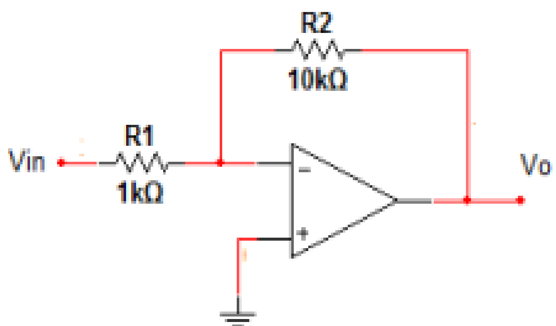
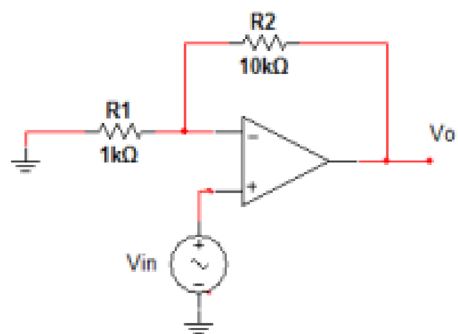
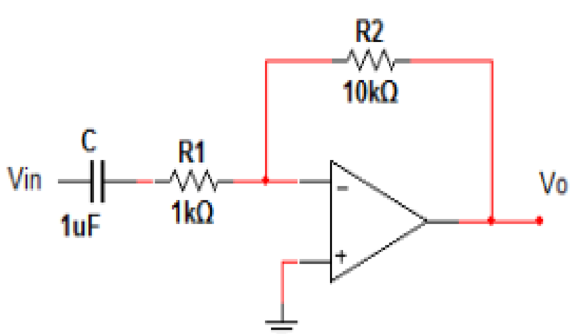
Electronic Systems
Active Filters
Sheet 1

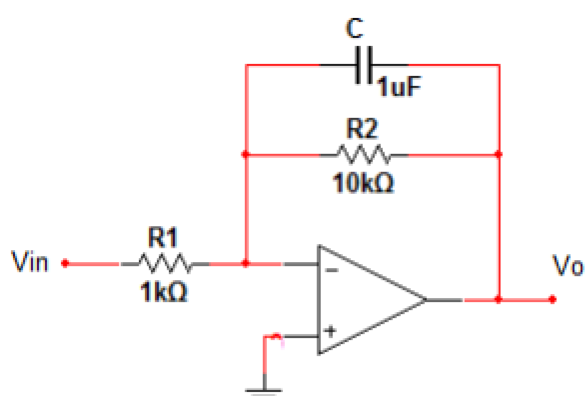
1. The circuits shown represent an op-amp inverting and non-inverting amplifiers respectively. Op-amps has a finite open-loop DC gain $A_o = 10^5$ and open-loop Band-Width $\omega_b = 10$ rad/sec.
   - Derive an expression for the closed-loop gain $A_V = V_o/V_{in}$.
   - Calculate the closed loop DC gain A_m and closed-loop Band-Width ω_C.
   - Calculate the Gain-Band-Width Product (GBP) for open and closed-loops.



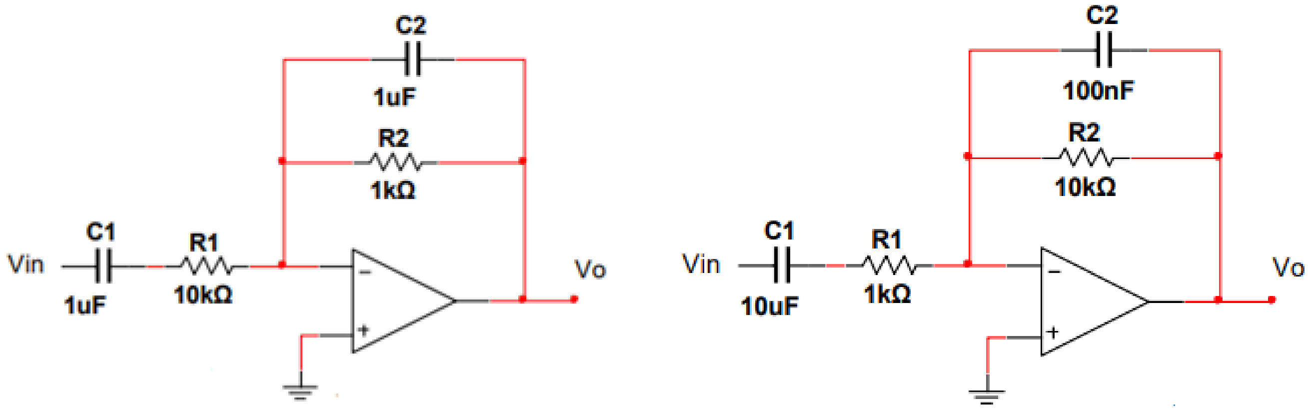


2. Analyze the circuits shown using ideal Op-amp.
   - Drive an expression for the closed-loop gain $A_V = V_o/V_{in}$.
   - Calculate the maximum DC gain (A_m) and the cut-off frequency (f_c).
   - Calculate the unity-gain frequency (f_T).
   - Sketch the frequency response magnitude
   - What is the filter type produced by each circuit?

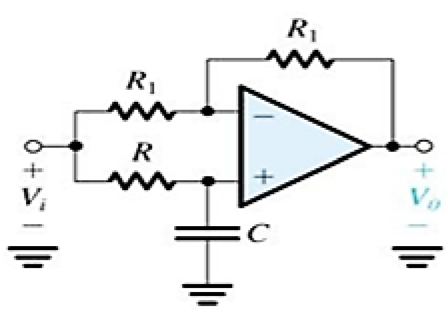




3. Analyze the circuits shown using ideal Op-amp.
   - Drive an expression for the closed-loop gain $A_V = V_o/V_{in}$.
   - Calculate the Lower and Higher cut-off frequencies (f_L and f_H).
   - Sketch the frequency response magnitude
   - What is the filter type produced by each circuit?



4. Analyze the circuit shown using ideal Op-amp.
   - Drive an expression for the closed-loop gain gain $A_V = V_o/V_{in}$.
   - Sketch the frequency response magnitude
   - What is the filter type?



5. By cascading a first-order op amp-RC low-pass circuit with a first-order op amp-RC high-pass circuit, one can design a wideband bandpass filter. Provide such a design for the case in which the midband gain is 12 dB and the 3 dB bandwidth extends from 100 Hz to 10 kHz. Select appropriate component values under the constraint that no resistors higher than 100 kΩ are to be used and that the input resistance is to be as high as possible.