the initial current through the battery just after the switch is closed (b) the steady state current through the battery when the switch has been closed for a long time and (c) the maximum voltage across the capacitor