

# ECE 321 - Homework #3

Filters. Due Monday, December 2nd

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

$$Y = \left( \frac{20}{(s+3)(s+5)} \right) X$$

1a) What is the differential equation relating X and Y?

1b) Find  $y(t)$  for

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

2) Design a circuit to implement

$$Y = \left( \frac{20}{(s+3)(s+5)} \right) X$$

Check your design in PartSim

3) Design a circuit to implement

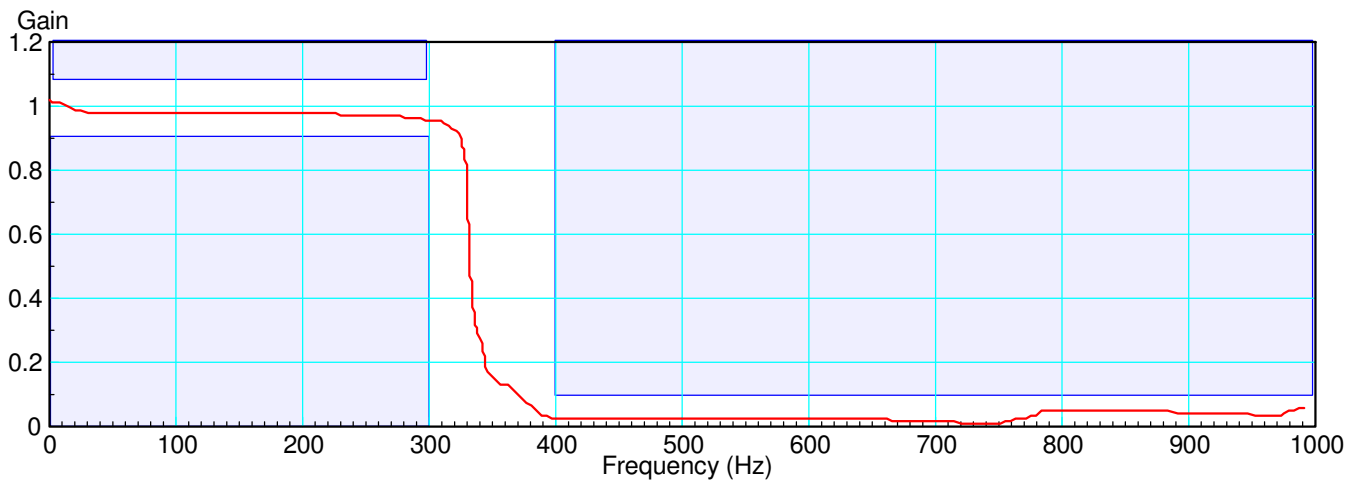
$$Y = \left( \frac{20}{(s+3+j5)(s+3-j5)} \right) X$$

Check your design in PartSim

Problem 4-8) You may use the following requirements or you may change them to match your term project

4) Requirements: Specify the requirements for a filter. As an example, a bass-boost could have the following requirements

- $0.9 < \text{gain} < 1.1$  for frequencies between 20Hz and 300Hz
- $\text{gain} < 0.1$  for frequencies above 400Hz



- 5) Analysis: Design a filter to meet these requirements. Include in your calculations
  - The required number of poles
  - The transfer function of your resulting design,
  - A gain vs. frequency plot for your filter, and
  - The gain at the design points (300Hz and 400Hz in the above example)
  
- 6) Simulation: Test your circuit design in PartSim (or similar program) to verify your design is correct
  
- 7) Validation: Build your circuit and take measurement to show that it does (or does not) meet your requirements