AC Circuits

1. Sketch a series of diagrams that show the process of generating an AC current.

2. Sketch a graph that shows an AC generator inducing an emf E(t) at two different frequencies, *f* and *2f*.

3. When we say that the voltage in our outlets is 120 V, we mean the rms value of the voltage. Determine the maximum voltage we would read from the wall socket.

4. Derive an expression for the relationship between P_{rms}, V_{max}, and I_{max}.

5. A 500Ω resistor is connected to a 50 V_{rms} circuit.
    a. Calculate the rms current in the circuit.
    b. Calculate the maximum potential difference across the resistor.
    c. Calculate the I_{max} and I_{RMS} through the resistor.
    d. Calculate the average power dissipation of the resistor.

6. A transformer has 25 turns on the primary coil and 500 turns on the secondary coil. The input voltage is 10.0 V AC. Calculate the output voltage of the transformer.

7. A power plant has an output of 12000 V, but the transmission line voltage is 240000 V.
    a. Describe the transformer used from the plant to the transmission lines.
    b. A transformer is then used at a substation to step the voltage down to 7200 V for transmission along the streets. Describe the properties of the substation transformer.
    c. The voltage is then reduced to 120 V at a house. Describe the properties of the house transformer.

8. The primary winding of an electric toy train transformer has 800 turns, and the secondary has 40. The current in the primary coil is 0.5 A.
    a. State whether this is a step-up or step-down transformer.
    b. If the input emf is 120 V, determine the output emf.
    c. Calculate the average power input.
    d. Calculate the current in the secondary coil. State the assumptions you made for this calculation.
    e. Suggest one reason why this transformer is used in this application.

9. The transformer has a ratio $\frac{number\ of\ primary\ turns}{number\ of\ secondary\ turns} = 2.5$. The primary coil of the transformer draws a current of 0.25 A from a 200 V alternating current (ac) supply. The current in the secondary coil is 0.5 A. What is the efficiency of the transformer?

10. A diode bridge is set up as shown on the right. Assume an AC power supply with an V_{rms} of 10 V is attached at the "V_{in}" position.
    a. Determine which terminal of "V_{out}" is positive and which is negative and label it on the circuit diagram.

    b. Assume there is a voltage drop of 0.5 V across each diode. Calculate the maximum potential difference between the positive and negative terminals of "V_{out}".