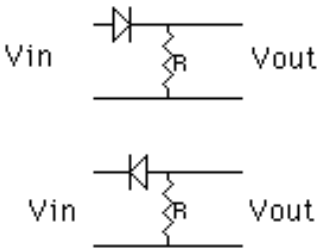
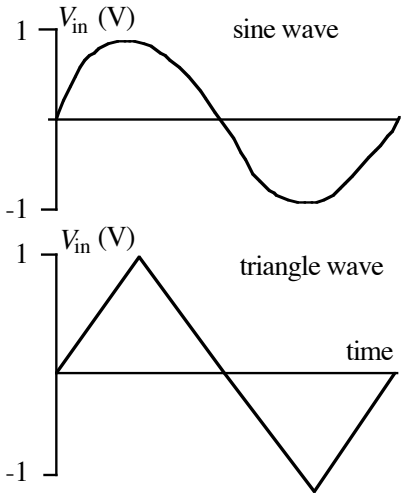
Physics 4700 Homework IV

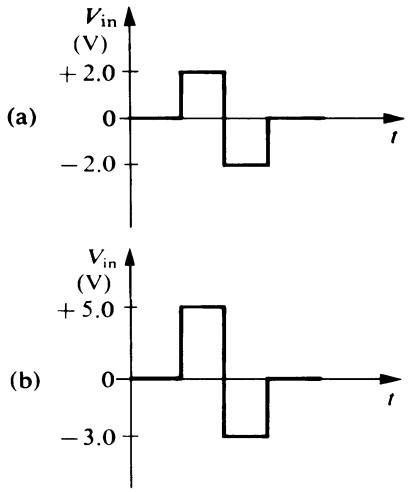
Due: March 2

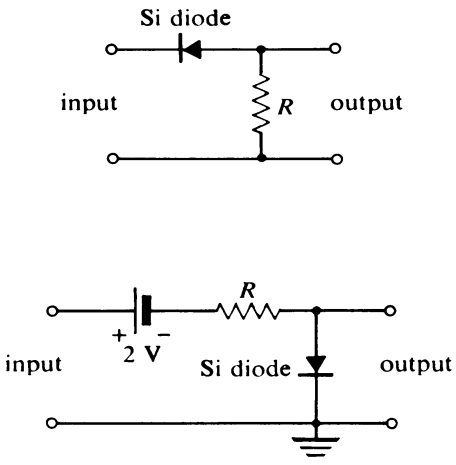
1. Given the following circuits and input waveforms sketch the output waveforms (4 waveforms in all). Assume the diodes are silicon.





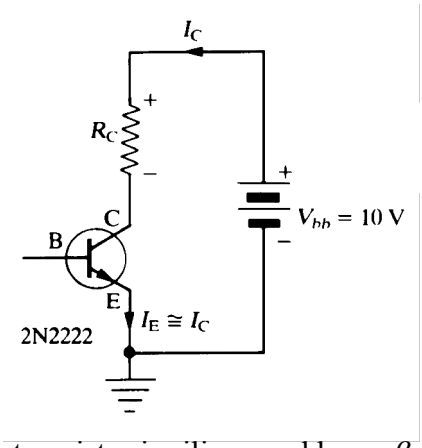
2. Sketch the output waveform to scale for the following.



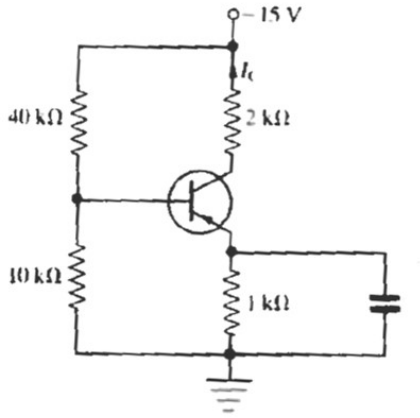


3.
   a. How are I_C, I_B, and I_E related?
   b. How are I_C and I_B related in terms of α? In terms of β?
   c. How are I_C and I_E related in terms of α? In terms of β?
   d. How are I_B and I_E related in terms of α? In terms of β?

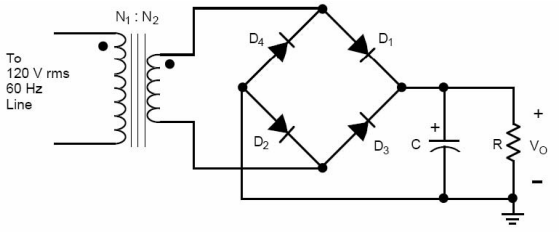
4. In this problem assume that the emitter is grounded and the collector resistor is connected between the collector and power supply. Consider a transistor of with a maximum power dissipation of 200 mW and a 20 V power supply. On the graph of I_C *vs.* V_{CE} sketch the maximum power curve and shade in the forbidden region of operation. Also draw the dc load line for a 2 kΩ collector resistor. Is this a safe load line? Repeat for 400 Ω collector resistor. Is this a safe load line?



5. Calculate I_C and V_{CE}. The transistor is silicon and has a β of 100.



6. Use the 5SPICE program (available on the computers in the lab or download free at www.5spice.com) to simulate the output of a full-wave rectifier. Pick reasonable values for R and C to smooth out the 60 Hz input voltage. When you analyze the circuit with the program you will want to use the *transient* option.



7. Plot V_{out} vs. V_{in} for the following circuit if $V_{in} = V_0 \sin \omega t$, with $V_0 = 2$ V and $\omega = 360$ Hz. Assume the diode is made of silicon.