10.22 The three loads in the circuit seen in Fig. P10.22 are described as follows: Load 1 is absorbing 7.5 kW and 2500 VAR; load 2 is absorbing 10 kVA at a 0.28 pf lead; load 3 is a 12.5 Ω resistor in parallel with an inductor that has a reactance of 50 Ω.

a) Calculate the average power and the magnetizing reactive power delivered by each source if $V_{e1} = V_{e2} = 250/\sqrt{2}$ V (rms).
b) Check your calculations by showing your results are consistent with the requirements

$$\sum P_{dev} = \sum P_{abs}$$
$$\sum Q_{dev} = \sum Q_{abs}$$

![Figure P10.22](image)

10.24 The three loads in the circuit shown in Fig. P10.24 are $S_1 = 5 + j1.25$ kVA, $S_2 = 6.25 + j2.5$ kVA, and $S_3 = 8 + j0$ kVA.

a) Calculate the complex power associated with each voltage source, $V_{e1}$ and $V_{e2}$.
b) Verify that the total real and reactive power delivered by the sources equals the total real and reactive power absorbed by the network.

![Figure P10.24](image)

10.29 a) Find the average power dissipated in the line in Fig. P10.29.
b) Find the capacitive reactance that when connected in parallel with the load will make the load look purely resistive.
c) What is the equivalent impedance of the load in (b)?
d) Find the average power dissipated in the line when the capacitive reactance is connected across the load.
e) Express the power loss in (d) as a percentage of the power loss found in (a).

![Figure P10.29](image)

10.32 A factory has an electrical load of 1600 kW at a lagging power factor of 0.8. An additional variable power factor load is to be added to the factory. The new load will add 320 kW to the real power load of the factory. The power factor of the added load is to be adjusted so that the overall power factor of the factory is 0.96 lagging.

a) Specify the reactive power associated with the added load.
b) Does the added load absorb or deliver magnetizing vars?
c) What is the power factor of the additional load?
d) Assume that the voltage at the input to the factory is 2400 V (rms). What is the rms magnitude of the current into the factory before the variable power factor load is added?
e) What is the rms magnitude of the current into the factory after the variable power factor load has been added?
10.47 The peak amplitude of the sinusoidal voltage source in the circuit shown in Fig. P10.47 is 180 V, and its frequency is 5000 rad/s. The load resistor can be varied from 0 to 4000 Ω, and the load capacitor can be varied from 0.1 μF to 0.5 μF.
   a) Calculate the average power delivered to the load when \( R_0 = 2000 \) Ω and \( C_0 = 0.2 \) μF.
   b) Determine the settings of \( R_0 \) and \( C_0 \) that will result in the most average power being transferred to \( R_0 \).
   c) What is the most average power in (b)? Is it greater than the power in (a)?
   d) If there are no constraints on \( R_0 \) and \( C_0 \), what is the maximum average power that can be delivered to a load?
   e) What are the values of \( R_0 \) and \( C_0 \) for the condition of (d)?
   f) Is the average power calculated in (d) larger than that calculated in (c)?

Figure P10.47

![Figure P10.47](image)

10.49 The variable resistor in the circuit shown in Fig. P10.49 is adjusted until the average power it absorbs is maximum.
   a) Find \( R \).
   b) Find the maximum average power.
   c) Find a resistor in Appendix H that would have the most average power delivered to it.

Figure P10.49

![Figure P10.49](image)

10.50 The variable resistor \( R_0 \) in the circuit shown in Fig. P10.50 is adjusted until maximum average power is delivered to \( R_0 \).
   a) What is the value of \( R_0 \) in ohms?
   b) Calculate the average power delivered to \( R_0 \).
   c) If \( R_0 \) is replaced with a variable impedance \( Z_0 \), what is the maximum average power that can be delivered to \( Z_0 \)?
   d) In (c), what percentage of the circuit’s developed power is delivered to the load \( Z_0 \)?

Figure P10.50

![Figure P10.50](image)