ECE 2300 – CIRCUIT ANALYSIS

HOMEWORK #9

1. A complex number with a phase between 90˚ and 180˚ (in the 2nd quadrant) is added to a second complex number with a phase between –90˚ and –180˚ (in the 3rd quadrant). What is the sign of the real part of this sum?

2. A complex number with an arbitrary real part and a positive imaginary part is multiplied by a second complex number that is imaginary, with a negative coefficient for *j*. What can you say about the product?

3. Solve the following equation for *m* and *n*. You should assume that *m* and *n* are real numbers. The variable *n* is an angle, and you should show your units.



4. Find the nonzero value of *ω* for which the expression for *Z(ω)* given is purely real. Give your answer as a function of *R*, *L*, and *C*.



5. In the circuit given, the voltage source *vS(t)* is made up of the summation of several frequency components. The circuit is operating in steady state.

1. Find the Thévenin impedance as seen by the load, *RL*, as a function of the angular frequency, **.
2. Find the Thévenin impedance as seen by the load, *RL*, at 1[kHz].



6. A device was connected to a resistor and capacitor, as shown in Figure 1, and the steady-state voltage that resulted was

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The same device was then removed from that circuit, and was connected to a resistor and inductor, as shown in Figure 2. The steady-state current that resulted was

.

Next, the same device was removed from that circuit, and was connected to a resistor, as shown in Figure 3. Find the steady-state value of *vW(t)*.





7. The circuit shown operates in steady-state. Find the numerical expression for the current *iQ(t)*.





8. For the circuit shown below:

a) Find the expression for the steady-state current *i(t)*, as a function of *R*.

b) Find the expression for the steady-state current *i(t)*, for *R* equal to 500[], 1[k], 2[k], and 4[k]. (PWA8, No. 1)



9. In the circuit below, find the nonzero frequency at which the voltage *vS(t)* is in phase with the current *iS(t)*. Problem adapted from (PEQWS8, No. 9).



10. The circuit given is in steady-state. The current through an unknown device, *iD(t)* has been measured, and its expression is given with the figure.

a) Find the expression for the steady-state voltage *vD(t)*.

b) Find a circuit model in the time domain, including values for the model parameters, for the unknown device. Assume that it is a passive device. (PWA8, No. 2)



11. The circuit given is in steady-state. Find a numerical expression for the steady-state current, *i(t)*. (PWA8, No. 3)



Selected Numerical Solutions

1. Solution omitted

2. Solution omitted

3. 

4. ****

5. a) Solution omitted, b) 66.5 + 0.203j[]

6. 45.2 cos(500[rad/s]*t* + 12.4°)[V]

7. 387 cos(30[rad/s]t – 17°)[mA]

8. Solution omitted

9. Solution omitted

10. Solution omitted

11. Solution omitted