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AUDIO AMPLIFIER

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1. Summary

In this project, we have to make an Audio Amplifier. We will take input from a microphone, pass it through a pre-amplifier stage to convert the input into a stronger and noise tolerant signal so that further amplification can be done on it.

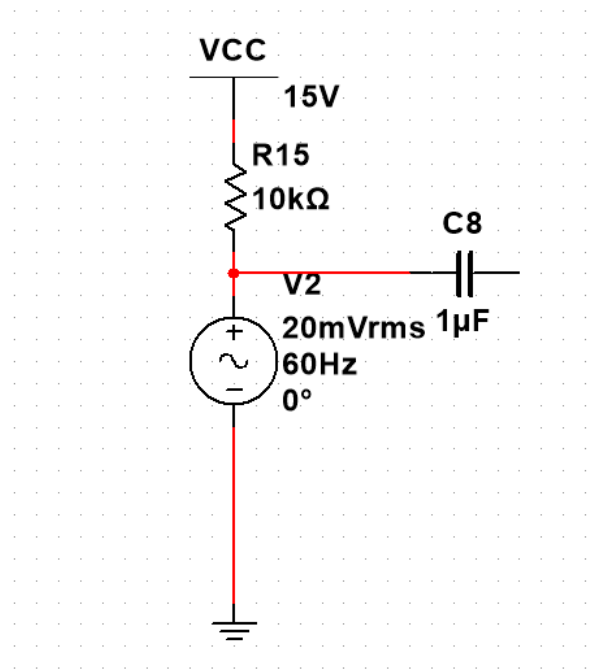
The output is then sent to the Gain Cell so that we get the required voltage for the speaker to function.

The output from the Gain Cell is sent to a filter. We need a band-pass filter which passes frequencies between 20Hz and 20kHz. However, since we are making a first-order filter, we set the cutoffs as 32Hz and 19.8kHz.

The filtered signal is then sent to a Power Amplifier. The amplifier increases the power of the signal significantly so that a speaker of 8Ω load can be operated.

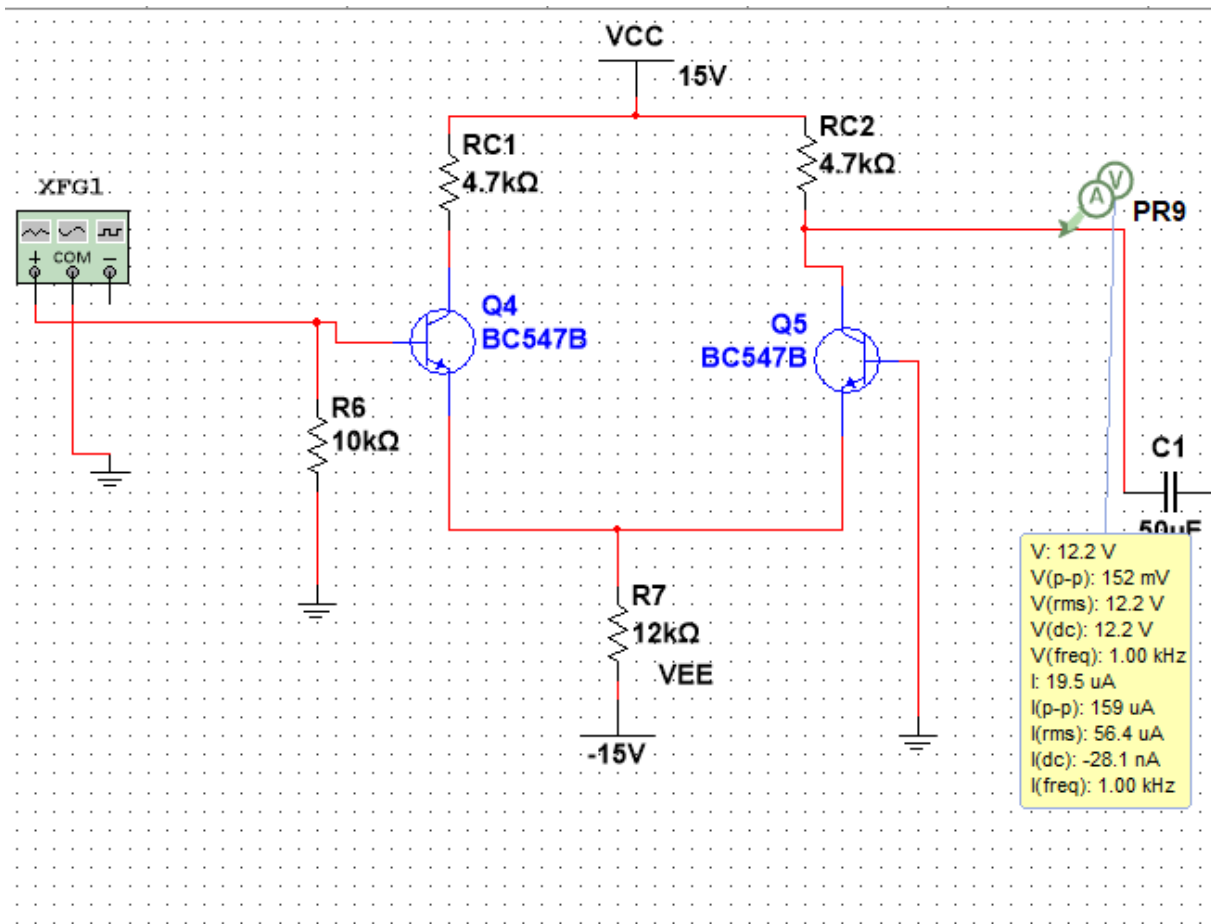
2. Design of Experiment

2.1 Mic



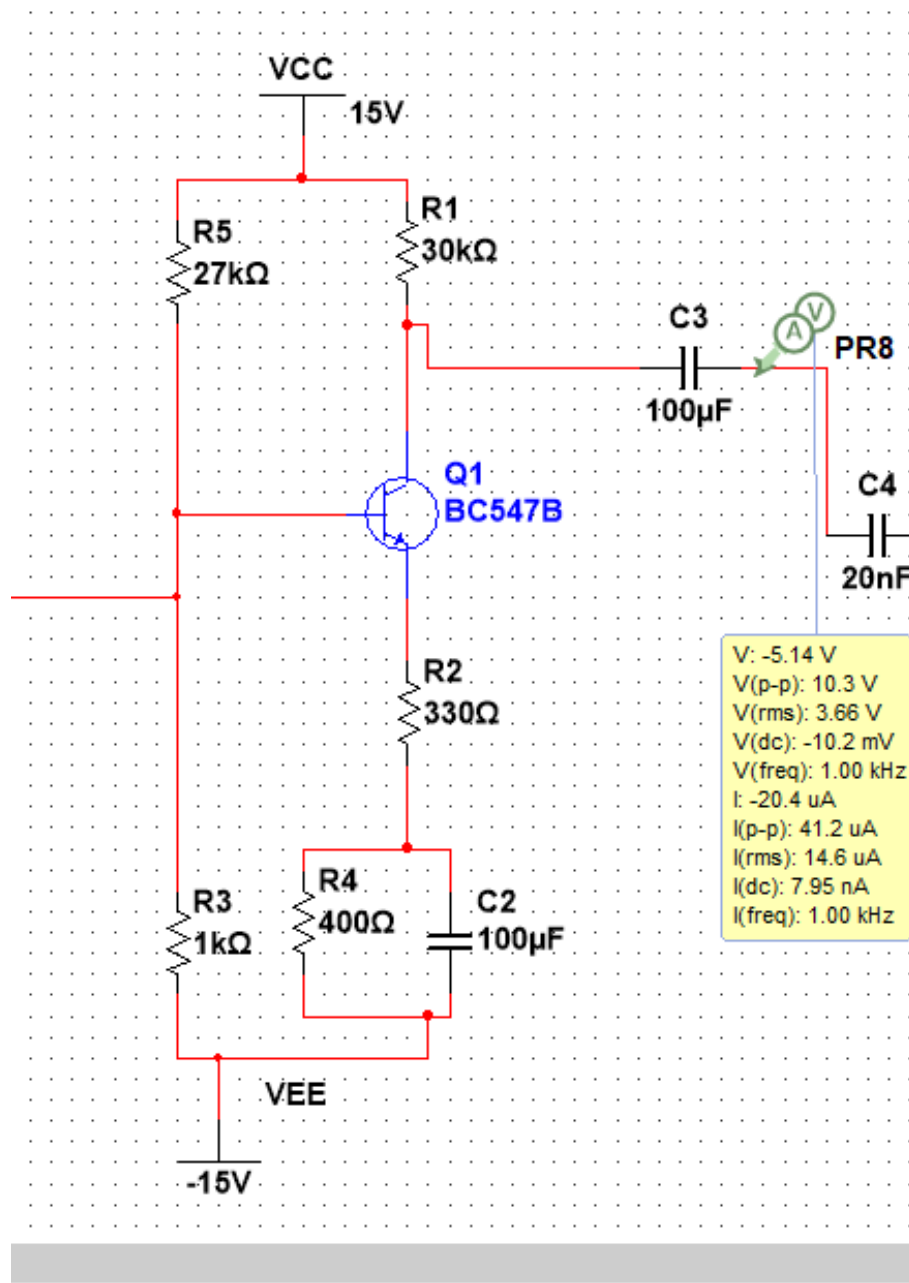
This is a standard circuit for a mic. A $10\text{k}\Omega$ resistor is used to control sensitivity of the mic and the capacitor is used to remove the DC component, so that only AC signal passes.

2.2 Pre-amplifier



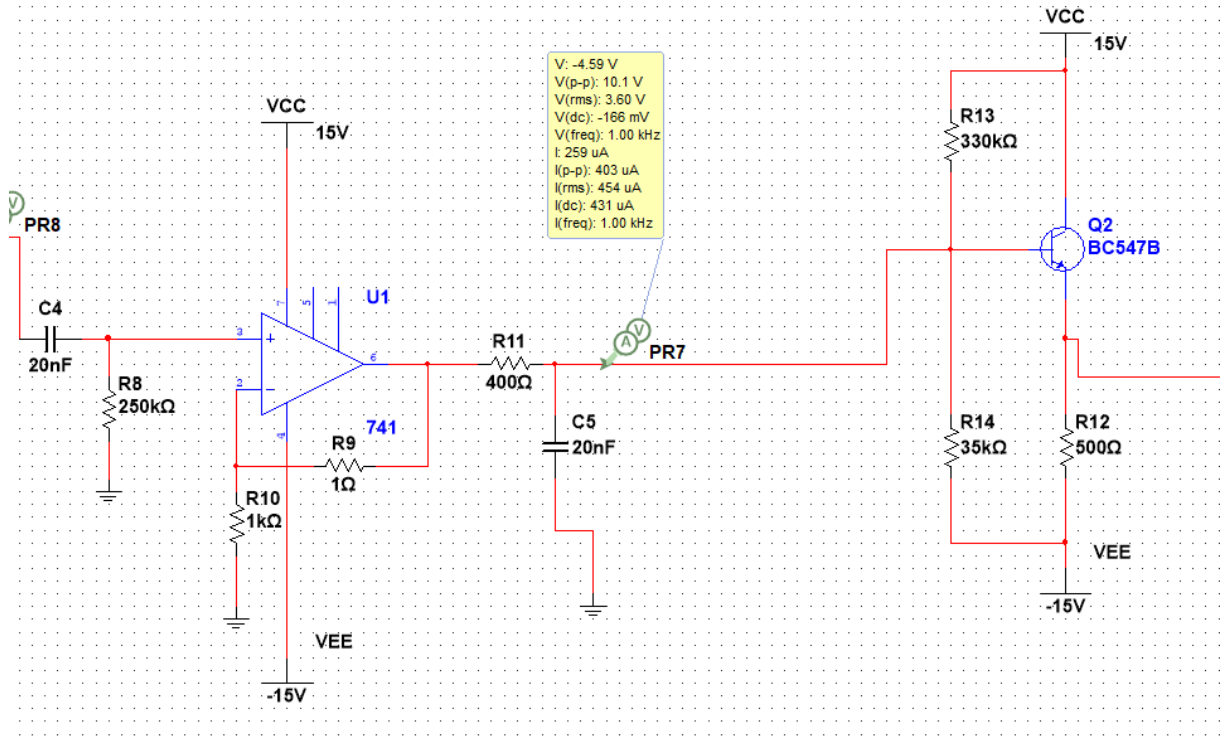
The preamp stage is used to amplify the signal so that it becomes more tolerant to noise and further amplification and filtering can be done on it.

2.3 Gain Cell



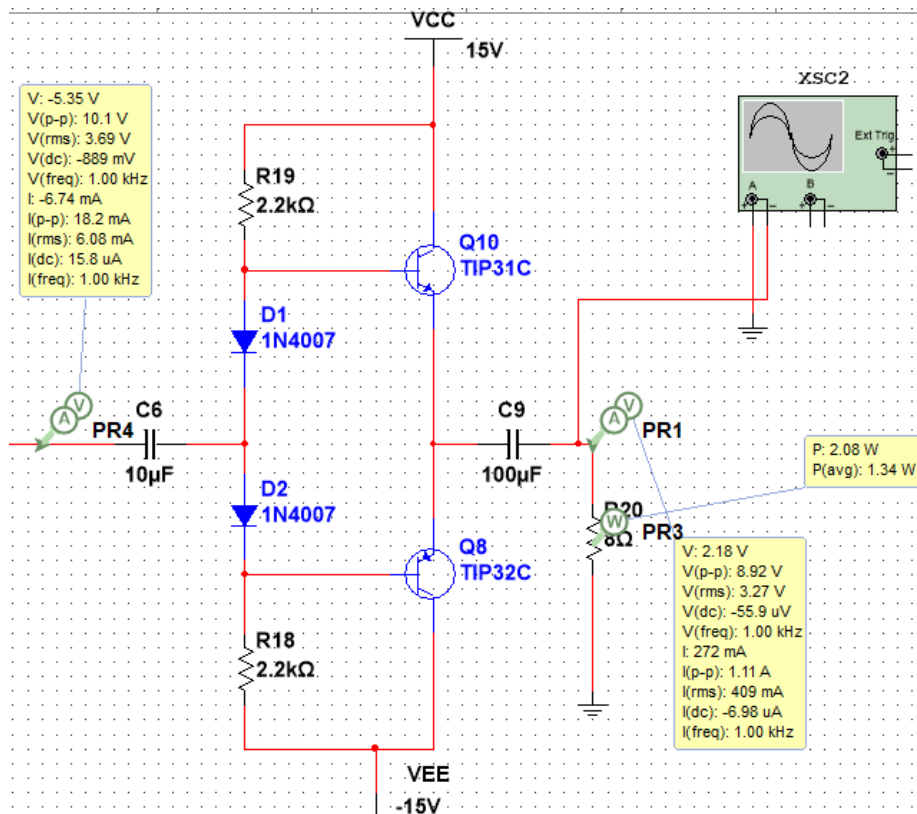
The Gain Cell is used to increase the total gain of the system to the required level.

2.4 Filter



We have taken such pairs of the resistors and capacitors so that the band-pass filter works between 20Hz and 20kHz. Since we are using a first-order filter, we set the cutoff frequencies as 32Hz and 19.8kHz as we cannot get a sharp decline at 20Hz and 20kHz. We also have made a common-collector buffer in order to match the impedance between filter and power amplifier.

2.5 Power Amplifier



The Power Amplifier is a diode-biased type-AB power amplifier. This has a high efficiency rate. It is used to increase the power of the signal so that the power dissipated at Load Resistor, which is the speaker, is 1.34W. This is enough for functioning of the speaker. It also has less distortion.

3. Procedure

The pre-amplifier is a differential amplifier. There is no impedance matching between gain stage and differential amplifier thus there is a loss of gain. The final gain though is 10Vpp. The input resistance of filter is 250k which is much higher than the R_c of the gain cell which is 30k.

After this stage input impedance of power amplifier could not be increased because that led to the truncation of the final output observed on the oscilloscope. Thus to match impedance at this stage we implemented a common-collector buffer . This has a special quality it gives no gain but has very high input impedance and very low output impedance .

Through this method we were able to transfer all the voltage from filter to input of power amplifier which gave us the required power to drive the speaker which had a resistance of 8Ω .

4. Results

- Gain of preamplifier(diff amp): 9
- Gain of Gain Stage (CE amp): 60
- Gain of Active Filter (first order using IC741): 0.98
- Gain of buffer: 1
- Vrms output of Class AB Power Amp: 3.27 V
- Input to diffamp: 20 mVpp
- Output of diffamp: 152mVpp
- Output of gain stage: 10.3 Vpp
- Output of filter: 10.1 Vpp
- Output of buffer: 10.1 Vpp
- Output of Power amp: 8.96 Vpp

5. Conclusions

The audio power amplifier is designed in four stages: pre-amplification unit, gain cell unit, active filter unit and power amplification unit. For the pre-amplification unit, BC547, NPN transistor is used to achieve the gain; gain cell is designed to to get a voltage gain; active filter is designed to achieve amplification for band of voices only; for the power amplifier unit, TIP31C and TIP32C transistors are used. In addition, the measured results show the output power is 1.34W . Judging from all kinds of results, this designed audio power amplifier can meet the aim of the project topic.

Bibliography

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