ECE 320 & ECE 329

ENERGY SYSTEMS I

BACKGROUND STUDY IN ENERGY SYSTEMS

SESSION no. 2

ECE 320

Energy Systems I

Lesson 2

Guest Experts

AC Power

ECE 320
Homework
Due: Lesson 3 (Recite Lesson 2)

1. In the circuit shown in Figure 1, a load having an impedance of 39+j26 Ohms is fed from a voltage source through a line having an impedance of 1+j4 Ohms. The voltage source Vs is 250V rms at 60 Hz.
   a. Calculate the load current and the load voltage.
   b. Calculate the real power and the reactive power delivered to the load.
   c. Calculate the real power losses in the line.
   d. Calculate the real power and the reactive power supplied by the source.

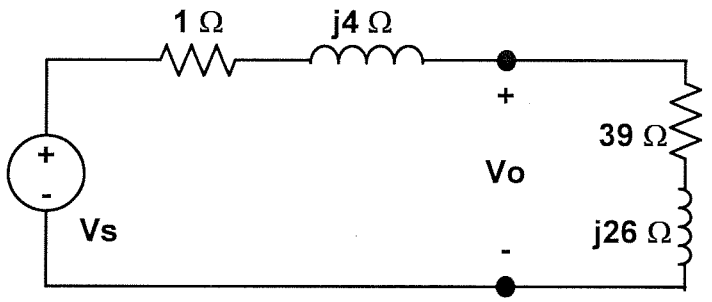

Figure 1. Electric power circuit.

2. For the same circuit shown in Figure 1, the source is a step voltage of 12.0u(t) where u(t) is a unit step function. The inductors are labeled with their 60Hz impedance. Find the current as a function of time.

3. Two loads in the circuit shown in Figure 2 can be described as follows:
   Load 1 absorbs an average of 8kW at a leading power factor of 0.80.
   Load 2 absorbs 20kVA at a lagging power factor of 0.60.
   a. Determine the power factor of the combined two loads in parallel.
   b. Determine the source current.
   c. If the frequency is 60Hz, find the value of the capacitor which, if placed in parallel with the two loads, would correct the power factor to 1.00. Let the load voltage be adjusted to 250V at a zero phase angle.

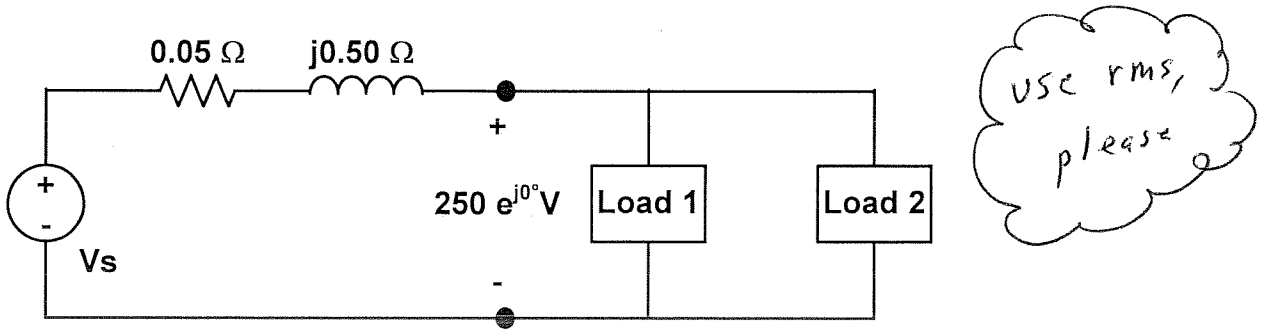

Figure 2. Two-load distribution circuit

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4. Calculate the rms values of the currents with the waveforms shown in Figure 3.

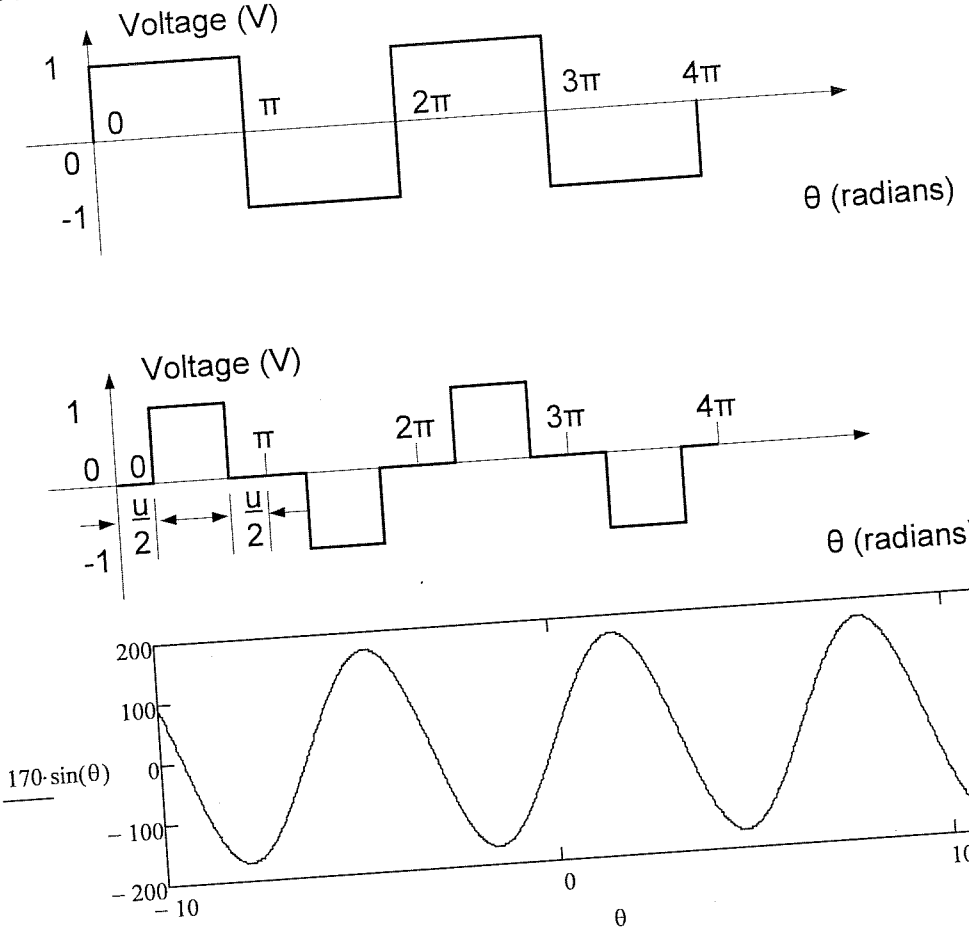

Figure 3. Waveforms.

5. Consider the circuit shown in Figure 4.
   a. Find the currents in each branch of this circuit.
   b. Find the real power and reactive power in each element (resistor, inductor, capacitor, and source).

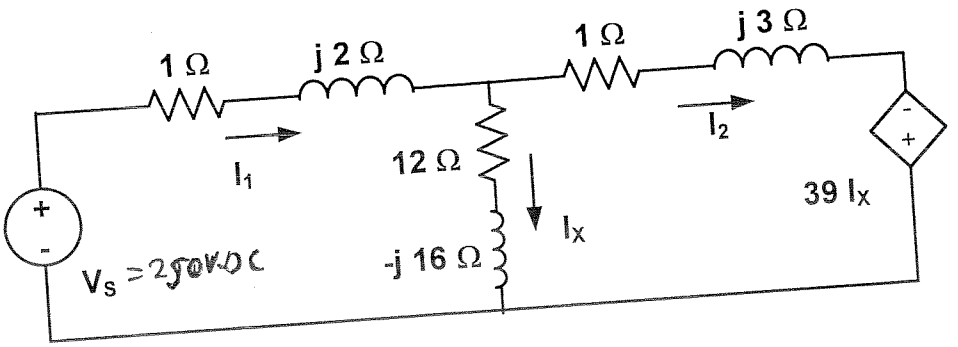

Figure 4. Two-loop power circuit.