Audio amplifier

Lab FAT task Report

By

P. Karveandhan – 17BEC0003

V. Yashwanth- 17BEC0179

G. Yaswanth – 17BEC0257

D. Harsha Vardhan- 17EC0774

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Lokanath M

Assistant Professor(senior)

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AUDIO AMPLIFIER

Abstract:

Designing of audio amplifier circuit in bread board. The input of audio amplifier is a phone. The songs that is played in phone should be amplified by the circuit and the amplified output is played in the speaker.

1. Introduction:

The audio amplifier was invented around 1912 by Lee De Forest, made possible by his invention of the first practical amplifying electrical component. Key design parameters for audio power amplifiers are frequency response, gain, noise, and distortion. These are interdependent; increasing gain often leads to undesirable increases in noise and distortion. While negative feedback actually reduces the gain, it also reduces distortion. Most audio amplifiers are linear amplifiers operating in class AB.

2. Components required:

- 1N4007
- transistor (2N3904)
- 1kohm
- 6.8kohm ,4.7kohm
- Battery
- Breadboard
- Speaker
- AUX
- 100uf,220uf
- 10uf

3. Circuit diagram:

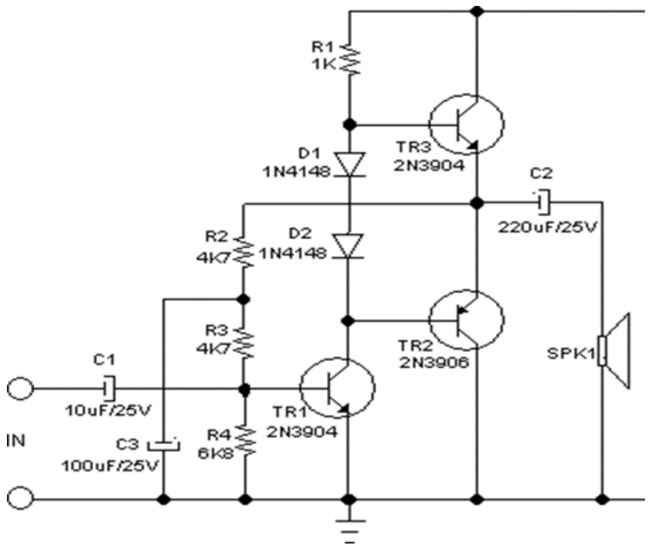

Fig2: this is the circuit diagram for the classAB audio amplifer

4. Working of audio amplifier:

- The circuit uses only 3 transistors and some passive components. It can drive standard 4-8 ohm loudspeaker. The basic configuration of the amplifier is a push-pull circuit. The complement transistor is not used to drive a transformer but to discharge the dc decoupling capacitor to give full wave alternating current to the loudspeaker. Some components from original circuit are omitted to make simpler circuitry.

- To maximize the potential voltage swing of the output, the junction of TR2 and TR3 emitters should be set at half of the supply voltage (1.5V). At this point, this voltage should produce a proper voltage at TR1's base that cause TR1 begin to active (0.6V). The biasing voltage is the voltage across R4,

VR4 = 1.5V * R4/(R4+R3+R2) VR4 = 1.5V * 6.8/(6.8+4.7+4.7) VR4 = 0.63V

- The feedback mechanism make the resistors selection is not critical, as long as the current is enough to give proper idle current at the TR1 collector. We can make a simple rule by setting the R2- R3-R4 current (half of supply voltage divided by the total R2+R3+R4 resistance) minimum at ten times of the base current (collector current divided by the transistor gain). Lets check it out with the rule, the collector current (at idle condition) is

Ic = (Vcc – 2*Vdiodes)/2R1 Ic = (3V-2*0.6V)/ 2k

Ic = 0.9 mA

- At low current condition, the gain (hFe) of the transistor (TR1) is around 100. So the base current will 0.009 mA, and the ten times is 0.09 mA, so the maximum of total R2-R3-R4 resistance is the half supply voltage divided by this current:

Rmax = 1.5V/0.09mA Rmax = 16.67k Ohm

- A filtering capacitor C3 is inserted between R3 and R3 to short the signal. Without this capacitor, the circuit will try to regulated to make sure the output will never swing from the half point even when the input signal is applied. Our experiment show distorted negative cycle when we omit this capacitor.

- To ease the explanation on how this circuit enable TR2 and TR3 transistors work complementary, let's imagine that TR1 is replace by a variable resistor, let's call it R1′ since its position is symmetric with the R1. At some point of R1′ value, at 1k ohm, which is the set for idle situation, both transistors TR3 and TR2 will be slightly "on" symmetrically. At this idle point, both transistors are set on symmetric small current conduction by keeping small voltage across base-to-base of two transistors, and this is done by D1 and D2. This small voltage is the sum of two voltage drops of two forward-biased diodes. At positive cycle of the sine input signal, R1′ (TR1's collector-emitter equivalent resistance) will decrease below 1k ohm, TR3 will be cut-off and TR2 will be activated to serve the output (discharging the C2). At negative cycle of the input waveform, the R1′ will get higher than 1k ohm, TR2 will be cut-off and TR3 will be activated to serve more current for serving the output, charging the C2.

5. Simulation results:

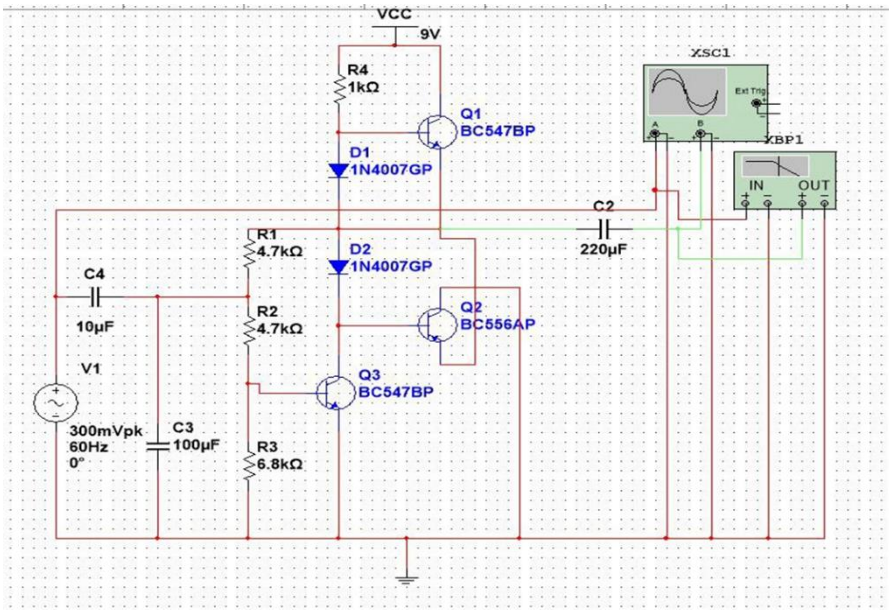

Fig1. Shows the circuit diagram in multisim

AMPLIFICATION

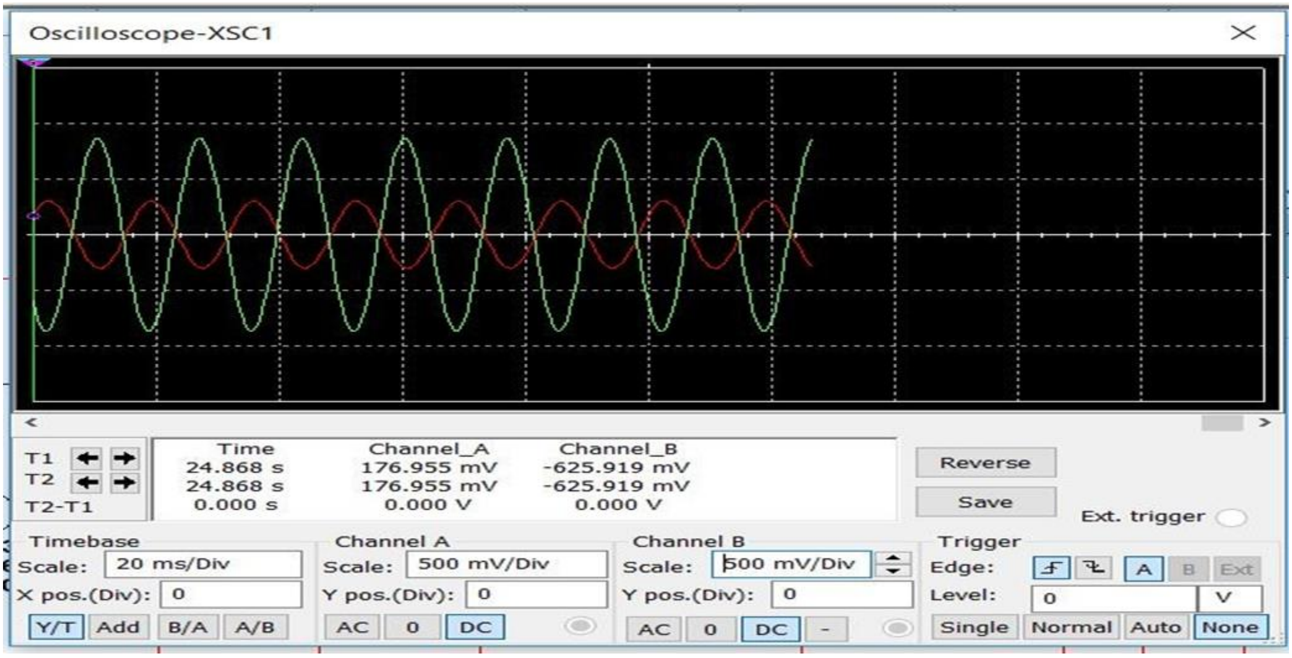

Fig 2 : red is the input and green is the output , from this fig we can crealy see the input is amplified

6. Hardware results:

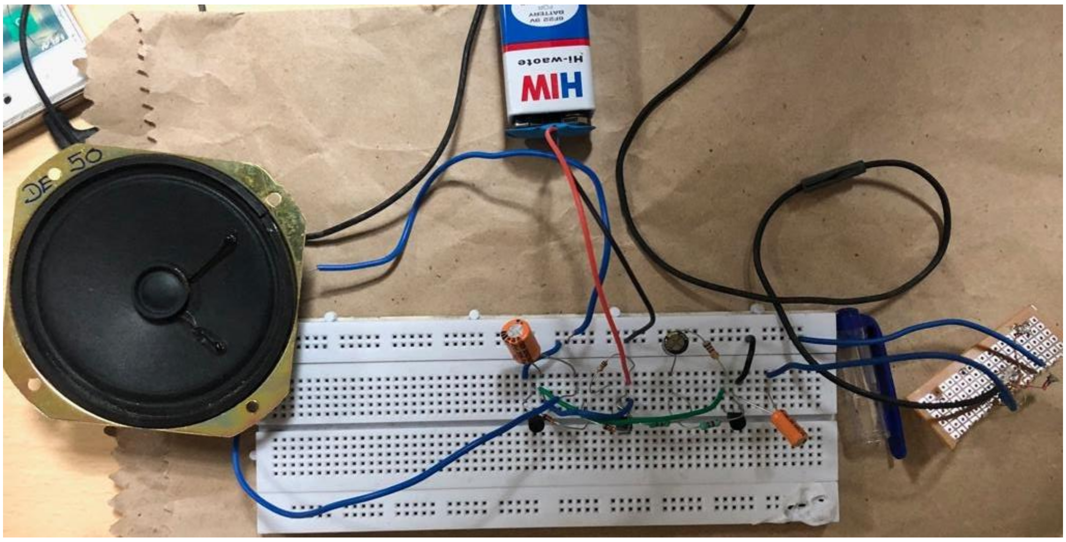

fig3.1: this fig shows the breadboard circuit

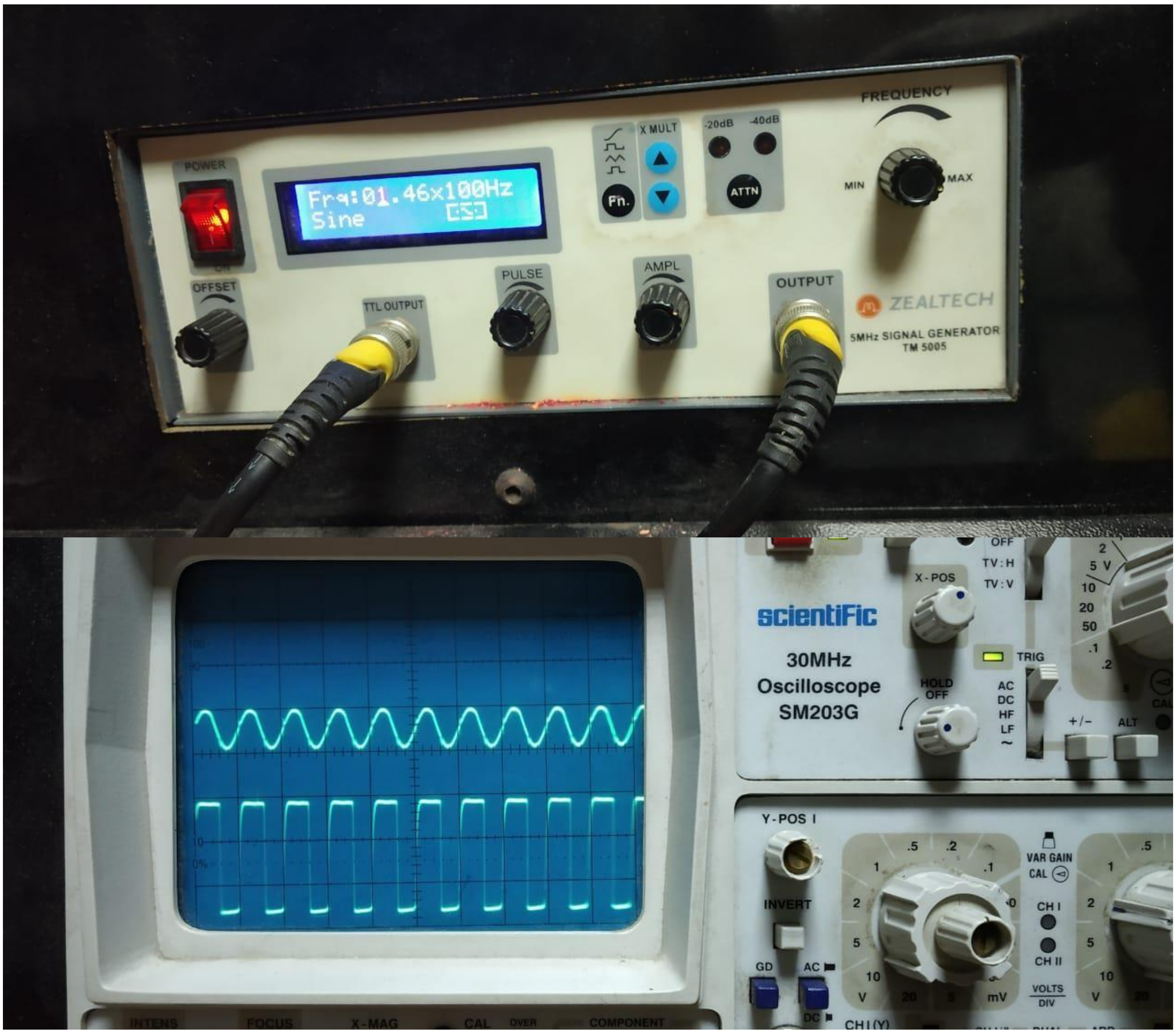

Fig3.2: shows the input sin wave and output amplified square wave

7. Limitations:

- The use of BJTs cause more power dissipation. Thus, reducing the efficiency of the system.
- The filter circuit tends to increase the DC level of the audio signal, causing a disruption in the biasing.
- The use of linear devices causes power dissipation, thus reducing the efficiency of the circuit.
- It is a theoretical circuit and output contains distortion.
- The circuit doesn’t provide any provision to remove noise signal and thus the output may contain noisy disturbance.

8. Applications:

- This circuit can be used at home theatre systems to drive subwoofers to produce a high quality, high bass music.
- This circuit can also be used as a power amplifier for low frequency signals.
- It is also used for long range transmission like if we want to draw the power for high range antennas then it can easily be done with the help of subwoofer amplifier circuit.