Experiment 5

Filters using Op-Amps

1. **Design a Low pass filter circuit having gain 10 with f_H=15.9KHz.**

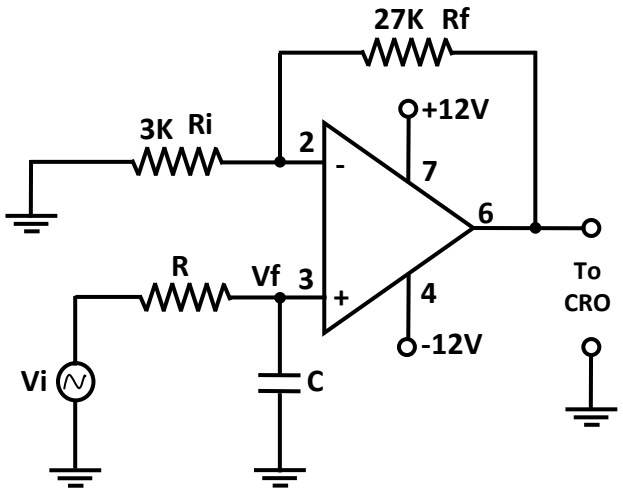

Fig 5.1: Low Pass Filter Circuit.

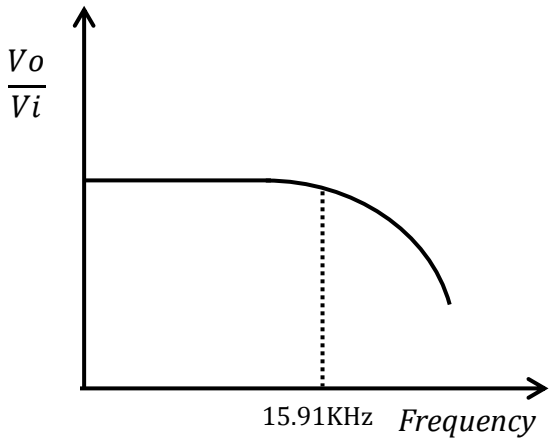

Fig 5.2 Model Graph for Low pass filter

$$f_H = \frac{1}{2\pi RC} = \frac{1}{2\pi * 100 * 0.1\mu} = 15.91\text{KHz}$$

$$\frac{V_0}{V_f} = 1 + \frac{R_f}{R_i} = A_V = \left(1 + \frac{27K}{3K}\right) = 10$$

Vin = 1V

Freq(Hz)	Vout	Gain(Vout/Vi)	20logGain
100			
300			
500			
1K			
3K			
5K			
7K			
10K			
12K			
14K			
15.9K			
20K			
30K			
50K			
70K			
100K			
500K			
1M			

2. Design a High Pass filter circuit having gain 10 with f_L=1.59KHz.

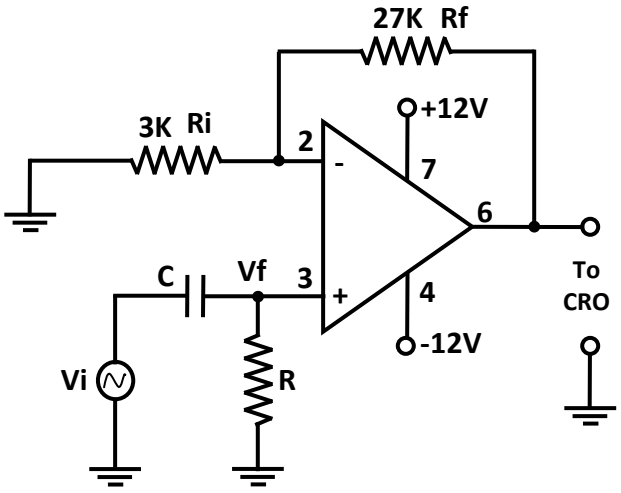

Fig 5.3: High Pass Filter Circuit.

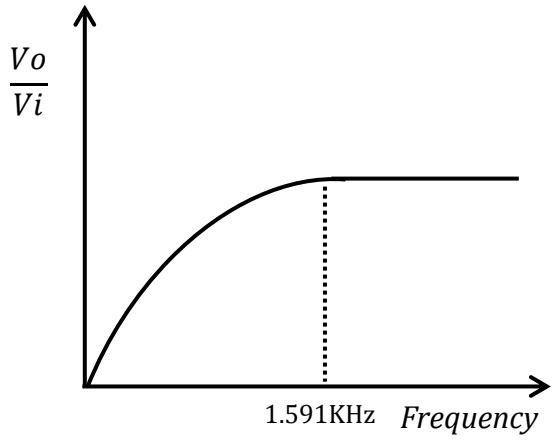

Fig 5.4: Model Graph for High pass filter

$$f_L = \frac{1}{2\pi RC} = \frac{1}{2\pi * 1K * 0.1\mu} = 1.591\text{KHz}$$

$$\frac{V_0}{V_f} = 1 + \frac{R_f}{R_i} = A_V = \left(1 + \frac{27K}{3K}\right) = 10$$

Vin = 1V

Freq(Hz)	Vout	Gain(Vout/Vi)	20logGain
100			
300			
500			
1K			
3K			
5K			
7K			
10K			
12K			
14K			
15.9K			
20K			
30K			
50K			
70K			
100K			
500K			
1M			

3. **Design a Band Pass filter circuit having gain 12 with f_L=1.59K Hz and f_H = 15.9KHz.**

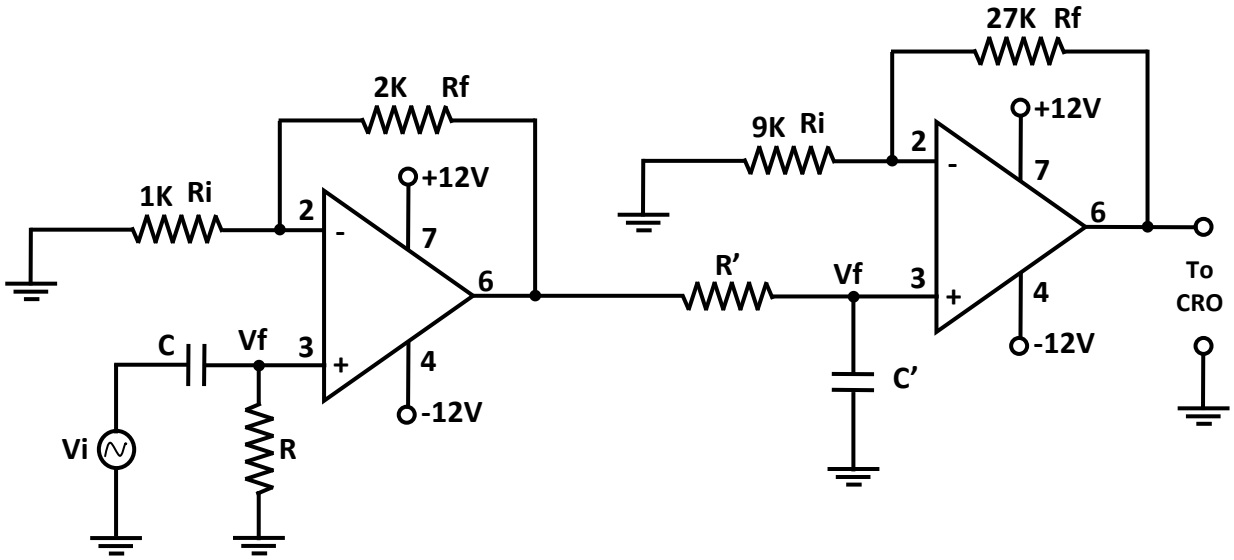

Fig 5.5: Band Pass Filter Circuit.

$$f_H = \frac{1}{2\pi RC} = \frac{1}{2\pi * 100 * 0.1\mu} = 15.91\text{KHz}$$

$$f_L = \frac{1}{2\pi R'C'} = \frac{1}{2\pi * 1K * 0.1\mu} = 1.591\text{KHz}$$

$$\frac{V_0}{V_f} = 1 + \frac{R_f}{R_i} = A_V = \left(1 + \frac{27K}{9K}\right) = 4$$

for Low pass

$$\frac{V_0}{V_f} = 1 + \frac{R_f}{R_i} = A_V = \left(1 + \frac{2K}{1K}\right) = 3$$

for Highpass

Overall circuit Gain = 4 * 3 = 12

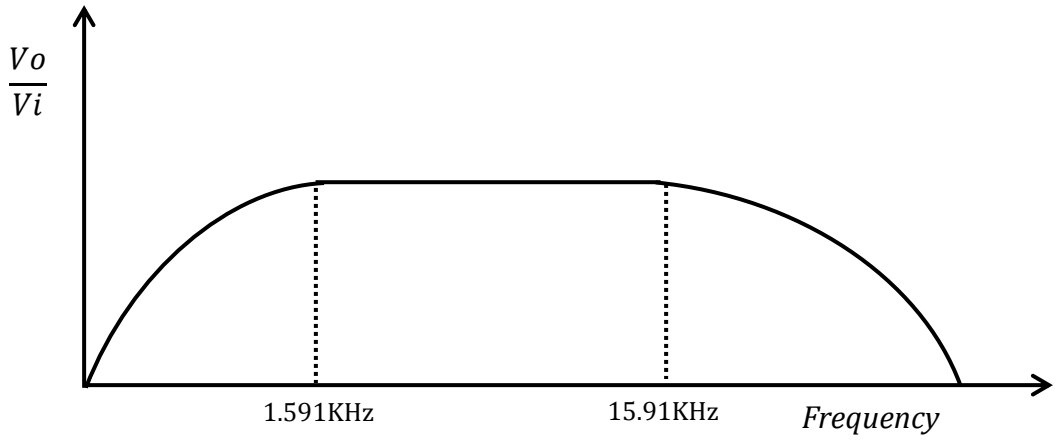

Fig 5.6: Model Graph for Band pass filter

Vin = 1V

Freq(Hz)	Vout	Gain(Vout/Vi)	20logGain
100			
300			
500			
1K			
3K			
5K			
7K			
10K			
12K			
14K			
15.9K			
20K			
30K			
50K			
70K			
100K			
500K			
1M			