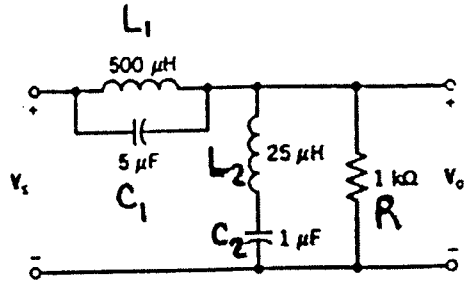
EECS210 Hwk 12

1. The following circuit is used to reject two unwanted signal frequencies. To simplify calculations let $s = j\omega$.



   a Find the transfer function $H(s) = \frac{V_o}{V_i}$.

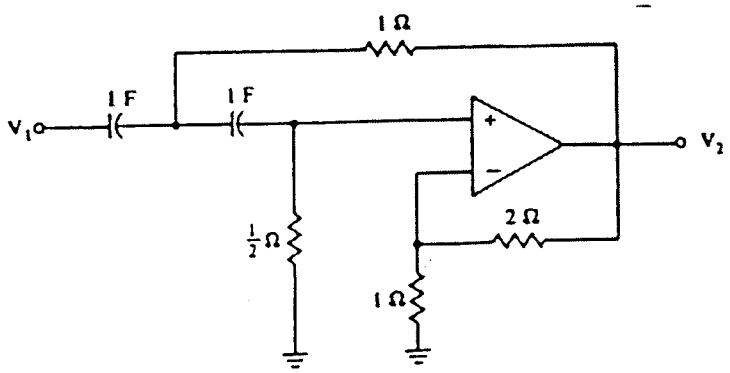
   b Make a Bode plot (magnitude & phase, use the Matlab command bode)

   c What are the two rejected frequencies?

2. Make a pole/zero for the following transfer function and sketch the asymptotic Bode plot.

$$H(s) = \frac{10s + 400}{s^3 + 10s^2 + 100s}$$

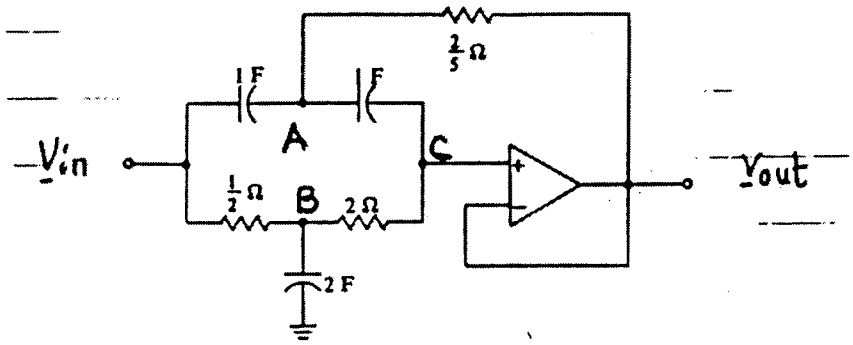
3. Consider the following circuit



(a) Derive the system transfer function $H(s) = \frac{V_2}{V_1}$. What kind of filter is this ?

(b) Scale the circuit to obtain a high pass filter with a 3dB cutoff frequency $\omega_c =$ 10 rad/s ($|H(\omega_c)| = 0.707|H(\infty)|$) using a 0.02μF capacitors to replace the 1μF capacitors.

4. Consider the following circuit



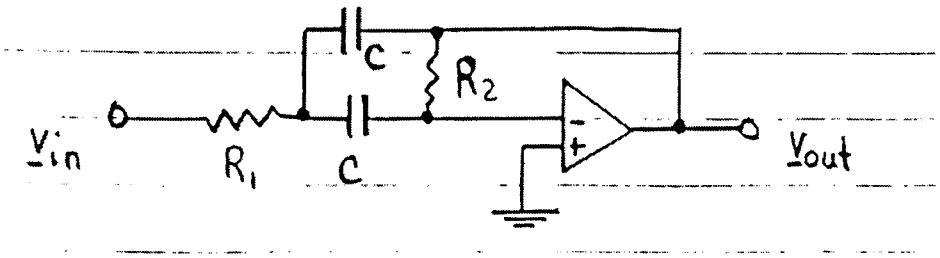
(a) Write node equations at nodes A,B and C.

(b) Derive the transfer function $H(s) = \frac{V_{out}}{V_{in}}$.

(c) Show that the circuit acts as a bandstop filter with a center frequency of 1 rad/s & a Q of 1.

(d) Scale the circuit to obtain a center frequency of 60Hz using capacitors of 1 and 2nF in place of 1F and 2F.

5. Consider the following circuit.



(a) Derive the transfer function for this bandpass filter.

(b) Compute its center frequency and 3dB full-width bandwidth.

(c) The filter is to have a center frequency of 500Hz & a 3dB full-width bandwidth of 50Hz. Find R_1, R_2 if C=10nF. What is the filter gain at ω_0?

6. (a) Construct an asymptotic Bode plot (magnitude & phase) for the system transfer function

$$H(s) = \frac{10(1+0.1s)(1+0.01s)}{(1+s)}$$

(b) Plot the exact Bode plots using the Matlab command bode.

7. Determine the system transfer function associated with the following Bode plot.