Physics 208 **AC CIRCUITS HOMEWORK** **Fall 2003**

1) A 60 watt lightbulb is plugged into a standard 115 volt outlet. Find (a) $I_{\rm rms}$, (b) I_0, (c) the maximum instantaneous power.

2) A 3 Ω resistor is connected across a generator having a frequency of 60 Hz and a maximum EMF of 20 volts. (a) Find the angular frequency, ω, of the resulting current. (b) Find $I_{\rm rms}$ and I_0. (c) Find the average power.

3) (a) Calculate the reactance of a 1.0 mH inductor at frequencies of 60 Hz and 6 kHz. (b) Calculate the reactance of a 10 μF capacitor at the same frequencies.

4) Suppose the winding in a motor has an inductance of 50 mH and a resistance of 10 Ω. Find the rms current drawn by the motor when it is connected to a 115 volt (rms) 60 Hz supply.

5) The receiver circuit in a radio needs to be tuned to 1050 kHz. What capacitor would you use in conjunction with a 1 mH inductor to make the circuit resonate at that frequency?

6) A 5 μF capacitor is charged to 30 volts and is then connected across a 10 mH inductor. (a) How much energy is stored in the system? (b) What is the frequency of oscillation? (c) Find the maximum current in the circuit.

7) A 5 μF capacitor is connected in **series** with a 40 Ω resistor, and the combination is attached to an AC oscillator operating at $V_0 = 5$ volts and $\omega = 3000$/s. (a) Draw a phasor diagram with phasors for the current, the voltage drop across the resistor, and the voltage drop across the capacitor. Add the two voltages to obtain a phasor for the source voltage. (b) Find the peak current, I_0. (c) Determine whether the current leads or trails the voltage, and find the phase angle between $I(t)$ and $V_S(t)$.

8) A 5 μF capacitor is connected in **parallel** with a 40 Ω resistor, and the combination is attached to an AC oscillator operating at $V_0 = 5$ volts and $\omega = 3000$/s. (a) Draw a phasor diagram with phasors for the current in the resistor, the current in the capacitor, and the voltage drop across the combination. (Remember that when two elements are connected in parallel the voltage drop across each one is the same.) Add the two currents to obtain a phasor for the net current, $I(t)$, provided by the generator. (b) Find the peak current, I_0. (c) Determine whether the net current leads or trails the voltage, and find the phase angle between $I(t)$ and $V_S(t)$.

9) A series LRC circuit consists of a 5 Ω resistor, a 3 nF capacitor and a 50 μH inductor. The combination is attached to an AC oscillator operating at $V_0 = 5$ volts. Find the peak current (a) at the resonant frequency, (b) 0.8 times the resonant frequency, and (c) 1.2 times the resonant frequency.