ECE 301
Fall Semester, 2005
HW #7

wlg   Name _____
Due: Nov 29   Print (last, first)

Use engineering paper. Work only on one side of the paper. Use this sheet as your cover sheet, placed on top of your work and stapled in the top left-hand corner. Number the problems at the top of the page, in the center of the sheet. **Do neat work. Underline your answers. Show how you got your equations**. **Be sure to show how you got your answers.** Each problem counts 15 points.

(1) You are given the circuit of Figure 1. (a) Calculate the power factor of the entire circuit. (b) What is the average power supplied by the source? Ans: pf = 0.936 lagging, P = 5.9 W.
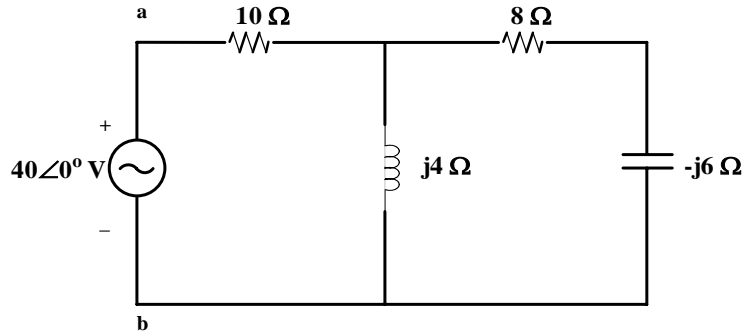

Figure 1: Circuit for problem 1.

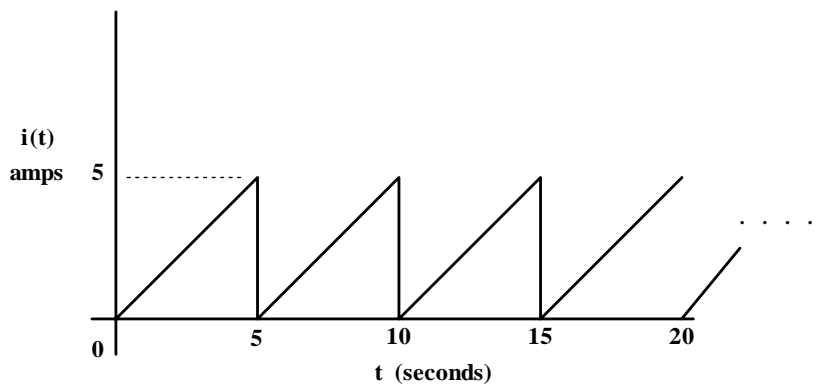(2) Find the RMS value of the current waveform shown in Figure 2. Ans: I_{rms} = 2.89 A

Figure 2: Waveform for problem 2.

(3) Consider the circuit of Figure 3. Find the following with respect to the source voltage.

(a) the power factor; Ans 0.9956 lagging
(b) the average power delivered by the source; Ans: P = 15.56 W
(c) the reactive power; Q = 1.47 VARs
(d) the apparent power; S = 15.63 VA
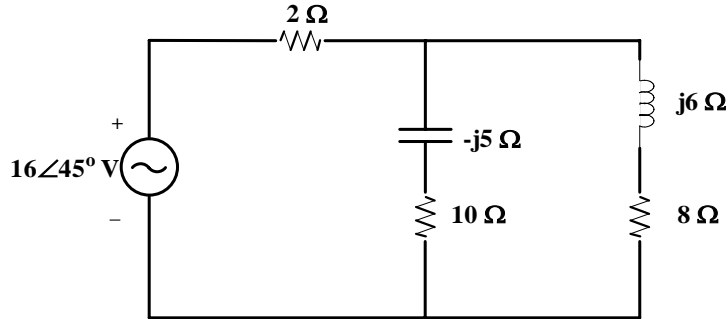(e) the complex power; **S** = 15.56 + j1.466 VA

Figure 3: Circuit for problem 3.

(4) For each of the following cases, find the complex power, the average power, and the reactive power.

(a) $v(t) = 112\cos(wt + 10^o)$ V   Ans: S = 224∠60° VA, P = 112 W, Q = 194 VAR
$i(t) = 4\cos(wt - 50^o)$ A

(b) $v(t) = 160\cos(377t)$ V   Ans: S = 320∠-45° VA, P = 226.3 W, Q = 194 VAR
$i(t) = 4\cos(377t + 45^o)$ A

(5) A source delivers 50 kVA to a load with a power factor of 65% lagging. Find the load's average and reactive power. P = 32.5 kW, Q = 38 kVAR.

(6) A 40 kW induction motor, with a lagging power factor of 0.76 is supplied by a 120 V $_{rms}$ 60 Hz sinusoidal voltage source. Find the capacitor needed, in parallel with the motor, to raise the power factor to 0.9 lagging. Ans: C = 2.734 mF.