To Study active filters characteristics using OPAMP (IC-741)

Analog Electronics Lab Experiment -6

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Lab Section: P5
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1. Objective

To study the Active Filters using OP AMP (IC-741)

1) Low Pass Filter

2) High Pass Filter

3) Band Pass Filter

Report the following:

1) Circuit diagrams for all three configurations.

2) Plot the Voltage Gain versus Frequency for all the three types of active Filters .

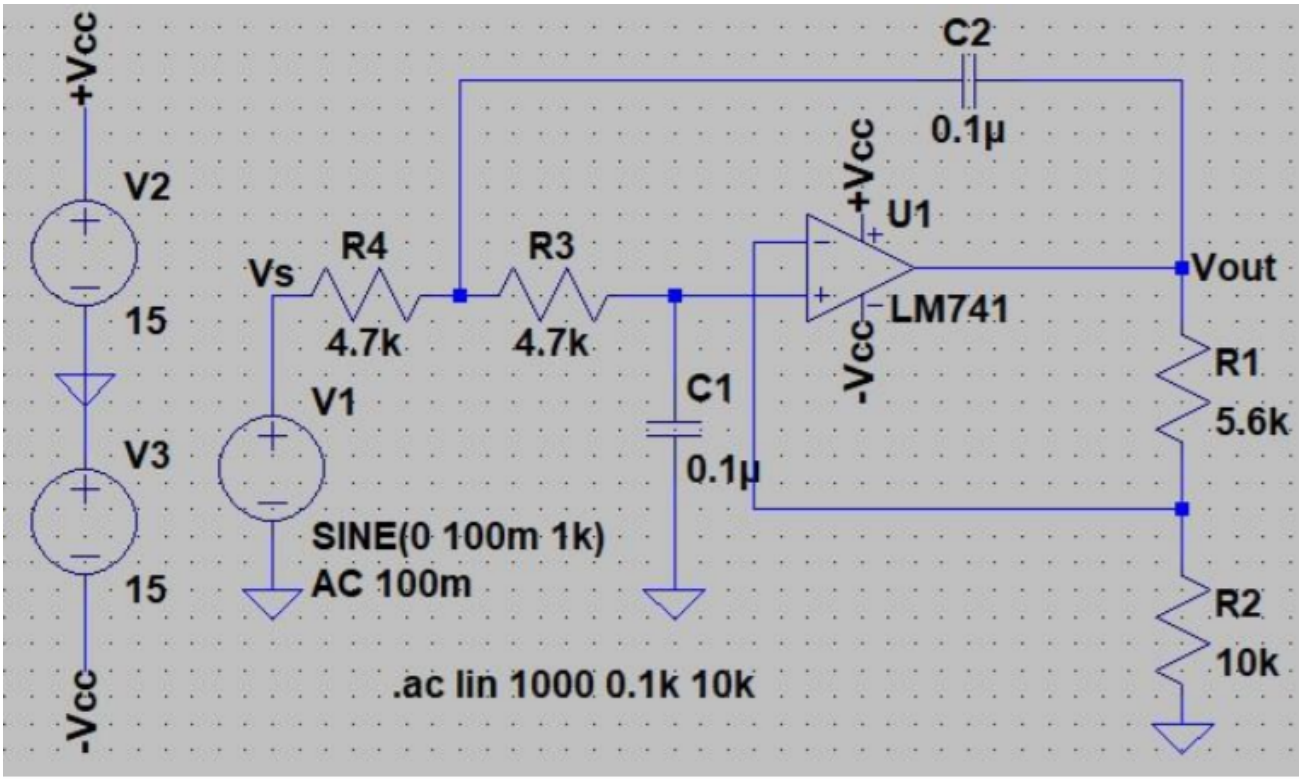
3) Calculate the 3-dB cut-off frequency and compare your simulated values with the theoretical ones in tabular form.

Assumptions:

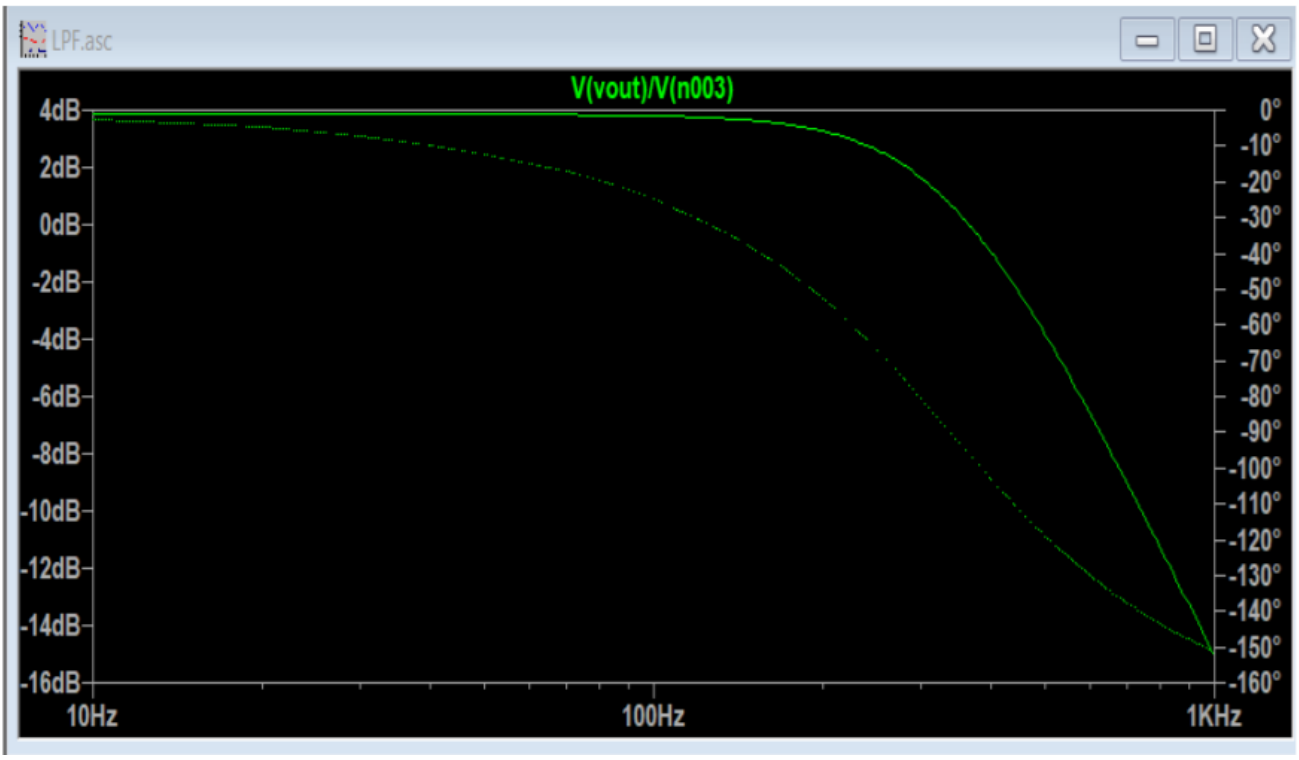
1) Ideal behaviour of the OPAMP.
2) All the calculations to be done at 1kHz frequency.

2. Low Pass Filter

1. **Circuit Diagram**:



2. **Resultant Curve and simulation result**



Simulated Value of f_{3dB} = 331.13 Hz

Simulated value of Av = 3.863 dB

3. **Hand Calculations**

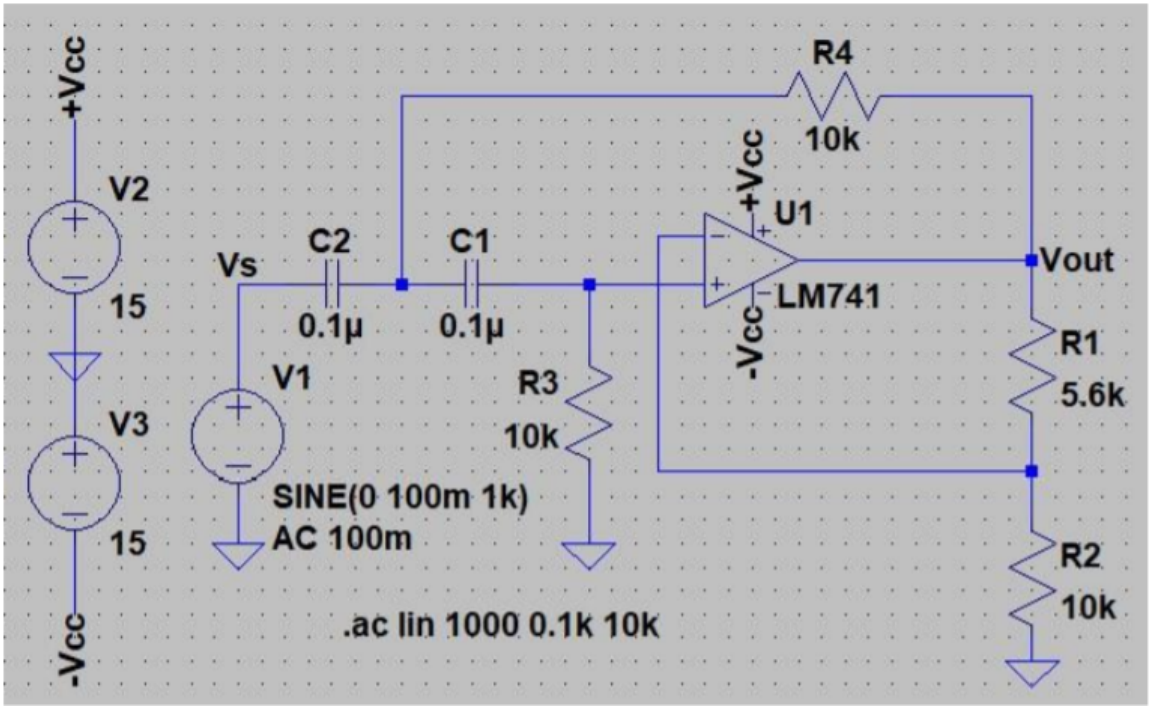
Theoretically, the cutoff frequency is given as: fo,th = 1/(2.pi.(R3.R4.C1.C2)1/2); where R3,R4,C1,C2 are as per shown in the schematic.

So, fo,th = 338.6 Hz.

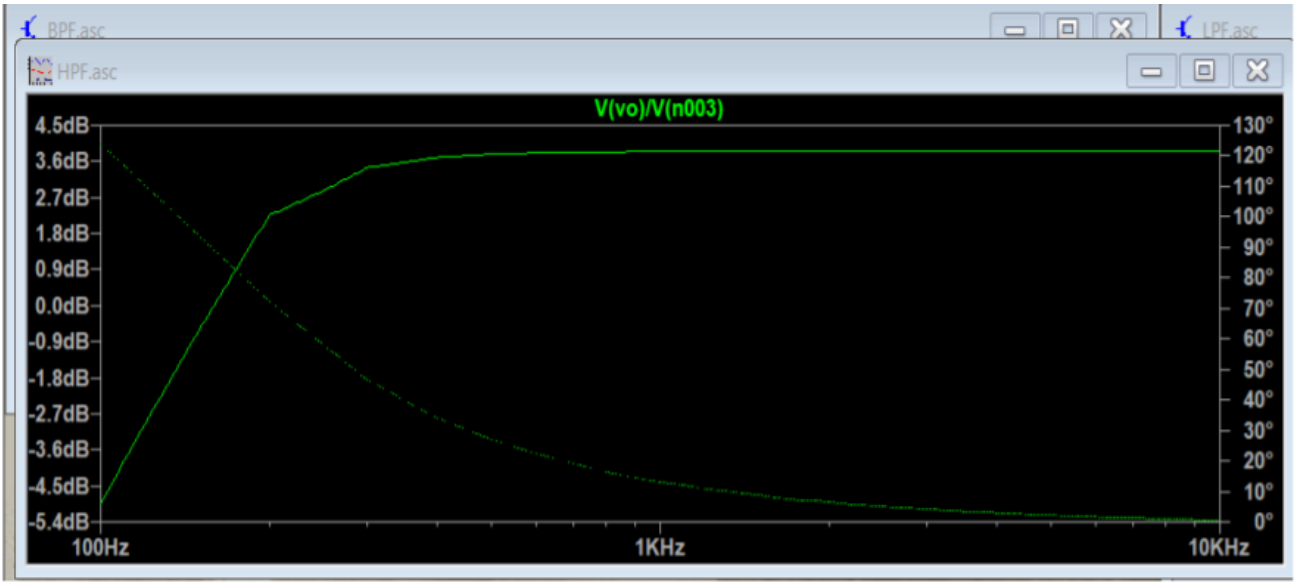
And for Av it is 20Log((R2 + R1)/R2) = 3.862 dB

3. High Pass Filter

1. **Circuit Diagram**:



2. **Resultant analysis and simulated result**



(Simulated)f-3dB= 162.28623Hz

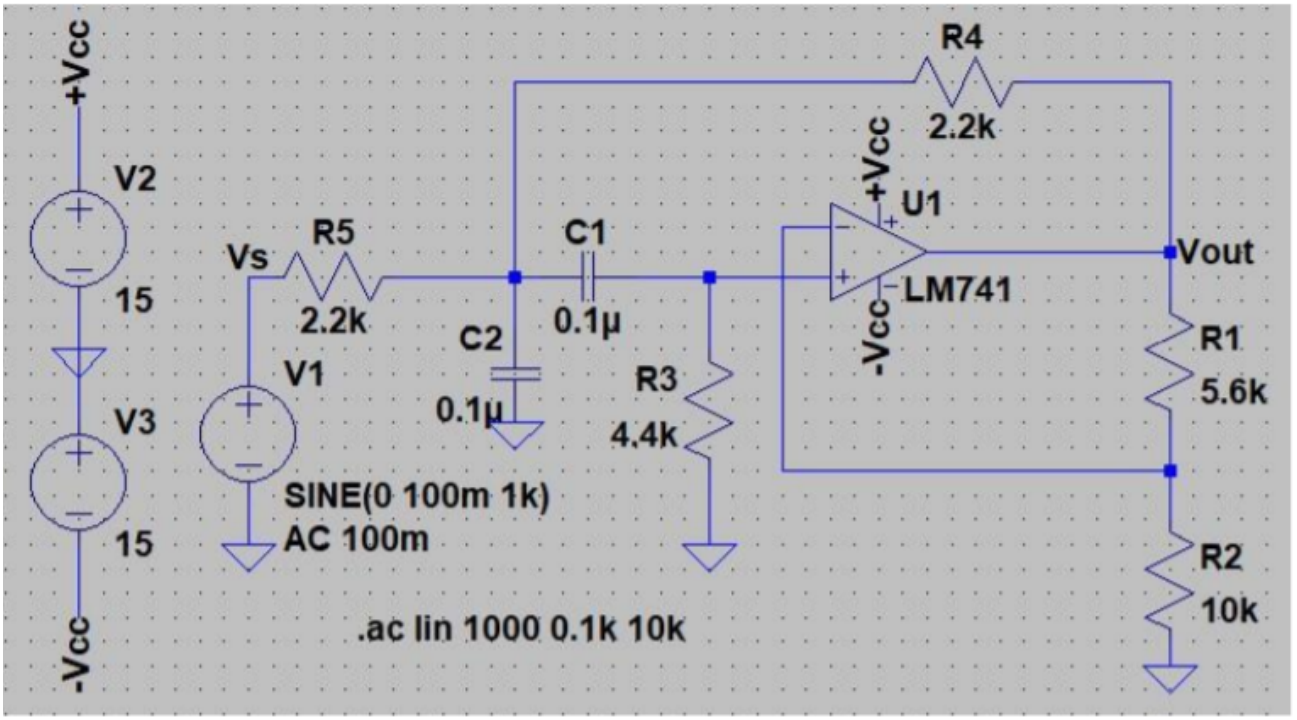
(Theoretical) f-3dB=159.15 Hz

Formula for F-3db=1/sqrt(R1R2C1C2)

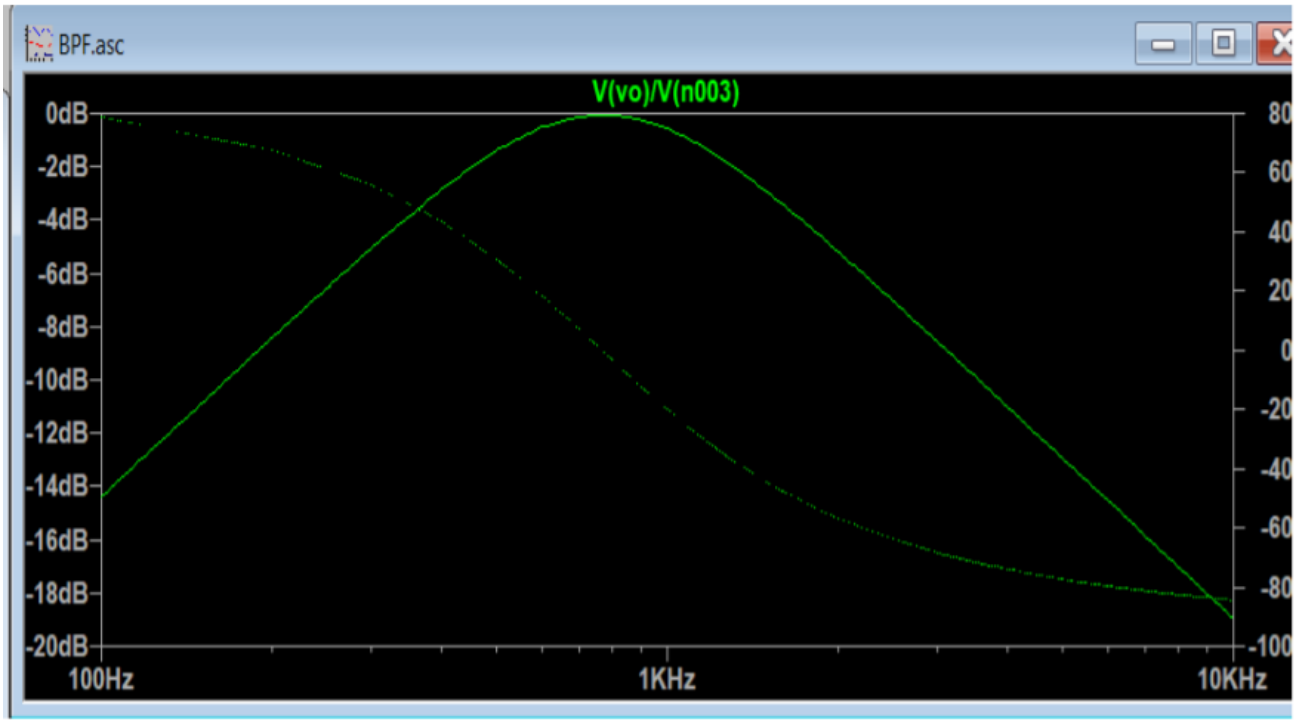
Av, high frequency = 20log(R2 + R1/R2) = 3.862 dB
Av simulated = 3.858 dB

4. Band Pass Filter

1. **Circuit Diagram**:



2. **Resultant analysis and simulation results**



Maximum Amplitude of 696.1031 mdB at a frequency of 722.77228 Hz

Theoretically, the cutoff frequency is given as: fo,th = 1/(2.pi.R4.C1); where R4,C1 are as per shown in the schematic. Theoretical value at max f=723.43Hz

f-3dB (lower) =352.52588Hz

f-3dB (higher) = 1.4831683KHz

For Av, the simulated value was to be 0.696 dB
And, in theory, 20Log((R2 + R1)/(2R2 - R1)) = 0.695 dB

5. Results

1. **For 3-dB frequencies**

Filter Type	Simulated fo (Hz)	Theoretical fo (Hz)
Low Pass	331.13	338.6
High Pass	162.28	159.15
Band Pass	722.77228 (Higher)	723.43 (Higher)

2. **For Voltage gains**

Filter Type	Simulated fo (dB)	Theoretical fo (dB)
Low Pass	3.863	3.862
High Pass	3.858	3.862
Band Pass	0.696	0.695