ECE 321 - Homework #3

Poles & zeros, Filter Design. Filters

1) Assume X and Y are related by the following transfer function:

$$Y = \left(\frac{80}{(s+4)(s+12)} \right) X$$

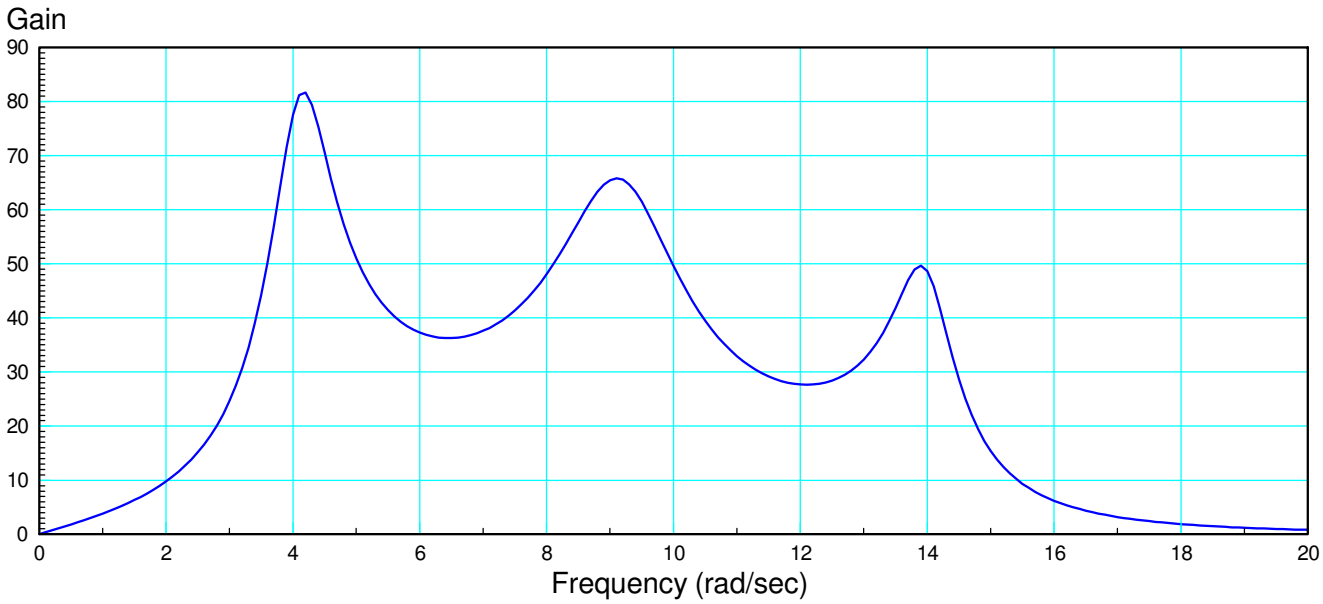
a) What is the differential equation relating x and y?

b) Determine y(t) assuming

$$x(t) = 6 + 2\cos(5t) + 4\sin(5t)$$

Filter Design

2) Give the transfer function of a filter with the following gain vs. frequency



Subwoofer Design

3) Give a filter which meets the following requirements.

- $0.9 < \text{gain} < 1.1$ $\quad f < 300\text{Hz}$
- $\text{gain} < 0.2$ $\quad f > 450\text{Hz}$

You can use a Butterworth, Chebychev, or any filter design you like, as long as you can build it (problem #4):

Plot the gain of your final design vs. frequency for $0 < w < 1000$ Hz

4) Design an op-amp circuit to implement your filter in problem #3

5) Check the gain vs. frequency for your ciruit using CircuitLab

6) Build your filter on your breadboard from homework set #1

- Measure the gain at 300Hz
- Measure the gain at 450Hz

7) Demonstrate your filter either in person or with a video