10/09/05

EE 40 – Introduction to Microelectronic Circuits

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Problem Set # 6

Due: 5 PM Tuesday, Oct. 18th, 2005 in 240 Cory

5.1 **Complex Numbers and Calculator Pilot's License:** For the four complex numbers
#1 = 3 + j4 #2 = -3+j4 #3 = -3 –j4 #5 = 3 –j4
do the following.

a. Sketch each number as a vector in the complex plane and determine its angle in degrees from the real axis within the range of [0, 360]..

b. Specify the make and model of your calculator. Then use the rectangular to polar conversion on your calculator to determine the range of angles for your calculator and note if its range is shifted or if incorrect redundancies occur .

c. Describe the minimum number of steps to take the ratio of two numbers such as #1/#2 and #3/#4. Are the angles correct?

5.2. **Maximum Power Transfer**: A 60 cycle 117V rms line voltage drives a load with an impedance of 1000 at an angle of 30°.

a. Find the rms current.

b. Determine the real and imaginary parts of the impedance.

c. Find the maximum power that could be transferred to the load.

d. Find the peak reactive energy stored in the load.

e. Find the peak current into the load.

f. Find the value of a reactive only L or C to put in series with the load to reduce the peak current to its average rms value (and prevent this peak current from going) all the way back to the generator).

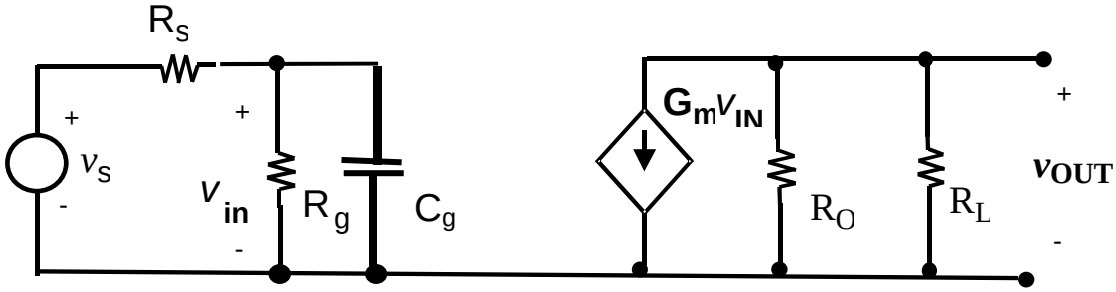
5.3. **Transfer Functions**: Using the circuit given below

a. Derive an algebraic expression for v_{OUT} in terms of v_S.

b. Determine the ratio of v_{OUT} / v_S at low frequency.

c. Determine the asymptotic behavior of v_{OUT} / v_S at high frequency

d. Make a Bode plot of v_{OUT} / v_S and label the low frequency gain, the break point and the asymptotic slope in db per decade at high frequency.



R_s =50Ω; R_g = 100Ω, C = 1pF G_m = 0.1 mho; R_c = 1000Ω, R_L = 500 Ω