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## Band Pass filter

This lab experiment is performed to find out the central frequency of the band pass filter. The central frequency was found with the help of circuit diagram and from the data table formed from the observations. In this lab experiment, a stack of low and high bandpass filters was also prepared. During the experiment, a pair of polarized capacitors was used. These pair of polarized capacitors with resistors was used to control the cut off frequency. These capacitors were added in a particular way to increase their capacity because the capacity of the capacitors depends upon the way in which they are connected. In this experiment, the bandpass filter is formed with the help of low pass filters and high pass filters that were connected opposite to each other, so that the bandpass filter could pass the signals that have both low and high-frequency ranges collectively.

A bandpass filter could pass the signals with a certain band or frequency without distorting any of the input signals or without producing any noise. The band of the various frequencies can be having any width, and this width is called bandwidth of the filter. The cascading process can form the bandpass filter. Under this process, cascading of high and low pass filter is performed. Cascading of low and high pass filter means using the output of the first filter as the input of the second filter.

The bandpass filter can be used to isolate the frequencies that lie within a particular band or group of frequencies. Each section of the filter resembles the frequencies of the previous filter. The high and low pass filters have their resistors and capacitors that interchange to form the bandpass filter. The various applications in which bandpass filter is used have filter' bands and frequencies of a wider range made of mixed signals. The circuit that is used in filtering the frequencies is designed by combining the properties of the low and high bandpass filters. This bandpass filter is designed to pass the signals in the bands of frequencies. Bandwidth can also be defined as the frequency ranges that exist on any point between cut off frequencies of the low and high pass filter or the band of frequencies.

The cutoff frequency 1, or we can say  $CF_1$ , is the lower frequency at which the transfer function of signals has the maximum value equivalent to  $1/\sqrt{2}$ . The cutoff frequency 2 is the higher frequency at which the transfer function of signals has the maximum values equivalent to  $1/\sqrt{2}$ . The center frequency is the frequency at which transferring of the signal function is at maximum. The above circuit diagram denotes a 741 op-amp circuit. This circuit has two resistors and two capacitors.  $R_1 = 2.2k\Omega$ ,  $R_2 = 22k\Omega$ ,  $C_1 = 10nF$ ,  $C_2 = 4.7nF$  Central frequency  $H$  In the above equation:  $f_r$  represent the central frequency.  $f_L$  represents the lower cut off frequency point.  $f_H$  represents the higher cut off frequency point. Using the above information related to the circuit,

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we found the cut off frequencies of the low and high pass filters in this lab report. The input voltage of the circuit that is calculated by applying the sine waves is used to estimate the output voltage of the circuit. In this lab report, we calculated and compared the cut off frequency of both low and high pass filters. We have also calculated the experimental central frequency in this report.

## Summary of experience

The main objective of this lab report was to perform the simulation of the bandpass filters. From this lab experience, I learned about the simulation process. In this experiment, the simulation for both low and high pass orders was performed. Also, the calculation of the cut off frequencies and their comparison was done during the experiment. From this, I can understand the difference between the lower and higher frequencies. The formula for calculating the central frequency was also worked out. The calculation of the central frequency point has shown very interesting results. Overall it was a great learning experience to perform this lab experiment and achieving all the objectives related to the bandpass filters.

## Discussion topics

The bandpass filter can be obtained by the cascading of the low and high pass filters. The bandpass filter is used in finding the frequencies which are either too low or too high. The results achieved by using these frequencies can help in finding a certain range of frequency through which we can pass the signals. The signals are passed by using a pair of resistors and capacitors with a specific capacity. We use the sine waves to apply the precise voltage as an input in order to get the specific voltage output. In this filter, the input of the first filter can be used as the output of other. With the help of input and output values, we found the total gain that we achieved through the entire process in the form of voltage or dB. In this lab experiment, we developed the bandpass filters by making a stack of low pass filter and attach a high pass filter at the end of the same stack. We also obtained the bandpass filter by making a stack of high pass filters by attaching a low pass filter at the end.

## Time required

The complete lab experiment can be completed in approximately 1 hour. In this 1 hour, we found all the voltage input values for calculating output and gain from this process. We can also found the entire frequencies in this 1-hour process. Feedback The making of the circuit diagram, attaching the resistors and capacitors was a very stimulating task that is associated with this experiment. The calculation of input and output value was also a learning activity but making the tables by using these values requires focus as these values are used for further calculation work. All the instructions provided by the instructor were very helpful in the completion of the

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