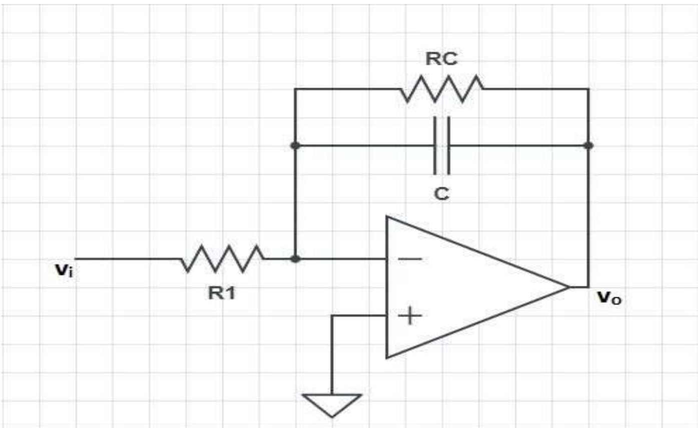
Tutorial Assignments: Analog Signal Processing (EE60032),

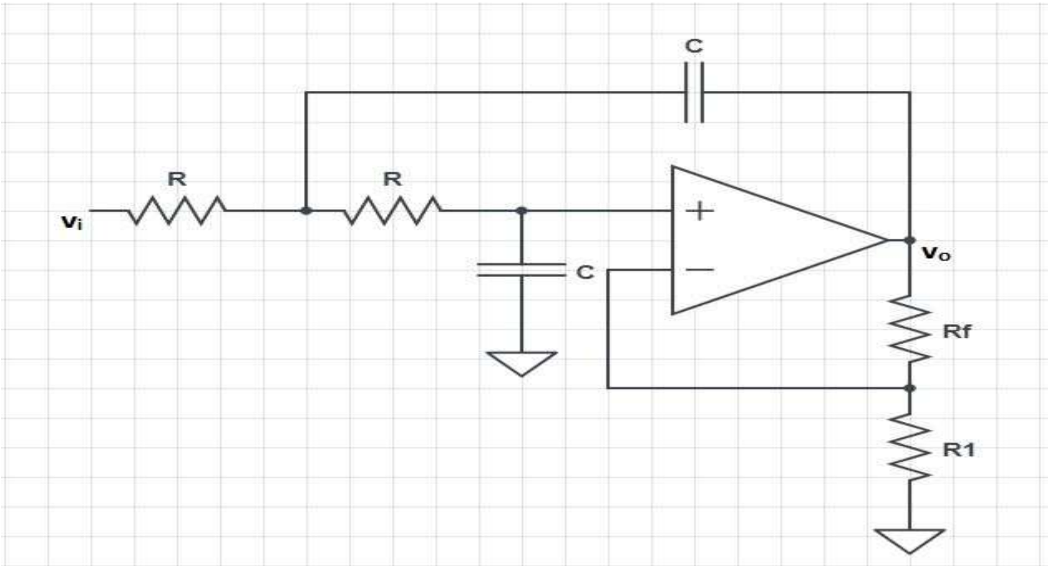
Department of Electrical Engineering, Indian Institute of Technology, Kharagpur

Faculty: Ashis Maity Session: Autumn 2018

1. In the circuit, specify suitable component values to achieve -3 dB frequency of 1 kHz with a DC gain of 20 dB and an input resistance of 10 kΩ. Find out the unity gain frequency. What is the phase at unity gain frequency?



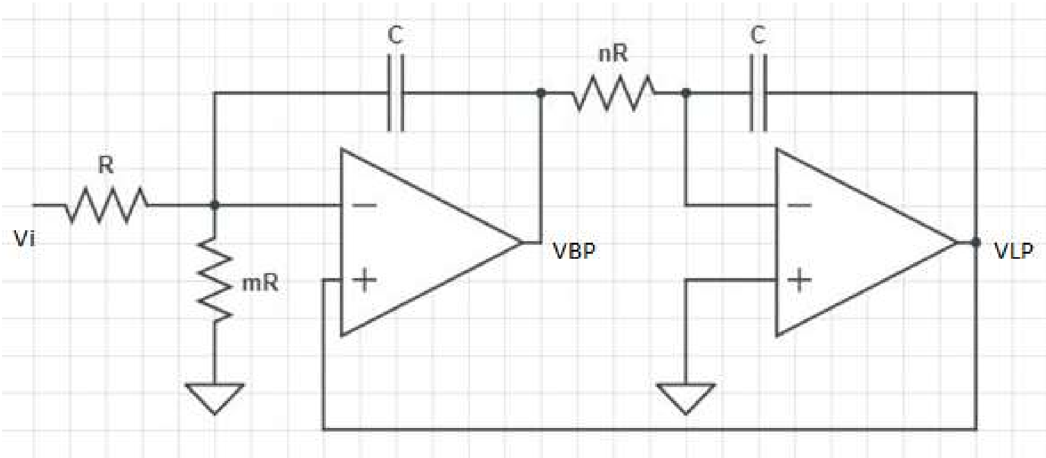
2. A second order KRC low pass filter with equal component design is shown in figure. Find out the component values to achieve f_o= 10 kHz and Q=5. Find out the DC gain.



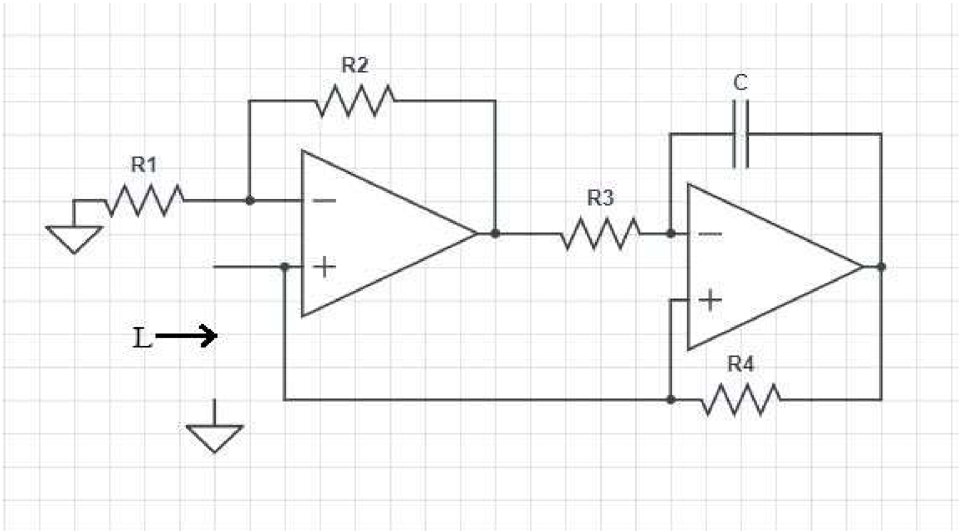
3. Draw a second order band pass filter using GIC block. Derive its transfer function. Find out the component values for a band pass response with f_o= 100 kHz and Q=25.

4. The simplified state variable filter shown in figure provides the low pass and band pass response using only two op-amps. Derive the overall transfer function V_{BP}/Vi and V_{LP}/Vi. Prove that Q= $\sqrt{n(1+1/m)}$ and ω_o= Q/nRC. Specify the component values for a band

pass response with f_o= 2 kHz and Q=10. What is the resonance gain of the circuit? What is the most serious drawback of the circuit?



5. Show that the following circuit simulates a grounded inductor with $L= R_1R_3R_4C/R_2$.



6. Find the Butterworth transfer function that meets the following low pass filter specifications: f_o= 10 kHz, A_{max}= 1dB, f_s= 15 kHz, A_{min}= 25 dB and DC gain= 1.

7. Find the Chebyshev transfer function that meets the same low pass filter specifications: f_o= 10 kHz, A_{max}= 1dB, f_s= 15 kHz, A_{min}= 25 dB and DC gain= 1.

8. A low pass filter must provide a pass band flatness of 0.45 dB for f1<f2= 1 MHz and a stop band attenuation of 9 dB at f_2= 2 MHz. Determine the order of the Butterworth filter satisfying the requirements.

9. Using Sallen and Key topology as a core, design a Butterworth filter for the following response: pass band flatness of 0.45 dB for f1= 1 MHz and stop band attenuation of 9 dB for f_2= 2 MHz.