ECE 3041 Spring 2012
Homework Problem Set 6 for Experiment No 8

Due Week of March 4

1. Design a first-, second-, and third-order RC low-pass, unity dc gain, passive filter with a $-3\ dB$ frequency of the experimenter's birthdate in kHz. Verify the design with a SPICE simulation using both SPICE (`.AC` analysis from 100 Hz to 1 MHz). Plot the gain (magnitude of the complex transfer function) in decibels (linear scale) and the phase in degrees as functions of the frequency (log scale). Verify the SPICE solution with a hand-calculation at the frequency 1 MHz. The design will be experimentally verified in lab during Experiment 8. Choose a standard value for the capacitor (values are given in Experiment 8). Use Mathcad to plot the magnitude and phase of the complex transfer function as a function of frequency for the same range used for SPICE.

2. Design a first-order high-pass shelving filter with an infinite frequency gain of -7.959 dB, a dc gain of -31.246 dB, a dc input impedance of 73 kΩ, and a zero frequency of 344.193 Hz. The only non resistive component that may be employed in the design is a single capacitor. A properly labeled circuit diagram with all of the component values stated is part of the design. Verify the solution with $SPICE$ by plotting the magnitude of the complex transfer function for the filter in dB and phase in degrees versus frequency as the frequency varies from 100 Hz to 100 kHz; superimpose upon the $SPICE$ solution the asymptotic Bode plot for the magnitude of the complex transfer function. Verify the $SPICE$ solution with a hand calculation at a frequency of 1 kHz. Use Mathcad to plot the magnitude and phase of the transfer function as a function of frequency using the same frequency range as used for SPICE. The design will be experimentally verified in lab during Experiment 8.