Homework -1

DP 11-6 A new electronic lamp (e-lamp) has been developed that uses a radio-frequency sinusoidal oscillator and a coil to transmit energy to a surrounding cloud of mercury gas as shown in Figure DP 11-6*a*. The mercury gas emits ultraviolet light that is transmitted to the phosphor coating, which, in turn, emits visible light. A circuit model of the e-lamp is shown in Figure DP 11-6*b*. The capacitance C and the resistance R are dependent on the lamp's spacing design and the type of phosphor. Select R and C so that maximum power is delivered to R, which relates to the phosphor coating (Adler, 1992). The circuit operates at $\omega_0 = 10^7$ rad/s.

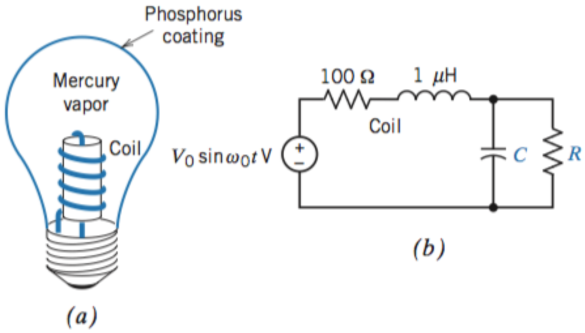


Figure DP 11-6 Electronic lamp.

P 11.5-4 Many engineers are working to develop photovoltaic power plants that provide ac power. An example of a photovoltaic system is shown in Figure P 11.5-4*a*. A model of one portion of the energy conversion circuit is shown in Figure P 11.5-4*b*. Find the average, reactive, and complex power delivered by the dependent source.

Answer: $\mathbf{S} = +j8/9$ VA

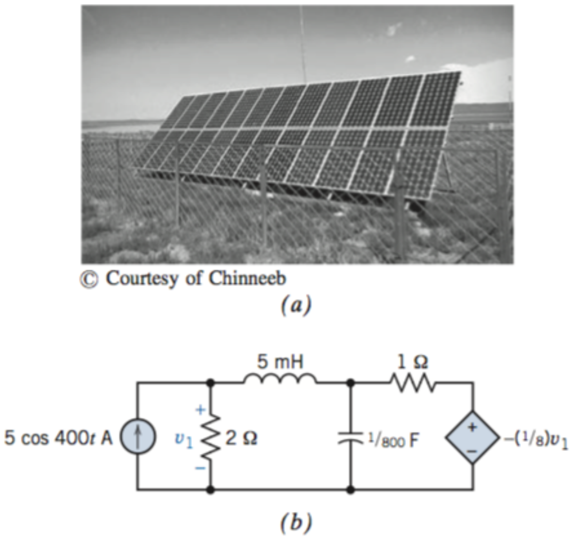


Figure P 11.5-4 (*a*) An installation of solar panels in rural Mongolia. (*b*) Model of part of the energy conversion circuit.

P 10.12-6 The input to the circuit shown in Figure P 10.12-6 is the voltage source voltage

$$v_s(t) = 3\cos(4000t + 30^\circ)\ \text{V}$$

and the output is the steady-state voltage $v_o(t)$. Use MATLAB to plot the input and output sinusoids.

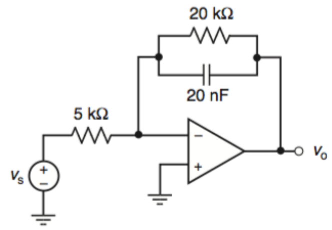
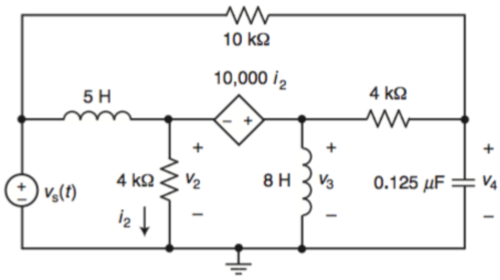


Figure P 10.12-6

P 10.12-2 Determine the node voltages for the circuit shown in Figure P 10.12-2 when

$$v_s(t) = 12\cos(400t + 45^\circ)\ \text{V}.$$



DP 11-2 Two loads are connected in parallel and supplied from a 7.2-kV rms 60-Hz source. The first load is 50-kVA at 0.9 lagging power factor, and the second load is 45 kW at 0.91 lagging power factor. Determine the kVAR rating and capacitance required to correct the overall power factor to 0.97 lagging.

P 10.8-6 The inputs to the circuit shown in Figure P 10.8-6 are

$$v_{s1}(t) = 30\cos(20t + 70^\circ)\ \text{V}$$

and

$$v_{s2}(t) = 18\cos(10t - 15^\circ)\ \text{V}$$

The response of this circuit is the current $i(t)$. Determine the steady-state response of the circuit.

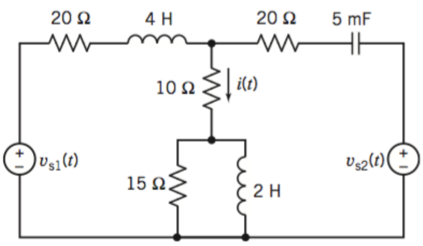
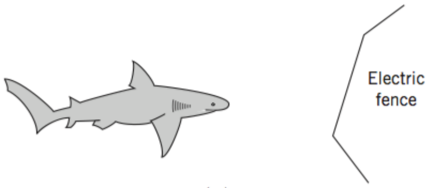
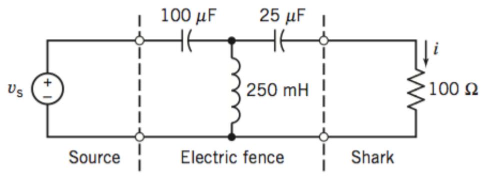


Figure P 10.8-6

P 10.6-11 ⊕ The development of coastal hotels in various parts of the world is a rapidly growing enterprise. The need for environmentally acceptable shark protection is manifest where these developments take place alongside shark-infested waters (Smith, 1991). One concept is to use an electrified line submerged in the water to deter the sharks, as shown in Figure P 10.6-11*a*. The circuit model of the electric fence is shown in Figure P 10.6-11*b*, in which the shark is represented by an equivalent resistance of 100 Ω. Determine the current flowing through the shark's body, $i(t)$, when $v_s = 375 \cos 400t$ V.



(*a*)



(*b*)

Figure P 10.6-11 Electric fence for repelling sharks.