LAB # 10

Active Filters

SUBMITTED BY:

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SECTION:

"A"

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COMPUTER SYSTEM ENGINEERING

ASSESSMENT RUBRICS

LAB REPORT ASSESSMENT				
Criteria	Excellent	Average	Nil	Marks Obtained
1. Objectives of Lab	All objectives of lab are properly covered [Marks 1]	Objectives of lab are partially covered [Marks 0.5]	Objectives of lab are not shown [Marks 0]	
2. Procedure	All experimental steps are shown. [Marks 2]	Some of the experimental steps are shown. [Marks 1]	Experimental steps not shown [Marks 0]	
3. Demonstration of Concepts	The student demonstrated a clear understanding of the assignment concepts [Marks 2]	The student demonstrated a clear understanding of some of the assignment concepts [Marks 1]	The student failed to demonstrate a clear understanding of the assignment concepts [Marks 0]	
4. Experimental Results	All experimental results are completely shown in form of table [Marks 3]	Experimental results are partially shown and some of the observations are missing [Marks 1.5]	No experimental results are shown [Marks 0]	
5. conclusion	Conclusion of the lab is properly written [Marks 2]	Conclusion of the lab is partially written [Marks 1]	Conclusion of lab is not written [Marks 0]	

Total Marks Obtained: _____

Instructor Signature: _____

Low Pass Filter

Objectives:

To study the Active Low pass filter and to evaluate:

- High cutoff frequency of Low pass filter.
- Pass band gain of Low pass filter.
- Plot the frequency response of Low pass filter.

Equipment:

1. DC power supplies +15V, −15V from external source
2. Function generator
3. Oscilloscope
4. Digital Multimeter

Components:

1. Resistance 10kΩ
2. Resistance 22kΩ
3. Capacitor 0.01µF
4. LM 741

Equation of low pass filter

Vin =Input signal Voltage
Vout = Output signal Voltage

| Vout/Vin |= Gain of filter as a function of frequency
AF =1+RF/R1 = pass band gain of filter
f = frequency of input signal
fH =1/2πRC =high cut off frequency, 3-dB frequency, corner frequency
Operation of low pass filter using equation 2

The ideal low pass filter has a constant gain AF from 0 to high cut off frequency (fH) at fH the
gain is 0.707 * AF, and after fH it decreases at a constant rate with an increase in frequency i.e.,
when input frequency is increased tenfold (one decade), the voltage gain is divided by 10. Gain
(dB) = 20 log | Vout / Vin | i.e., Gain Roll off rate is −20dB / decade.

Procedure

1. Connect the circuit as shown in Figure 2.

2. Switch ON the power supply

3. Connect a sinusoidal signal of amplitude 1V (p-p) of frequency 1KHz to Vin of Low

pass filter from function generator

4. Connect Ch-1 of oscilloscope to the signal source

5. Observe output on Ch-2 of oscilloscope

6. Increase the frequency of input signal step by step and observe the effect on output

V_{out} on oscilloscope

7. Tabulate values of V_{out}, gain, gain (dB) at different values of input frequency shown

in observation Table 2.

8. Plot the frequency response of low pass filter using the data obtained at different

input frequencies.

Theoretical Calculations:

Calculate all the following values

1. Pass band gain of Low pass filter AF = 1 + RF / R1

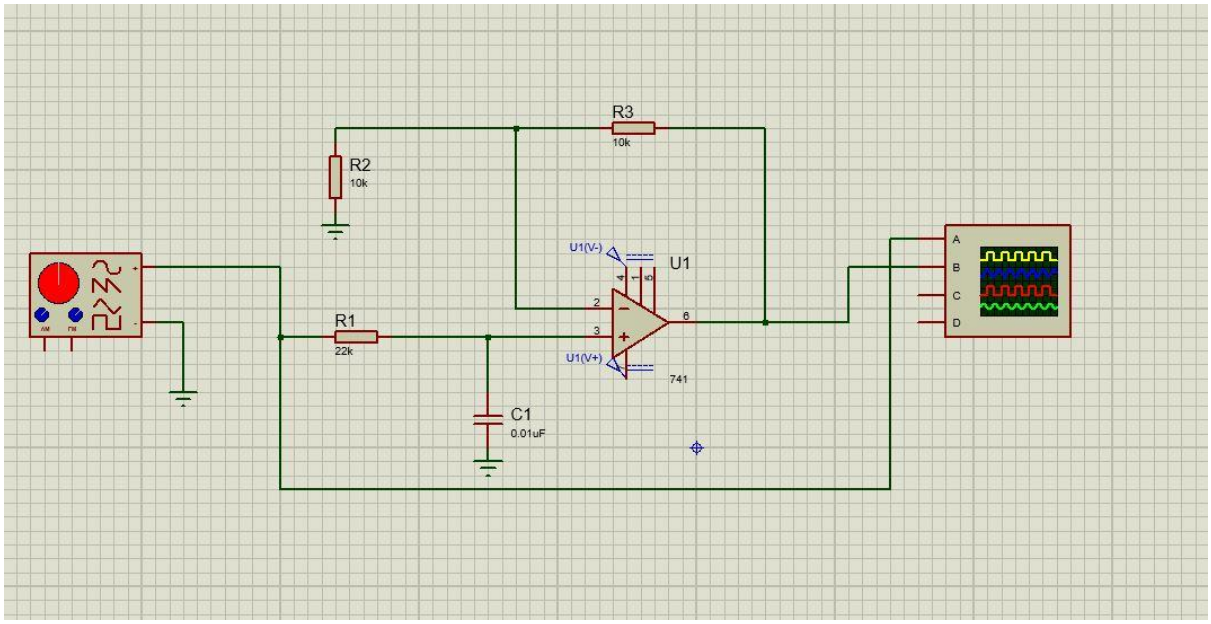
2. Pass band gain (dB) = 20 log |Vout / Vin|

3. 3 dB frequency fH = 1/2πRC

4. Gain at 3 dB frequency fH = 0.707 * AF

5. Roll off rate = −20db/decade

Proteus Circuit:



Results:

	Theoretical	Practical
Pass band gain (A_r)	2	2
Pass band gain (A_r) in db	6	6
3db frequency f_H	723	722
Gain at 3db frequency (f_H) in db	1.414	1.414

Table 2:

S.No	Input Frequency (Hz)	V_{out}	$\lvert V_{out}/v_{in}\rvert$=Gain	Gain(db)=20log$\lvert V_{out}/V_{in}\rvert$
1	300	9.18	1.8	5.182
2	500	8.2	1.62	4.1

3	700	7.33	1.44	3.3
4	1k	5.79	1.15	1.5
5	5k	1.43	0.28	-11.4
6	10k	0.70	0.14	-16.8
7	15k	0.4	0.096	-20.33

Conclusion:

A low-pass filter is a filter that passes signals with a frequency lower than a selected cutoff frequency and attenuates signals with frequencies higher than the cutoff frequency. The exact frequency response of the filter depends on the filter design.