

Experiment 10: Design and analysis of 1st order Low pass and high pass Filter

Aim/Objective: To design first order low pass and high pass filters using op-amp 741 IC for a given cutoff frequency.

Pre-requisite: NI Multisim and MyDAQ

Design:

For a given cutoff frequency $f = 1.59 \text{ KHz}$ for a Low pass filter,

$$f = 1/(2\pi RC)$$

Assume C as $0.001\mu\text{F}$

R = ? (Calculated as 100K)

For a given cutoff frequency $f = 10 \text{ KHz}$ for a High pass filter,

$$f = 1/(2\pi RC)$$

Assume C as $0.01\mu\text{F}$

R = ? (Calculated as 1.5K)

Circuit diagrams:

LOWPASS FILTER

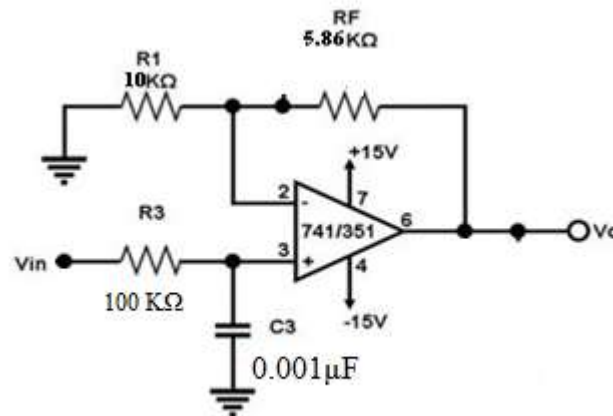


Fig 1. Active Low Pass Filter (1st order)

HIGH PASS FILTER

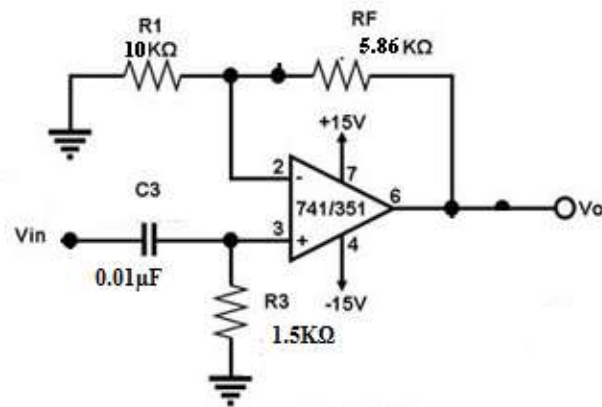


Fig 2. Active High pass Filter (1st order)

In Lab

1. Give the formula for cutoff frequency for the low pass filter?
2. What is the difference between analog filter and digital filter?
3. To obtain a band reject filter, LPF and HPF are to be connected in _____ method.
4. To obtain a band pass filter, LPF and HPF are to be connected in _____ method.

Procedure:

LOW PASS FILTER:

1. Connect the circuit as shown in the low pass filter circuit diagram (fig.1).
2. Apply $2V_{p-p}$ sine wave input to the resistor $R2$ at V_{in} .
3. Keep the input voltage constant and vary the frequency on semi-log scale ranging from $10Hz$ to $1MHz$ and note down the corresponding outputs on CRO.
4. Observe the theoretical and practical values of the cutoff frequency.
5. Draw the graph between voltage gain and frequency and mark the cutoff frequency.

TABULAR FORM: $V_{in} = 2V_{p-p}$ Sinusoidal Wave

S.No.	Input frequency (Hz)	Input Amplitude	Output Amplitude V_o (V_{p-p})	Gain V_o/V_n	Gain in $dB=20\log (A)$
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8					
9.					
10					

HIGH PASS FILTER:

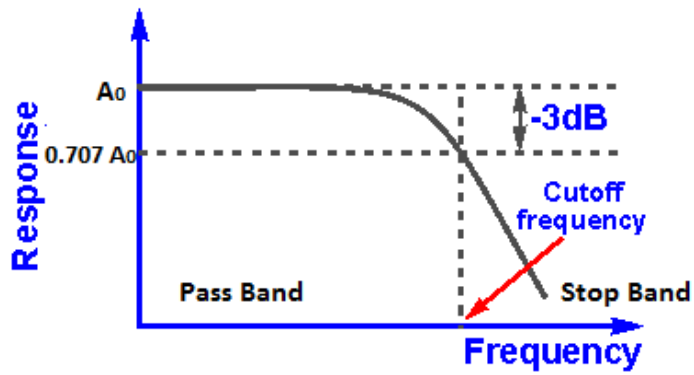
1. Connect the circuit as shown in the high pass filter circuit diagram (fig 2).
2. Apply $2V_{p-p}$ sine wave input to the capacitor C_2 at V_{in} .
3. Keep the input as voltage constant and vary the frequency on semi-log scale ranging from 10Hz to 1MHz and note down the corresponding outputs on CRO. Observe the theoretical and practical voltage gains.
4. Draw the graph between voltage gain and frequency and mark the cutoff frequency

TABULAR FORM: $V_{in} = 2V_{p-p}$

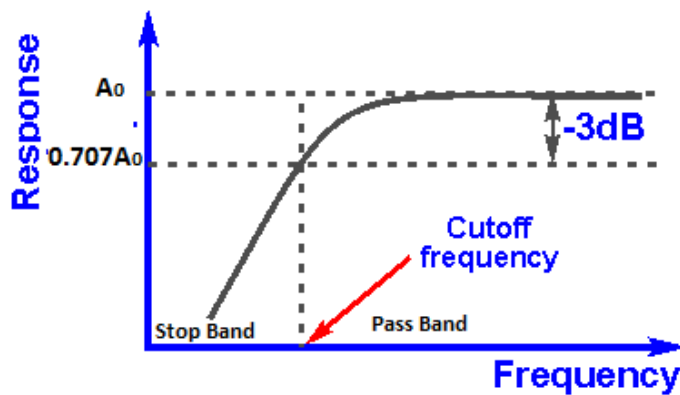
S.No.	Input frequency (Hz)	Input Amplitude	Output Amplitude $V_o (V_{p-p})$	Gain V_o/V_n	Gain in $dB=20\log (A)$
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8					
9.					
10					

FREQUENCY RESPONSE PLOTS:

LOW PASS FILTER



HIGHPASS FILTER



Result:

Evaluator Remark (if Any):	Marks Secured: ____ out of 50
	Signature of the Evaluator with Date