Analog Circuit Design
Mini Project

<u>Group Members</u>

Name	Enrollment no
Om Tayade	BT23ECE055
Soham Kale	BT23ECE057
Sanchit Thakare	BT23ECE058
Mohammed Aaquibuddin	BT23ECE059
Uday Gupta	BT23ECE060
Jaswanth Singh Rathod	BT23ECE069

Aim:

To design and implement a Band-Pass Filter using **two 741 operational amplifiers (op-amps)**.

Apparatus Required:

- 2 × IC 741 Operational Amplifiers
- 2 × Potentiometers (1 MΩ each)
- Resistors: 1 kΩ, 10 kΩ
- Function Generator
- Dual DC Power Supply (±15V)
- Breadboard and Connecting Wires
- Capacitor 1000PF ,100PF

Theory:

A **band-pass filter** is a frequency-selective circuit that allows signals within a specified **frequency range** (passband) to pass through while attenuating signals outside this range. The passband is defined by two cutoff frequencies:

- **Lower cutoff frequency (f□)**
- **Higher cutoff frequency (f□)**, where *f□* > *f□*

The **ideal band-pass filter** passes frequencies between f□ and f□ with minimal attenuation and suppresses others.

In this design, we create a **first-order band-pass filter** by cascading:

1. A **High-Pass Filter** (HPF) — attenuates low frequencies
2. A **Low-Pass Filter** (LPF) — attenuates high frequencies

Each section uses a **741 op-amp** in an active configuration to provide gain and better frequency response.

This combination results in a **first-order band-pass filter** with a slope of:

- +20 dB/decade before f□
- 0 dB/decade within the passband
- –20 dB/decade after f□

This is known as a **wide band-pass** configuration, where the bandwidth is large compared to the center frequency. The use of op-amps allows precise control of gain and frequency cutoffs by adjusting component values (resistors and capacitors).

Calculations:

For HPF :

fa=1/(2* pi *R *C)

fa = 159 HZ for R=1M Ohm

Gain =Af * (f/fc) /(1+(f/fc)^2)^½

Gain=10.8 DB

For LPF:

fa=1/(2* pi *R *C)

fb=16k HZ for R=100K Ohm

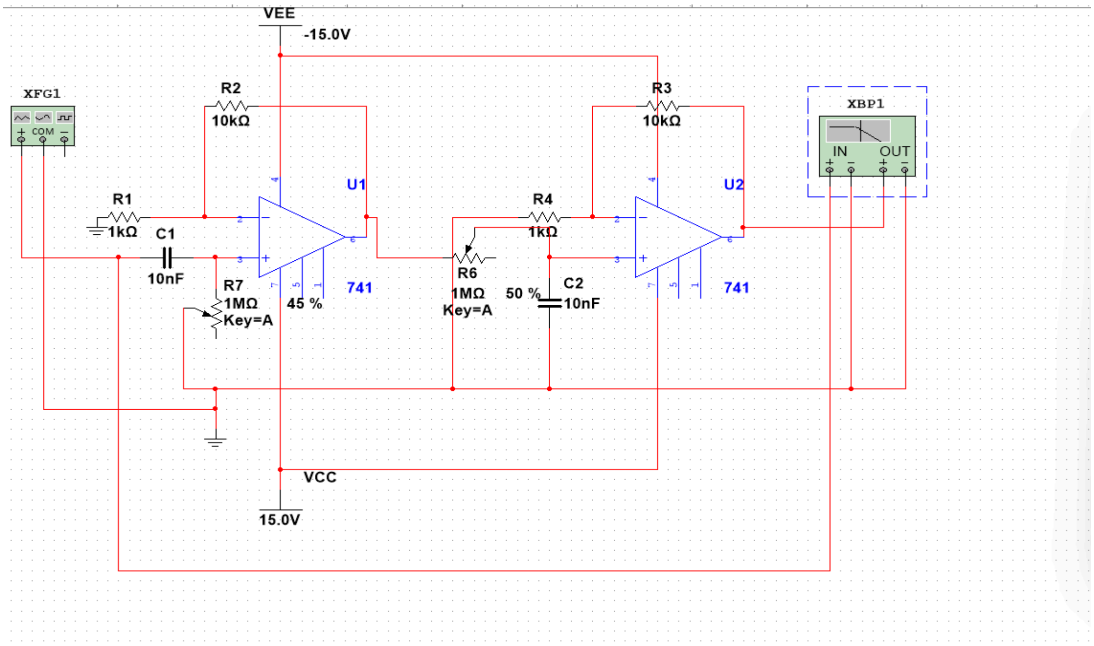
Gain =Af /(1+(f/fc)^2)^½

Gain =10.9 DB

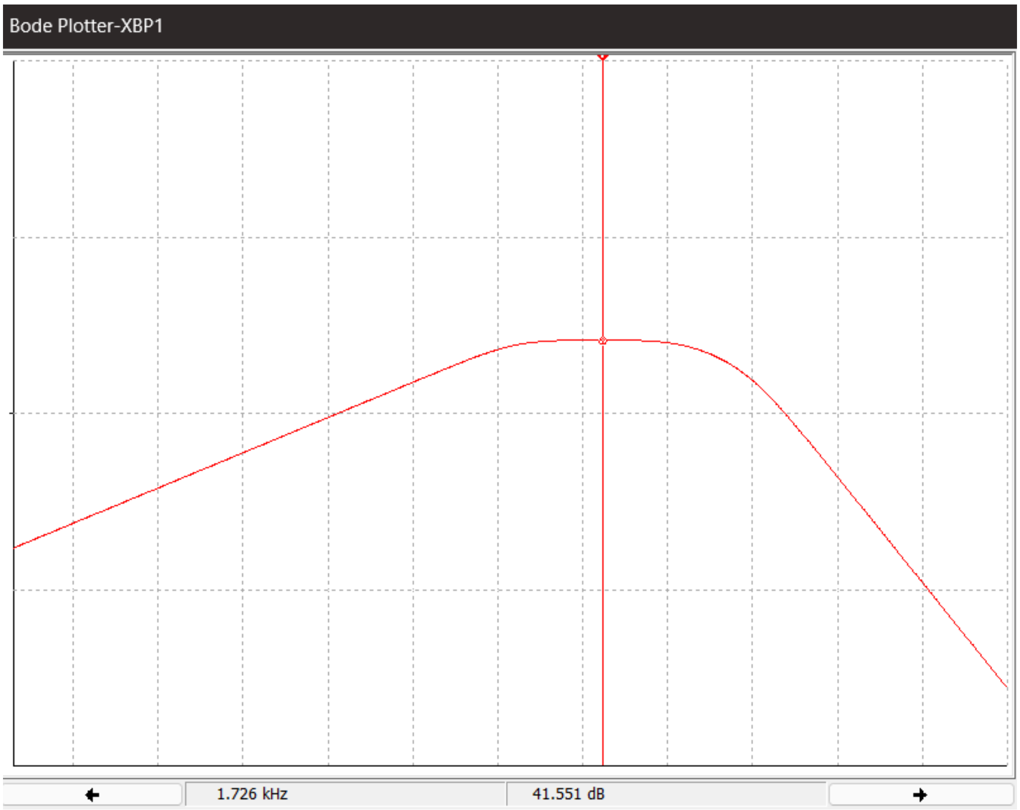
Final Gain=10.8* 10.9=117

Final Gain (DB) =41.36 DB

Multisim Ckt Diagram:



Output Waveform:



Conclusion:

We have performed a Bandpass filter using a High Pass Filter and Low Pass Filter .To adjust the band pass width we have used a potentiometer of maximum resistance allowed 1M ohm.