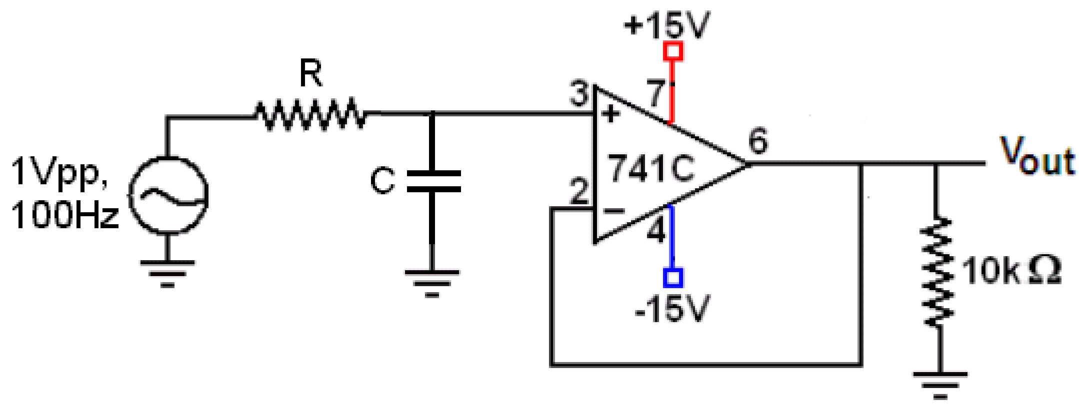
Electronics Lab

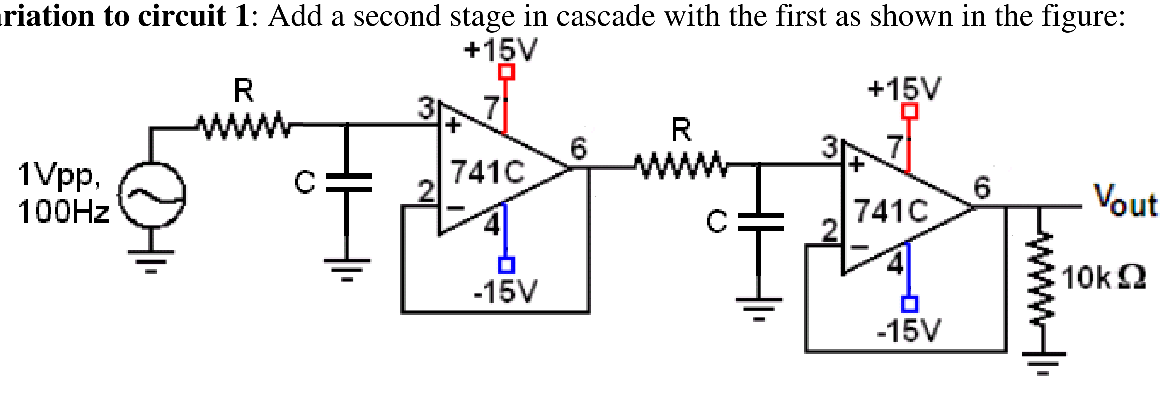
Filters

Experiment 1: *Active low pass filter based on an op-amp*.
- Connect the circuit shown in the figure with R=33kΩ and C=4.7nF (or the components provided by your instructor).



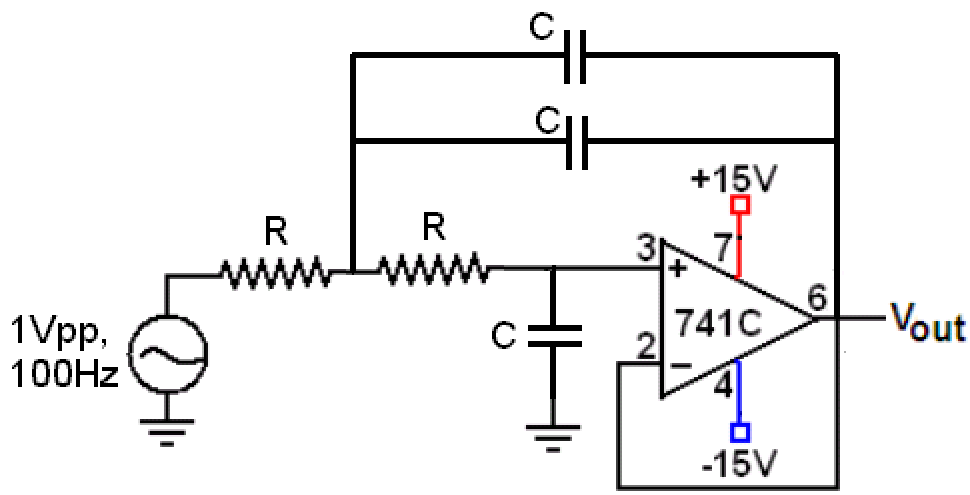
- Calculate the cutoff frequency, f_2.
- Measure the cutoff frequency experimentally by increasing the frequency until the output drops 3dB (to 0.707 V_{pp} in this case).
- Increase the frequency to $10f_2$ (one decade higher than the cutoff) and measure the gain at this point. Is it -20dB?
- Now increase the frequency to $100f_2$ (two decades higher than the cutoff) and measure the gain. Is it -40dB?

Variation to circuit 1: Add a second stage in cascade with the first as shown in the figure:



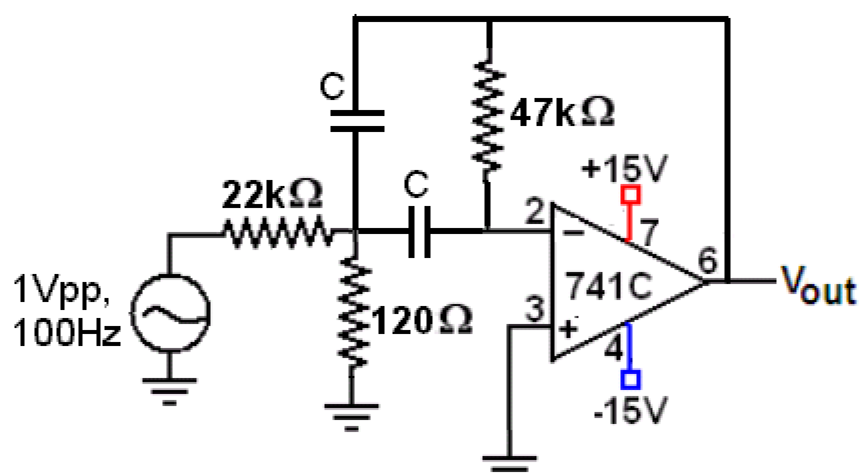
- Measure the gain at the cut-off frequency f_2 that you measured above and confirm that the drop is now 6 dB (output of 0.5Vpp).
- Increase the frequency to $10f_2$ and confirm that the gain is now -40dB.
- Repeat for to $100f_2$ and check that the drop is now -80dB (This might be difficult to measure, but try to get an upper bound at least).

Experiment 2: *Active second order low pass filter based on op-amps.*
- Connect the circuit shown in the figure with R=22kΩ and C=4.7nF (or the components provided by your instructor).



- Calculate the cutoff frequency f_2 using the theory developed in class.
- Check that the circuit behaves like a second order low pass filter by looking at the drop at one and two decades higher frequency. The gains should be -40dB and -80dB.

Experiment 3: *Active narrow band-pass filter.*
- Connect the circuit shown in the figure with C=33nF (or the capacitors provided by your instructor).



- Measure the gain for frequencies in a band that includes the peak value (around 2040Hz).
- Compare the resulting response to the one generated using the theory developed in class.