EE322 Fall 2012 Homework Problem Set 27 (PS27)

1. Text, Problem 12-1. Use MATLAB to generate your plots, and work your plots in terms of f (Hz) vice ω (radians/sec), from -50 Hz to +50 Hz, and put your phase plots in terms of degrees, vice radians.

2. Suppose a music signal is being recorded in a studio where a persistent 60 Hz hum is present (probably due to a fan in the building), and the hum is degrading the quality of the recording. Sketch the frequency response (magnitude and phase) of an ideal filter that could be used to filter out the annoying hum. What type of ideal filter is it?

3. Humans can hear sounds that have a frequency up to approximately 20 kHz. Suppose a music signal is being recorded in a studio where a disgruntled employee has been known to add in a 24 kHz tone that only dogs can hear, so that when the music plays, dogs howl. Sketch the frequency response (magnitude and phase) of an ideal filter that could be used to filter out this 24 kHz tone while maintaining only the range of sounds that humans can hear. What type of ideal filter is it?

4. Text, Problem 12-3. Use MATLAB to generate a plot of the frequency response magnitude and phase, work your plots in terms of f (Hz) vice ω (radians/sec), and put your phase plot in terms of degrees, vice radians. Use your magnitude plot to explain your answer to the question asked.

   This problem asks for the "null bandwidth". We will discuss this more in the next classes, but to answer this, you should look at the magnitude of the frequency response, find 0 Hz on the x-axis, and see where the magnitude first hits a value of zero (called a "null") to the right of 0 Hz. This frequency will be the null bandwidth for this filter.