ECE 2210 homework PA1

d

Note: In the following problems, you may assume voltages and currents are RMS unless stated otherwise or given as a function of time.

1. Read the AC power notes and examples.

2. Compute the power factor for an inductive load consisting of $L := 20 \cdot mH$ and $R := 6 \cdot \Omega$ in series. $\omega := 377 \cdot \frac{rad}{s}$

3. The complex power consumed by a load is $620 \angle 29^{o}\ VA$. Find:

   a) Apparent power (as always, give the correct units). b) Real power. c) Reactive power.

   d) Power factor. e) Is the power factor leading or lagging? f) Draw a phasor diagram.

4. In the circuit shown, the voltmeter measures $120V$, the ammeter measures $6.3A$ and the wattmeter measures $560W$. The load consists of a resistor and an inductor. The frequency is $60Hz$. Find the following:

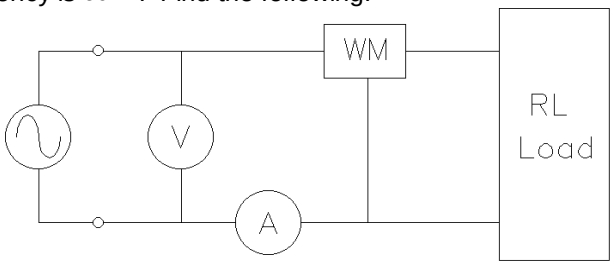
   a) Power factor b) Leading or lagging?

   c) Real power.

   d) Apparent power.

   e) Reactive power.

   f) Draw a phasor diagram.

   g) The load is in a box which cannot be opened. Add another component to the circuit above to correct the power factor (make $pf = 1$). Draw the correct component in the correct place and find its value. This component should not affect the real power consumption of the load.

5. For the circuit shown, find the following: (as always, give the correct units)

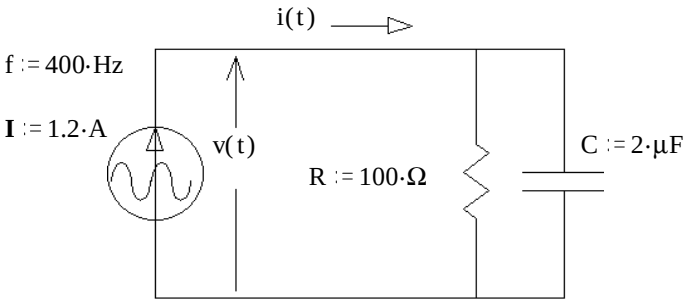
   a) The complex power.

   b) Real power.

   c) Reactive power.

   d) Apparent power.

   e) Draw a power phasor diagram.

6. A load draws $12kVA$ at $0.8\ pf$, lagging when hooked to $480V$. A capacitance is hooked in parallel with the load and the power factor is corrected to 0.9, lagging.

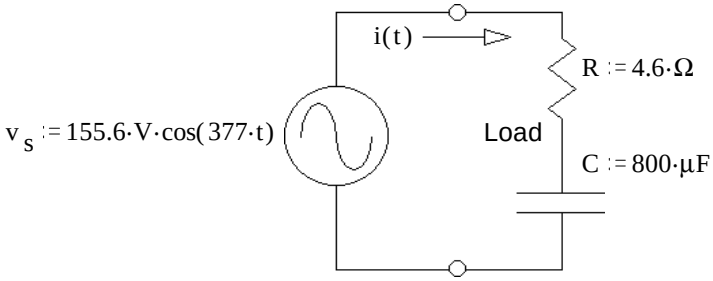
   a) Find the reactive power (VAR) of the capacitor. Draw a phasor diagram as part of the solution.

   b) Find the value of the capacitor assuming $f = 60Hz$.

7. Consider the circuit at right.
   The resistor and capacitor together make up the load.

   a) Find the load impedance of the circuit.

   b) Compute the average power dissipated by the load.

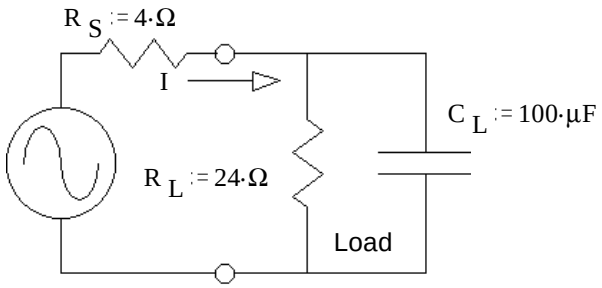
   

8. a) Compute the average power dissipated by the load (R_L and C_L taken together).

   b) Compute the power dissipated by the internal source resistance (R_S) in this circuit.

$V_S := 110 \cdot V_{rms}$

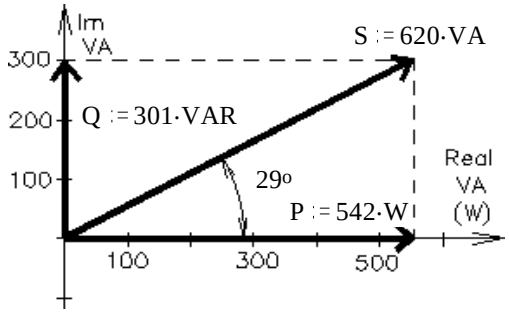
$\omega := 377 \cdot \frac{rad}{s}$



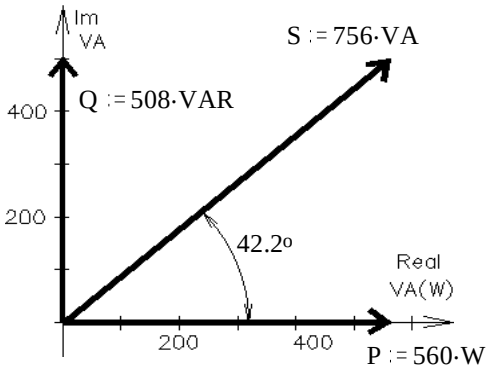
Answers

2. pf := 0.623

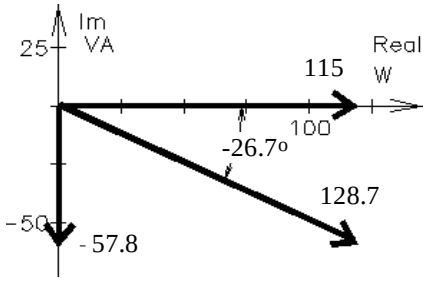
3. a) 620·VA
   b) 542·W
   c) 301·VAR
   d) 0.875
   e) lagging
   f) ------->

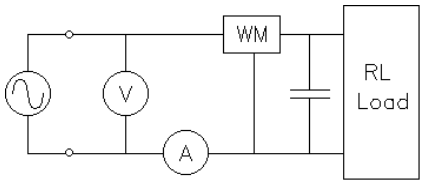


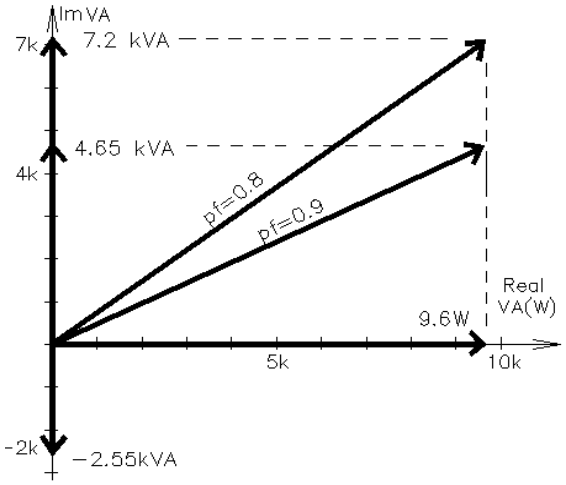
4. a) 0.741
   b) lagging
   c) 560·W
   d) 756·VA
   e) 508·VAR
   f) ------->
   g) 93.6·μF capacitor in parallel with load



5. a) (115 – 57.8·j)·VA
   b) 115·W
   c) - 57.8·VAR
   d) 128.7·VA
   e) ------->





6. 

a) - 2.55·kVA b) 29.4·μF

7. a) $\mathbf{Z} := 5.67 \cdot \Omega \cdot e^{-j \cdot 35.8 \cdot deg}$ b) $P_{av} := 1.73 \cdot kW$

8. a) $P_{av} := 364 \cdot W$ b) 110·W