HW9  ECE2100 Autumn 2014

Lectures Covered: Lecture59 - Lecture60

HW should be turned in by Monday, Nov. 17, before 4:30pm

Solve all the problems. All problems will not be graded, only a selection of HW problems will be graded.

Show all relevant steps. Don’t just write down the answers.

Late HWs will not be accepted. HW with lowest grade will be dropped. Lecture Students: turn in your HW in class. Recitation students: turn in your HW at the ECE Office Front Desk. HWs turned in anywhere else will not be accepted.

Show your work on these pages, attach additional pages if necessary.

- Be sure to organize the pages in order and staple them all together, otherwise you will lose one point

- Fill out the following section. You will lose an additional point if you fail to provide these details

Your Last Name________________________________________
Your First Name________________________________________

1. Lecture Student ______ or Recitation Student________ (check one)
2. If Recitation then fill out the following
   Name of recitation instruction________________________ Date/time of recitation________________
3. Your Lab Section/Group________________________________________________

Problems start from next page
**Problem 1:** Determine the Magnitude frequency response.
Problem 2: Use MATLAB to plot the magnitude frequency response of the circuit given in Problem 1 in the range $2.5 \times 10^4$ and $4.5 \times 10^4$ radians/sec. What type of filter is it? LP? BP? or HP?

Use $R = 10 \Omega$, $L = 1mH$ and $C = 1 \mu F$
Problem 3: Design an active low pass filter with a dc magnitude gain of 1 V/V and a cutoff frequency of 10,000 rad/sec. Assume that you have a 1 microFarad capacitor at your disposal.
Problem 4: Design an active Band Pass filter with a magnitude response shown below. Assume that you have 1 nanoFarad capacitors at your disposal.
**Problem 5:** Design an active Band Reject filter with a magnitude response shown below. Assume that you have 1 nanoFarad capacitors at your disposal.
Problem 6: Determine the Laplace transform of

\[ f(t) = 2t e^{-3t} u(t) \]
**Problem 7:** Determine the Laplace transform of

\[ f(t) = 8e^{-4t} \cos(2t)u(t) \]
**Problem 8:** Determine the Laplace transform of

\[
\mathcal{L}\{f(t)\} = t \left[ u(t) - u(t-\tau) \right]
\]
Problem 9: Determine the Laplace transform of

\[ f(t) = \frac{d}{dt} \left[ 4te^{-2t} \cos(4\pi t + 30) u(t) \right] \]
Problem 10: Convert the following differential equation to s-domain (take Laplace transform of both the sides and use the time derivative property)

\[ \frac{d^2 f}{dt^2} + 2 \frac{df}{dt} + 4u(t) = 0 \]