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**(AUTONOMOUS)**  
**AFFILIATED TO JNTUA, ANANTHAPURAM**  
**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**III BTECH II SEMESTER**  
**(Academic Year 2021-22)**

## **NARROW BAND PASS FILTER CIRCUIT**

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# NARROW BAND PASS FILTER CIRCUIT

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- \* Band Pass Filters
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# ABSTRACT

- \* Narrow Band-pass filtering techniques have been a challenging task since the inception of audio and telecommunication applications.
- \* a bandpass filter is defined as a wide bandpass if its figure of merit or quality factor  $Q$  is less than 10 while the bandpass filters with  $Q > 10$  are called the narrow bandpass filters.
- \* A Narrow band pass filter is one that allows a narrow range of frequencies around a center frequency to pass with minimum attenuation but rejects frequencies above or below this range . Narrow band pass filter is a multiple feedback circuit . The bandwidth of a Narrow bandpass filter is Narrow .The narrow band pass filter is designed for only specific frequencies .

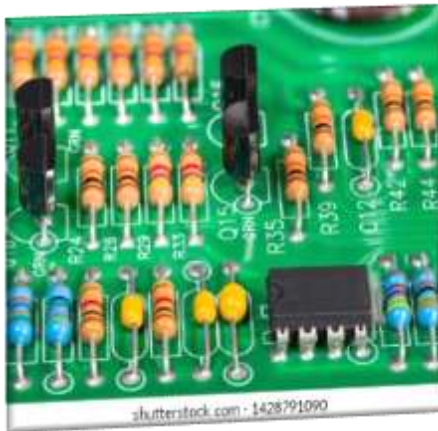
# INTRODUCTION

- \* The band Pass Filter which has a quality factor greater than ten.
- \* The band width of this filter is Narrow.
- \* Therefore, it allows the signal with a small range of frequencies.
- \* It has multiple feedback.

# COMPONENTS

## RESISTORS

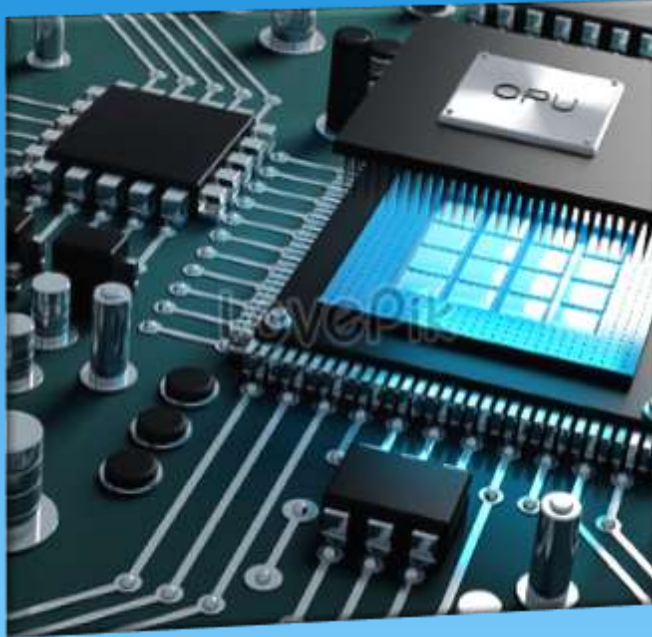
- \* Resistor is a passive element.
- \* A Resistor is an electrical components.
- \* That limits or regulates the flow of current in an electrical circuit.
- \* The value of resistors can be found by using color coding method.



## CAPACITORS

- \* A Capacitor is a Passive electronic component with two terminals.
- \* It is used for storing electrical energy in an electrical field.
- \* Ceramic capacitors, Film capacitors, Electrolytic capacitors etc. are the different types of capacitors.





# INTEGRATED CIRCUITS

- Integrated Circuits or IC is an electronic circuit in which many number of components like (transistors, resistors, capacitors etc.) active and passive components are fabricated and interconnected over a single crystal chip of silicon.



## IC741

- The 741 Op-Amp IC is a monolithic integrated circuit, comprising of a general purpose Operational Amplifier.
- The number **741** indicates that this operational amplifier IC has **7 functional pins**, **4 pins** capable of taking input and **1 output pin**.

# SPECIFICATION

COMPONENTS:	COUNT :	VALUES :
Resistors	3	10K $\Omega$
Resistor	1	5.7K $\Omega$
Capacitors	2	0.01 $\mu$ f
OP Amp	1	741IC



# FILTERS

- \* Filters are electronic circuits that remove any unwanted components or features from a signal.

## TYPES OF FILTERS :-

1. Low-pass filter
2. High-pass filter
3. Band-pass filter
4. Band-reject filter

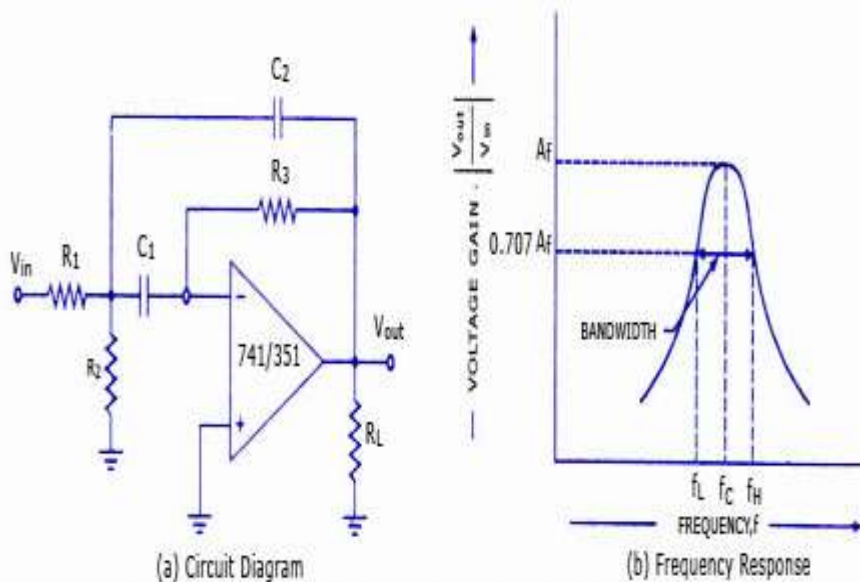
# BAND PASS FILTERS

- \* Arrangement of electronic components that allows only those electric waves lying within a certain range, or band, of frequencies to pass and blocks all others.

## TYPES OF BAND-PASS FILTER:-

1. Narrow Band-pass filter
2. Wide Band-pass filter

# NARROW BAND-PASS FILTER



(a) Circuit Diagram

(b) Frequency Response

Multiple Feedback Narrow Band-Pass Filter

Narrow Bandpass Filter

[www.CircuitsToday.com](http://www.CircuitsToday.com)

- \* A Narrow band pass filter employing multiple feedback as depicted in figure:
- \* It has two feedback paths, and this is the reason that it is called a multiple-feedback filter.
- \* The op-amp is used in the inverting mode.

# OPERATION

- \* If the value of quality factor is greater than ten then the pass band is narrow and bandwidth of the pass band is also less. This band pass filter is called as Narrow Band Pass Filter.
- \* It uses only one active component (op-amp) rather than two and this op-amp is in inverting configuration. In this filter the gain of the op-amp is maximum at centre frequency  $f_c$ . The input is applied to the inverting input terminal. This shows that the Op-amp is in inverting configuration. This filter circuit produces narrow band pass filter response

# DESIGN

It consists of two feedback paths, because of this multiple feedback paths it is also referred as 'Multiple feedback band pass circuit'. This circuit produce an infinity gain multiple feedback band pass filter. Due to this circuit the quality factor value increases maximum up to 20.

$$f_c = 1/\sqrt{R_1 R_2 C_1 C_2}$$

$$Q = f_c / \text{Bandwidth} = (\frac{1}{2}) \{ \sqrt{R_2 / R_1} \}$$

$$A_{\max} = -R_2 / 2R_1$$

$$R_1 = Q / \{ 2\pi f_c C A_{\max} \}$$

$$R_2 = Q / \pi f_c C$$

$$R_3 = Q / \{ 2\pi f_c C (2Q^2 - A_{\max}) \}$$

The gain at the centre frequency 'A<sub>max</sub>' must be less than 2Q<sup>2</sup>.

That is,  $A_{\max} < 2Q^2$

Where,

$f_c$  = cut off frequency in Hz

C = Capacitance, ( $C_1 = C_2 = C$ )

Q = Quality factor  $A_{\max}$  = Maximum gain

# Applications of narrow band pass filter :

- \* It is used in optics like LIDARS, LASER, etc.
- \* These filters are widely used in wireless transmitters and receivers.
- \* The bandpass filter is effectively used in optimizing Signal to Noise ratio, S/N ratio, and even the sensitivity of the receiver.
- \* As these bandpass filters are specially designed to allow a particular band of frequencies, so it is widely used in communication systems.

# ADVANTAGES

- \* When the filters are used in conjunction with switches, it offers low insertion loss and performance increases.
- \* Passive filters are easier to design.
- \* Available in portable size.
- \* As active components in the circuit provide amplification, Active Filters have power Gain.

# Why we go for NBPF

The band pass filter which has a quality factor greater than ten. The bandwidth of this filter is narrow. Therefore, it allows the signal with a small range of frequencies. It has multiple feedbacks.



# REFERENCES:

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- \* <https://lambdageeks.com/active-band-pass-filter-applications/>
- \* [https://docs.google.com/file/d/0B21HoBq6u9TsbG5WdjNZeGwtMWs](https://docs.google.com/file/d/0B21HoBq6u9TsbG5WdjNZeGwtMWs/preview?resourcekey=0-u4r3pLKki2WmE7iP7lx1Rg)
- \* [/preview?resourcekey=0-u4r3pLKki2WmE7iP7lx1Rg](https://docs.google.com/file/d/0B21HoBq6u9TsbG5WdjNZeGwtMWs/preview?resourcekey=0-u4r3pLKki2WmE7iP7lx1Rg)

THANK YOU