Problems

Chapter 11

1. An ac power source is connected to an inductor of inductance $L = 15.0$H. The emf of the power source is given by
$$\mathcal{E} = \mathcal{E}_m \sin(\omega_d t),$$
where $\mathcal{E}_m = 25.0$V and $\omega_d = 400$rad/sec.

   (a) Find the maximum current in the circuit.

   (b) Find the emf of the source at the time the current is a maximum.

2. An ac power source is connected to a capacitor of capacitance $C = 5.00\mu$F. The emf of the power source is given by
$$\mathcal{E} = \mathcal{E}_m \sin(\omega_d t),$$
where $\mathcal{E}_m = 25.0$V and $\omega_d = 400$rad/sec.

   (a) Find the maximum current in the circuit.

   (b) Find the emf of the source at the time the current is a maximum.

3. A series RLC circuit is connected to an ac source of variable frequency. The maximum emf is $\mathcal{E}_m = 10.0$V, $R = 4.00\Omega$, $L = 2.00$H and $C = 2.00\mu$F.

   (a) Find the resonant frequency of the circuit.

   (b) Find the amplitude of the voltage across the inductor at resonance.

   (c) Explain why the voltage across an individual component (inductor) can be greater than the source voltage.

4. A coil of wire has both a resistance and an inductance. The inductance is known to be $L = 0.095$H, but the resistance is unknown. This coil is connected in series to a capacitor of capacitance $C = 0.90\mu$F and an ac source of frequency 1000 Hz. The resulting phase constant is found to be $72°$. Find the resistance of the coil.

5. A series RLC circuit is connected to an ac source of $\mathcal{E}_m = 450$V and $\omega_d = 950$rad/sec. $R = 40\Omega$, $L = 0.50$H and $C = 2.5\mu$F.

   (a) Find the impedence of the circuit.

   (b) Find the current amplitude of the circuit.

   (c) Find the phase constant between the emf and the current.

6. The figure below shows an ac power source of emf $\mathcal{E}$ and internal resistance r connected to an external resistance R. Show that maximum power is dissipated across the external resistance if $R = r$.
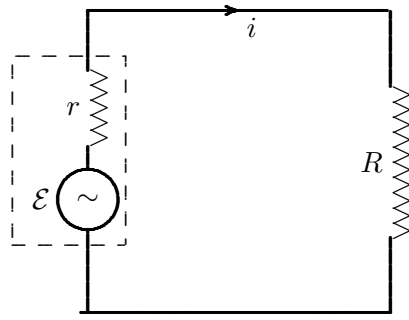
7. A transformer has a 100V ac power source connected to its primary coil of 500 turns. If the secondary coil has 20 turns, find the seconadry coil voltage.