Faculty of engineering at shoubra **Communication department** **ECE-322: Electronic Circuits (B)**		**Dr. Ahmad El-Banna** **Semester : Spring 2017** **Sheet :5** **Active filter**

1. A single-pole high-pass filter has a frequency-selective circuit with R =2.2kΩ and C = 0.0015 µF.
What is the critical frequency? What is the roll-off rate of the filter?

2. What is the bandwidth of a band-pass filter whose critical frequencies are 3.2 kHz and 3.9 kHz? What is the Q of this filter?

3. A certain band-pass filter has a center frequency of 15 kHz and a bandwidth of 1 kHz. Determine Q and classify the filter as narrow-band or wide-band.

4. What is the center frequency of a filter with a Q of 12 and a bandwidth of 1 kHz?

5. If resistor R_2 in the feedback circuit of an active single-pole filter of the type in Figure 1 Is 10 kΩ, the damping factor must be 1.414, what value must R1 be to obtain a maximally flat Butterworth response?

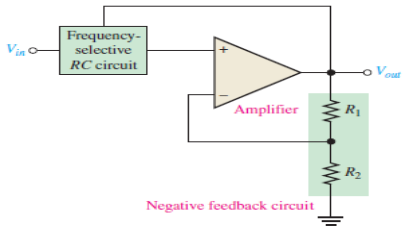


Figure 1

6. Determine the critical frequency of the Sallen-Key low-pass filter in Figure 2, and set the value of $R1$ for an approximate Butterworth response.

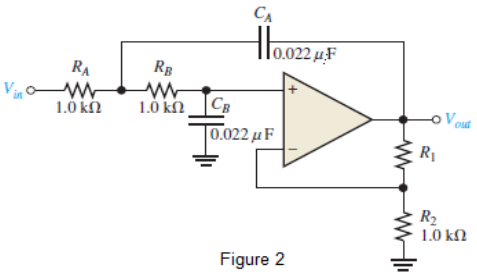


Figure 2

7. For the four-pole filter in Figure 3, determine the capacitance values required to produce a critical frequency of 2680 Hz if all the resistors in the RC low-pass circuits are 1.8 kΩ, Also select values for the feedback resistors to get a Butterworth response.

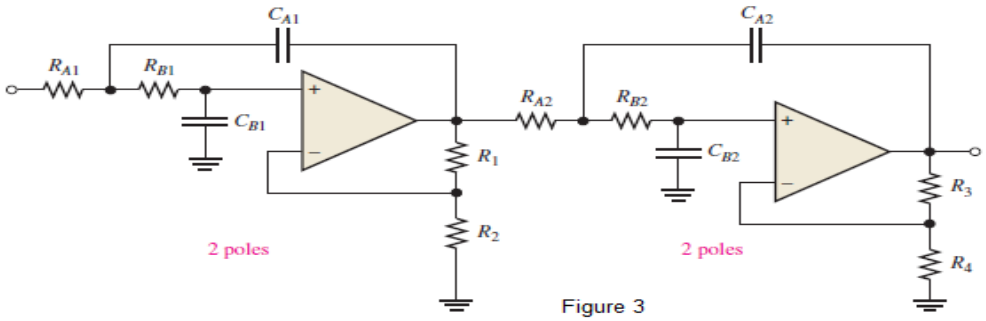


Figure 3

8. Using a block diagram format , show how to implement the following roll-off rates using single-pole and 2-pole LPF with Butterworth responses :

a) -40 dB/decade. b) -20 dB/decade.
c) -60 dB/decade. d) -100 dB/decade.
e) -120 dB/decade.

9. Choose values for the Sallen-Key high-pass filter in Figure 4 to implement an equal-value second-order Butterworth response with a critical frequency of approximately 10 kHz.

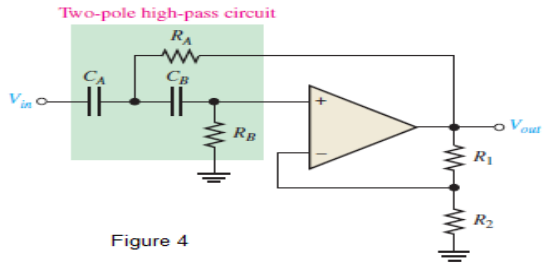


Figure 4

10. Determine the center frequency, maximum gain, and bandwidth for the filter in Figure 5.

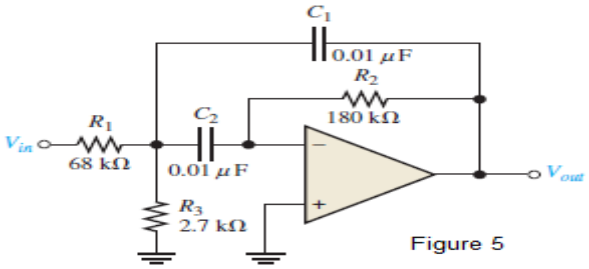
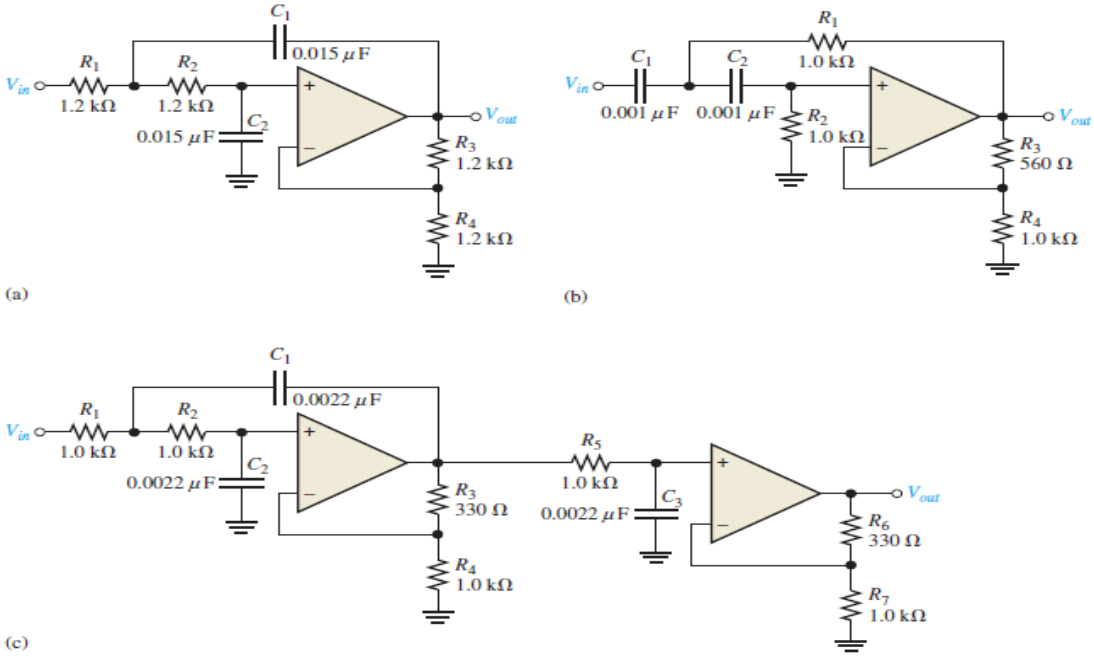


Figure 5

11. What is the damping factor in each active filter shown in Figure, Which filters are approximately optimized for a Butterworth response characteristic?



12. Determine the center frequency, *Q*, and *BW* for the passband of the state-variable filter in Figure 6.

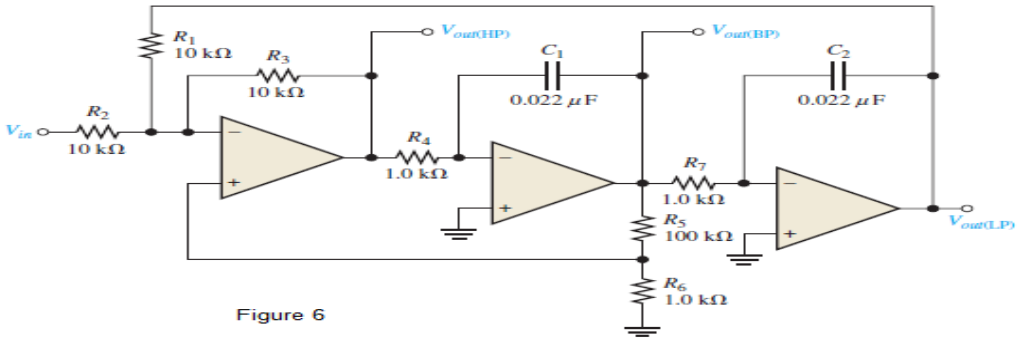


Figure 6

13. Verify that the band-stop filter in Figure 7 has a center frequency of 60 Hz, and optimize the filter for a Q of 10.

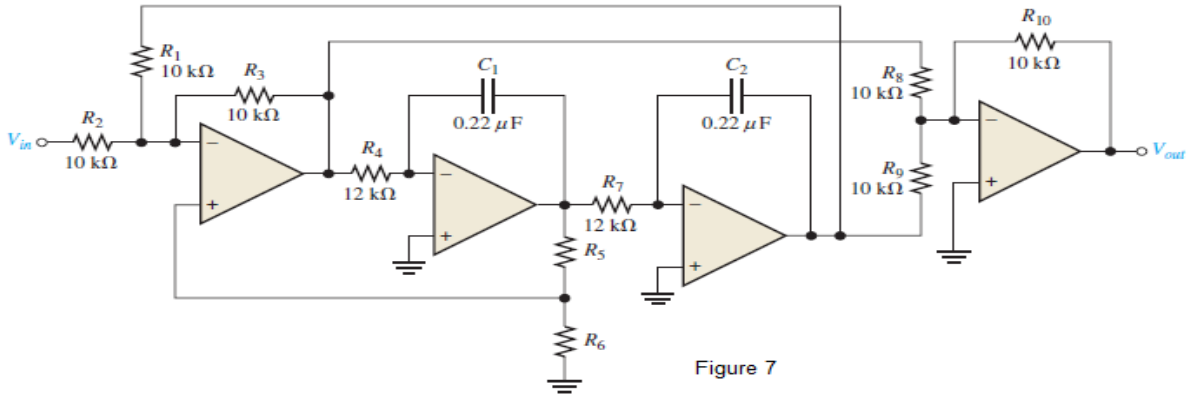
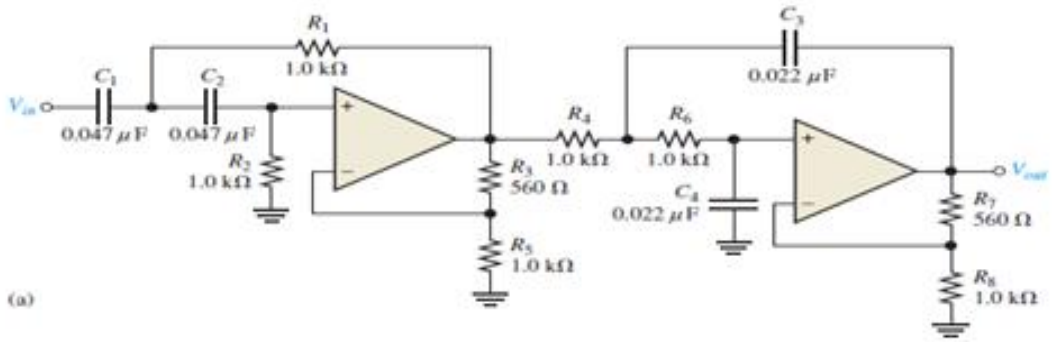
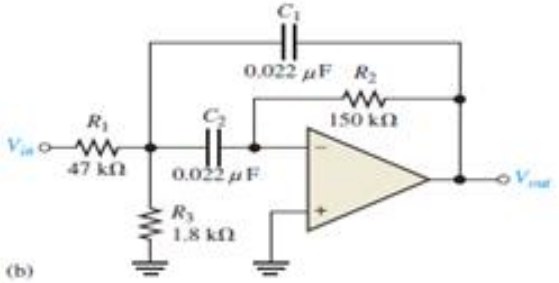
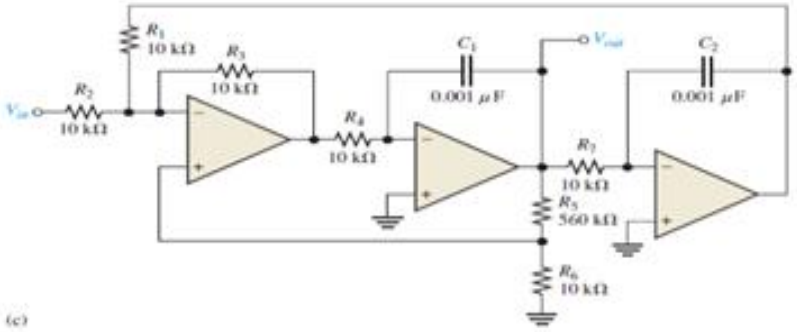


Figure 7

14. Determine the center frequency and bandwidth for each filter in Figure







ORDER	ROLL-OFF DB/DECADE	1ST STAGE			2ND STAGE			3RD STAGE		
		POLES	*DF*	R_1/R_2	POLES	*DF*	R_3/R_4	POLES	*DF*	R_5/R_6
1	−20	1	Optional							
2	−40	2	1.414	0.586						
3	−60	2	1.00	1	1	1.00	1			
4	−80	2	1.848	0.152	2	0.765	1.235			
5	−100	2	1.00	1	2	1.618	0.382	1	0.618	1.382
6	−120	2	1.932	0.068	2	1.414	0.586	2	0.518	1.482