OBJECTIVES:

- (i) To construct the low noise high performance amplifier circuit using NE5534 IC
- (ii) To construct the headphone amplifier circuit using 3transistor.

AIM:

- (i) To design a low noise high performance frequency amplifier circuit using NE5534 IC.
- (ii) To design the headphone amplifier circuit using 3transistor.

APPARATUS REQUIRED:

S.No.	Components	Value/Range	Quantity	Specification/Remark
1	Resistors	10ΚΩ	03	0.5W,5%tolerance
		68KΩ	03	¹ / ₄ W, 5%tolerance
		100kΩ	01	
		330KΩ	01	
		4.7KΩ,3.3KΩ,1.5KΩ	Each 1	
		,2.2ΚΩ		
2	IC	NE5534	01	-
3	Capacitors	10µF	02	Electrolytic
		1µF	02	Electrolytic
		100µF	02	Electrolytic
		470µF	01	Electrolytic
4	Electret mic	-	01	-
5	Audio jack	-	01	-
6	Transistor	BC237, BC239	01	-
7	Battery	9v-10v	01	-
8	Bread Board	-	01	-

THEORY:

In a communication system, the receiver section needs amplification for the weak signal which is received from the antenna. So this amplification can be accomplished through the main component called Low Noise Amplifier or LNA. The characteristics of this amplifier can be described by certain parameters like gain, noise figure, chip area, linearity, power consumption & bandwidth.

The block diagram of the low noise amplifier is shown below. The designing of a low noise amplifier can be done by using a common gate amplifier, active inductor & common drain stage. Generally, the common gate amplifier is mainly used at the input stage whereas the common drain amplifier is used at the output stage to provide the best input as well as output matching. The low noise amplifier is bound with particular characteristics like gain & noise figure but the selection of LNA mainly depends on some specific parameters like power supply, bandwidth, chip area & linearity.

CIRCUIT DESCRIPTION:

The main function of this low noise microphone pre-amplifier circuit is to amplify the weak audio signals. Once an audio source like the microphone has less sound range then this circuit is helpful in amplifying that low signal or weak signals & transmits that signal for further amplification. The above circuit can be designed with an IC instead of a transistor because this IC will provide a much better distortion filter. This low noise amplifier IC includes low noise, high unity-gain, low power consumption with short circuit protection, and low harmonic distortion.

The mic preamplifier specifications may change based on the mic used to capture the audio signals & the type of sound being recorded. The essential specifications to be considered within a pre-amplifier circuit are noise, distortion & gain. This circuit operates with a 9V to 12V battery. Here, Electret Mic generates audio signals that are transmitted to the input of IC. Here you can use any audio source instead of a microphone. This circuit's overall voltage gain mainly depends on the resistors connected at the non-inverting terminal of the IC. The output signal which is generated from this IC can be transmitted through one more capacitor to filter out any noise. This circuit is very useful where low noise audio preamplifier is necessary like live music, cell phones, soundcard within laptops, and audio recording application. Figure 2.1 has been clearly explain the process of low noise pre amplifier circuit.



Fig.no:2.1 Circuit diagram low noise high performance amplifier

PROCEDURE:

1.Ensure the power supply is OFF before giving the connections.

2. Check the component status and identify the terminals.

3. Make the connection about the reference of circuit diagram.

4.Connect the input voltage to the input terminal of the NE5534.

5.Connect the output terminal of the NE5534 to the audio out.

6.Connect the of the NE5534 to the resistive divider network, consisting of two resistors R1 and R2.

HEADPHONE AMPLIFIER CIRCUIT USING 3 TRANSISTORS:

A headphone amplifier is a relatively low-power amplifier that boosts the low-voltage audio signal from a source device (be it a turntable, laptop, or smartphone) to a sufficient level, such that it converts (or transduces) into sound waves by the speakers inside your headphones.



Figure: 2.2 Headphone amplifier circuit diagram

It works like the amps which power full-sized speakers but also operate at a lower scale. In this project, we are going to build a simple headphone amplifier circuit using some transistors.

A Headphone amplifier circuit is integral when it comes to mass media production & recording. They are small, easy to use and design & provide low power consumption. The application of the low noise pre amplifier circuit has shown in fig 2.2

TECHNICAL SPECIFICATION:

IC NE5534:

The NE/SA/SE5534/5534A are single high-performance low noise operational amplifiers. Compared to other operational amplifiers, such as TL083, they show better noise performance, improved output drive capability, and considerably higher small-signal and power bandwidths. This makes the devices especially suitable for application in high quality and professional audio equipment, in instrumentation and control circuits and telephone channel

amplifiers. The op amps are internally compensated for gain equal to, or higher than, three. The frequency response can be optimized with an external compensation capacitor for various applications (unity gain amplifier, capacitive load, slew rate, low overshoot, etc.).

FEATURES:

- Small-Signal Bandwidth: 10 MHz
- Output Drive Capability: 600, 10 VRMS at VS = 18 V
- Input Noise Voltage: 4 nV Hz
- DC Voltage Gain: 100000
- AC Voltage Gain: 6000 at 10 kHz
- Power Bandwidth: 200 kHz
- Slew Rate: 13 V/s
- Large Supply Voltage Range: 3.0 to 20 V

ELECTRET MICROPHONE:

The resistor R1 (10K) is used to limit the current flowing through the microphone (maximum should be 0.5mA) and the capacitor C1 (1uF) is used to filter the DC noise that might be coupled along with the analog electrical signals (output). Also, note that the capacitor is also polarity sensitive and the positive should be connected to microphone Output pin. This capacitor is rated for 20Hz to 16,000Hz so any sound waves in that range will be picked up the microphone.

FEATURES:

- Operating Voltage: 2V to 10V
- Current consumption: 0.5mA (max)
- Recommended operating voltage: 2V
- Operating Frequency: 20Hz to 16,000Hz
- Impedance: $<2.2k\Omega$

OUTPUT ANALYSIS:



Figure:2.3 Output for low noise microphone preamplifier circuit

PRELABQUESTIONS:

1. How to design a Low noise amplifier?

A low noise amplifier can be designed using either a negative feedback topology or one without any feedback. The former approach is more commonly used because it can provide better performance when compared to an equivalent amplifier without feedback.

2. What is IC NE 5534?

The NE5534, NE5534A, SA5534, and SA5534A devices are high-performance operational amplifiers combining excellent dc and ac characteristics. Some of the features include very low noise, high output-drive capability, high unity-gain and maximum-output-swing bandwidths, low distortion, and high slew rate.

3. What is use of electret microphone?

An electret microphone is a type of electrostatic capacitor-based microphone, which eliminates the need for a polarizing power supply by using a permanently charged material. Another term for an electret microphone is a 'permanently polarized condenser' or 'permanently biased condenser'. However, electret microphones do feature an internal preamp, which does need power.

POST LAB QUESTIONS:

1. What is the purpose of a low noise amplifier?

- To increase the signal-to-noise ratio
- To increase the gain of an amplifier
- To remove unwanted noise from an electromagnetic wave To attenuate the input of an amplifier.

2. What is the difference between noise and interference?

Noise is unwanted signal that can interfere with the operation of a circuit. It is usually caused by thermal agitation, voltage fluctuations, or other electrical effects. Interference is an unwanted signal that interferes with the operation of another circuit.

3. What is the Advantage and disadvantage of low noise amplifier?

Advantage:

- These are designed to reduce that extra noise.
- These electronic amplifiers are helpful in amplifying very low-strength signals.
- This amplifier is used once the SNR or signal-to-noise ratio is high & needs to be decreased by almost 50% while power is enhanced.

Disadvantage:

• Low noise amplifiers are expensive. • These are very sensitive to flicker noise & DC offsets.

RESULT:

Thus the low noise high performance frequency amplifier circuit using NE5534 IC has been verified successfully.

MARK ALLOCATION:

S.		Mark	Mark Awarded
No	Parameters	Allotted	
1	Circuit Design/ code developing and debugging / Trouble shooting	0-3	
2	Implementation and Demonstration	0-3	
3	Discussion	0-3	
4	Report writing & Presentation	0-3	
5	Contribution & Team Dynamics	0-3	
Total		15	

Signature of Lab In-charge