EECS 215: Introduction to Electronic Circuits WN 2010
Problem Set 11

Issued: 4/10/10

Due: 4/19/10, **9:30 AM**

U&M refers to a problem from Ulaby and Maharbiz.

Note: This problem set has 6 required problems of varying difficulty. There are also 2 extra credit problems that require a very high level of competency and computing/analysis skills as well as some material presented by not required for the class. You are advised not to attempt them unless you have time, would enjoy the challenge, and are done with the required part. Any extra credit will be applied to you total problem set point total. However, the maximum average score will be pinned at 100%.

Problems:

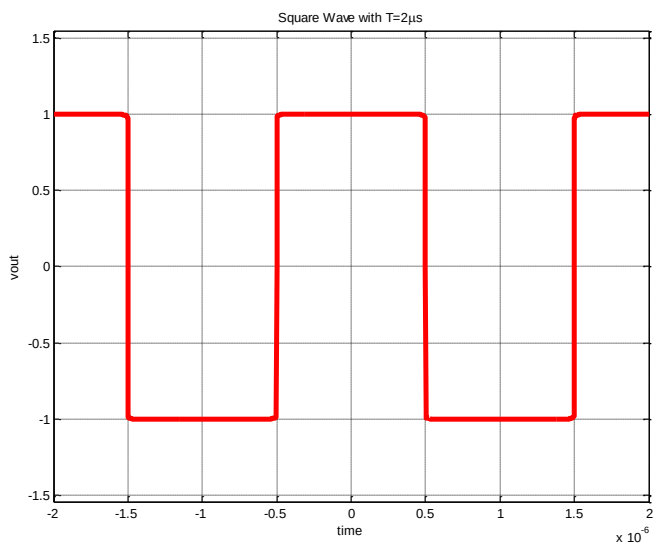
1. U&M 9.20
2. U&M 9.24
3. U&M 9.3
    a. What kind of filter is this? Briefly justify your answer.
    b. Do the problem as stated (symbolic variables)
       Now assume the following values for the components
       $R = 500\Omega \; C = 1/3\,\mu F \;\; L_1 = 1\mu H \;\; L_2 = 3\mu H$
    c. What is the numerical value of ω_0? Using Matlab, plot the Bode plot over an appropriate frequency range. Verify that you numerical results are consistent with your calculation of ω_0. To 3 significant figures, find the value of ω where $|H(\omega)|$ is a maximum (call this ω_m). How does ω_m compare with ω_0?
4. U&M 9.6
    a. What kind of filter is this? Briefly justify your answer.
    b. Do the Problem as stated
5. U&M 9.31
6. U&M 9.33

Extra Credit Problem 1 (20 points of extra credit)

For the circuit resulting from U&M 9.6

a) Find the transfer function $\mathbf{H=V_o/V_s}$ for your scaled circuit. (note: this may be a little messy, but keep your answer as "clean" as you can).
b) Find the poles and zeroes of the transfer function.
c) Do a Bode plot over an appropriate frequency range for your resulting H. Does your Bode plot make sense given the poles and zeroes you found in (b)?

Extra Credit Problem 2: (15 points of extra credit).

For the circuit in problem 3b,c, (U&M 9.3 circuit with component values as given in3b) numerically find and plot $V_o(t)$ if $V_{in}(t)$ is a 1V 0 to peak 50% duty cycle square wave with:

a) At a period T=10µs
b) At a period T=4.5µs
c) At a period T=3.7µs
d) At a period T=2 µs
e) At a period T=50 ms