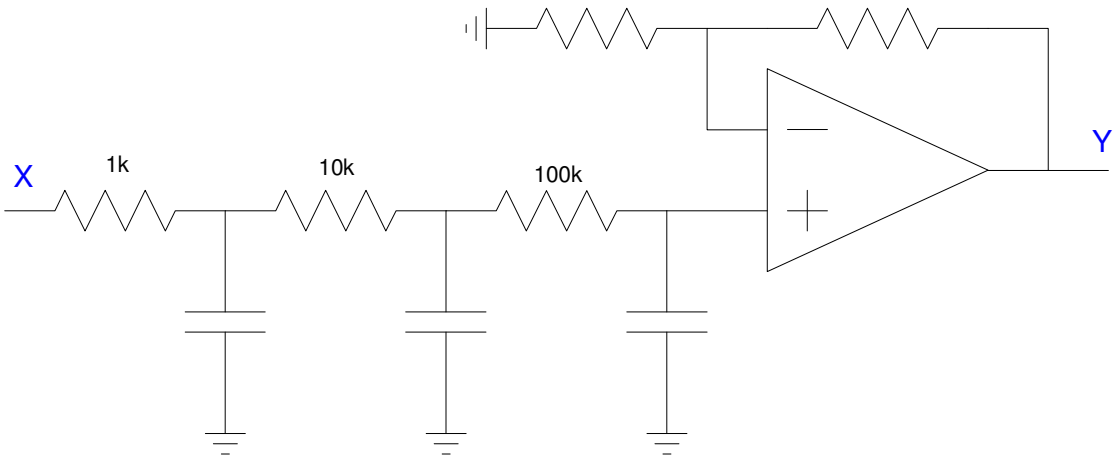
ECE 321: Handout #7

Active Filters

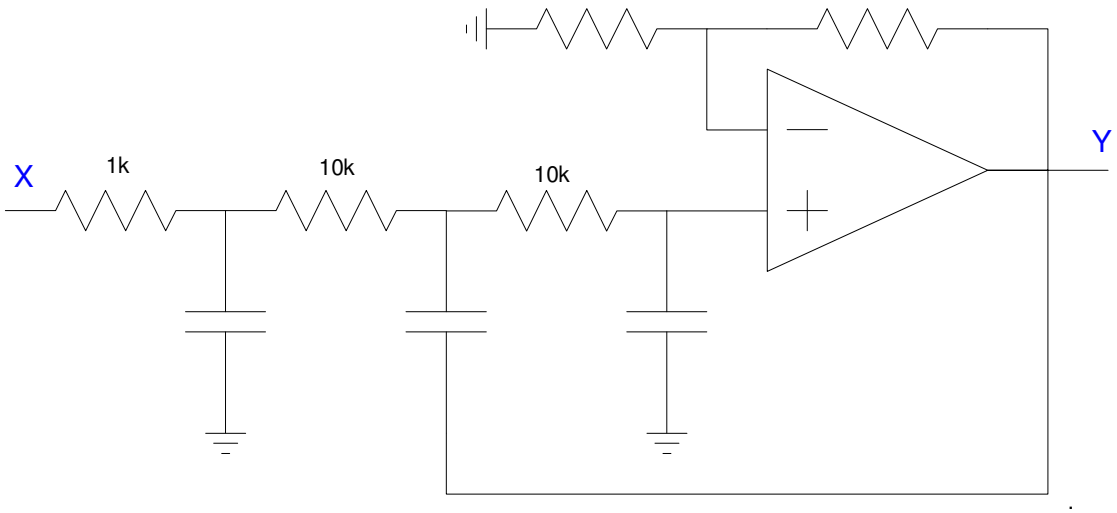
1) Find R and C so that the following filer has the transfer function

$$Y = \left(\frac{1000}{(s+4)(s+10)(s+20)} \right) X$$



2) Find R and C so that the following filter has the transfer function

$$Y = \left(\frac{4000}{(s+10)\left(s^2+15s+400\right)} \right) X$$



1) Find R and C so that the following filer has the transfer function

$$Y = \left(\frac{1000}{(s+4)(s+10)(s+20)}\right)X$$

Write this as

$$Y = \left(\frac{4}{s+4}\right)\left(\frac{10}{s+10}\right)\left(\frac{20}{s+20}\right)(1.25)X$$

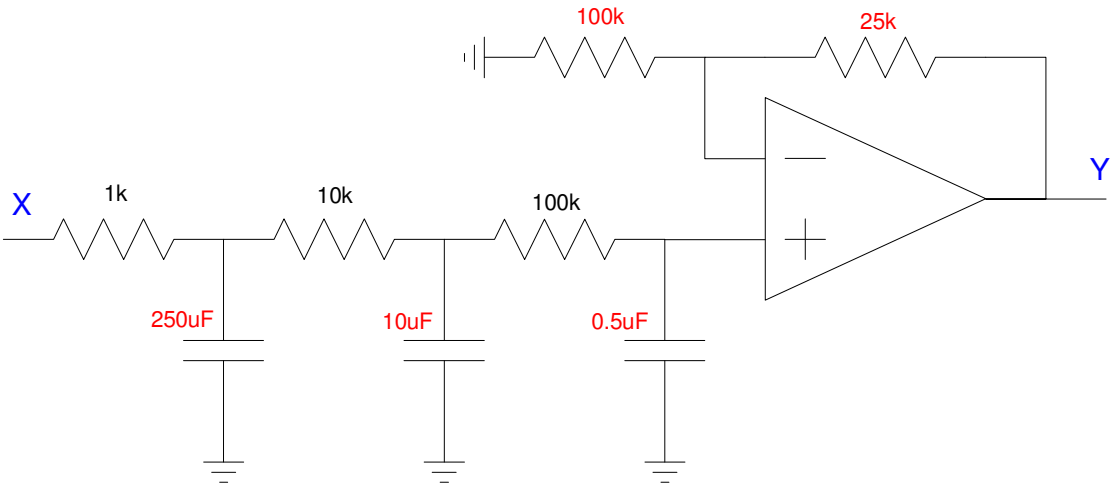
This is three cascaded RC filters along with an amplifier

$$\frac{1}{R_1 C_1} = 4 \quad \Rightarrow \quad C_1 = 250\mu F$$

$$\frac{1}{R_2 C_2} = 10 \quad \Rightarrow \quad C_2 = 10\mu F$$

$$\frac{1}{R_3 C_3} = 20 \quad \Rightarrow \quad C_3 = 0.5\mu F$$

$$gain = 1.25 = 1 + \frac{R_a}{R_b}$$



2) Find R and C so that the following filter has the transfer function

$$Y = \left(\frac{4000}{(s+10)\left(s^2+15s+400\right)} \right) X$$

Rewrite as

$$Y = \left(\frac{10}{s+10} \right) \left(\frac{400}{\left(s+20\angle 67.98^0\right)\left(s+20\angle 67.98^0\right)} \right) X$$

First stage is an RC filter

$$\frac{1}{R_1 C_1} = 10 \quad \Rightarrow \quad C_1 = 10\mu F$$

Second stage: active low pass filter

$$\frac{1}{R_2 C_2} = \sqrt{400} = 20 \qquad C_2 = 0.5\mu F$$

$$3 - k = 2\cos(67.98^0)$$

$$k = 2.25$$

$$k = 1 + \frac{R_a}{R_b}$$

The resulting filter has a DC gain of 2.25 (should be 1.00). Label the output 2.25Y (it's 2.25 times large than it should be)