ECE 2300 – CIRCUIT ANALYSIS

HOMEWORK #10

10.1 Find the rms value of the periodic voltage *v(t)*.



10.2 Three loads in the figure below are connected in parallel across a 110[Vrms], 60[Hz] sinusoidal voltage source as shown in the figure. The circuit is in the steady-state.

Load 1 absorbs 250[W] and 500[VAR].

Load 2 absorbs (1850–40[VA].

Load 3 has an impedance of 3-10j[].

Find the expression for *iX(t)*. Assume that *vS(t)* is a cosine function with a phase of zero.



10.3 The circuit shown below is operating in steady state. The load absorbs
(5070-34)[VA]. The voltage source delivers 7500[W]. Find all the possible values for *LA*.





10.4 The circuit given below operates in steady-state.

1. Draw the circuit given in the phasor domain.
2. Find the values of *LX* that will make the load have a unity power factor, that is, a power factor equal to 1.





10.5 The circuit given below operates in steady-state. It is known that Load 1 absorbs 30[kW] and absorbs 25[kVAR]. Load 2 absorbs 2215[kVA]. Load 3 absorbs an apparent power of 45[kVA], at a lagging power factor of 0.73.



1. Find *iX(t)*.
2. Find *vL3(t)*.



10.6 For the circuit shown, a source **Vs** supplies, through a network, three loads connected in parallel. The voltage across the loads is known to be
|**Vl**| = 500[Vrms].

It is also known that Load #1 absorbs 10[kW] at a power factor of 0.8 lagging, Load #2 absorbs 20[kW] and -15[kVAR], and Load #3 absorbs 30[kVA] at a power factor of 0.5 leading.

Calculate the numerical values for the complex power, average power, reactive power, and apparent power supplied by the source, as well as the corresponding power factor.



10.7 In the circuit below, the load impedance *ZL* absorbs 3500[W] and absorbs 4500[VAR]. The sinusoidal source delivers 9800[W] to the rest of the circuit. Find the values of the capacitance for the line that will satisfy these constraints, given that the frequency is *f* = 100[Hz].



10.8 In the circuit shown below, a voltage source provides a sinusoidal voltage to three loads in parallel. This system is in steady state, and operates at a frequency of 60[Hz]. It is known that:

Load 1 absorbs 600[W] and delivers 500[VAR].

Load 2 absorbs 750[VA] with a leading power factor of 0.7.

Load 3 absorbs 80015[VA].

Find *iX(t)* for this system.



10.9 The load *ZL* absorbs 104.933.42[VA]. The source delivers 126[W] and an unknown amount of reactive power. The quantity *XLI* is the reactance of the line.

1. Find the values of *XLI* that will satisfy these conditions.
2. Assume that this system operates at 60[Hz]. Find a model for the line in the time domain using ideal circuit elements. (Use any of the values that you found in part a).)



## Numerical Solutions

10.1 1.53[V]

10.2 34.58 cos(377[rad/s]t + 41.97°)[A]

10.3 77.1[mH]

10.4 a) solution omitted here b) 378[H] or 22.7[mH]

10.5. a) 3915cos (300[rad/s]t + 85.2°)[A]; b) 23.0 cos(300[rad/s]t – 51.7°)[V]

10.6 57,580 – 8313j[VA]; 57,580[W]; -8313[VAR]; 58,181[VA]; 0.989 leading

10.7 3.76[F]

10.8 solution omitted here

10.9 -55.8[], or -10.4[]; b) 47.5[F] capacitor in series with a 22[] resistor, or 255[F] capacitor in series with a 22[] resistor