



ELECTRONIC DEVICES AND CIRCUITS

INDIVISUAL PROJECT REPORT

SUBMITTED BY:

221748 – Muhammad Abdullah Khan

SUBMITTED TO:

Dr. Neelum Yousaf

DATE:

28-12-2023

Problem Statement:

The project centers on the design and implementation of an RC-coupled amplifier using the common emitter configuration, a fundamental component in electronic circuit design. With the goal of achieving optimal signal amplification, the project encompasses the selection of appropriate components, calculation of biasing values, simulation for performance analysis, and physical prototype construction. This endeavor is crucial for understanding amplifier design principles, bridging theoretical knowledge with practical application. Stakeholders, including students and educators, stand to benefit from the project's outcomes, which contribute to a hands-on learning experience. Despite constraints such as a predefined budget, time limitations, and component availability, the project promises to provide valuable insights into the nuances of amplifier design and prepare participants for future endeavors in the field of electronics.

Objective:

The project aims to design and implement an efficient RC-coupled amplifier using common emitter configurations, providing participants with hands-on experience in electronic circuit design and relating theoretical principles through practical application.

Introduction:

The RC-coupled amplifier is a common configuration used in electronic circuits to achieve signal amplification. This design employs two common-emitter amplifiers connected in cascade, which allows for increased overall gain and bandwidth. The RC coupling is chosen for its simplicity and effectiveness in transferring the amplified signal from one stage to the next.

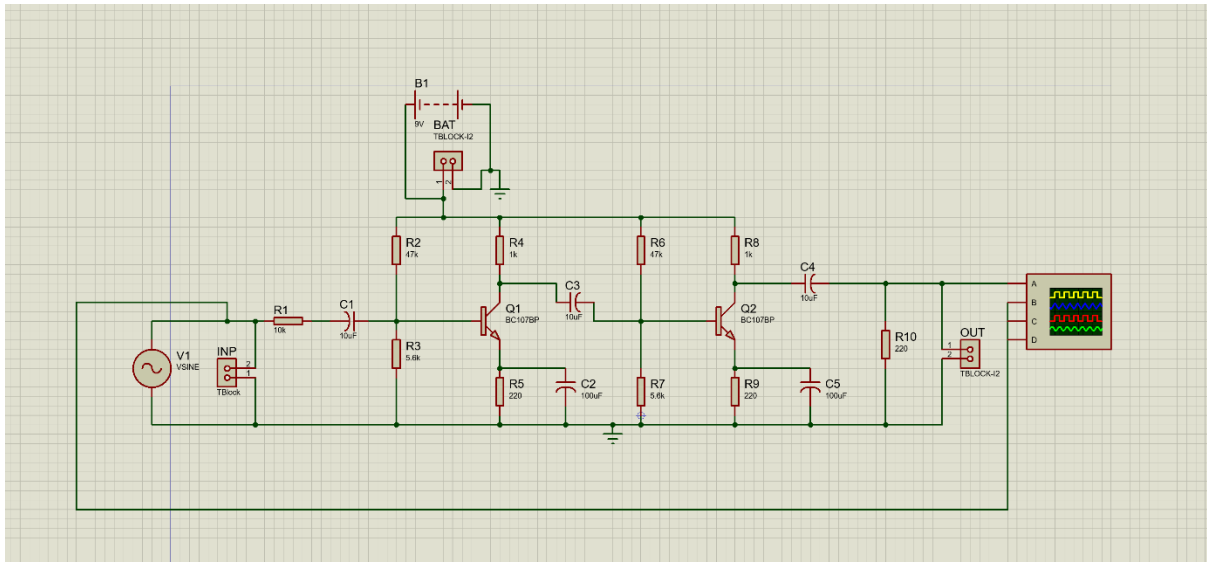
Components:

S.No	Device	Range/Rating	QTY
1.	(a) DC supply voltage	12V / 9V	1
	(b) BJT's	2N2222	2
	(c) Capacitors	10 μ F	2
		100 μ F	1
	(d) Resistors	220 Ω , 47k	2
		5.6K, 1k	2
2.	Signal generator	0.1Hz-1MHz	1
3.	CRO	0Hz-20MHz	1
4.	Connecting wires	5A	4

Methodology:

First a design was created on paper taking inspiration from our book in which two common emitter circuits were connected with each other in which the output of 1st one is the Input of the 2nd one. After this, we created a design on software known as Proteus through which we verified how the circuit will behave and it was according to our requirements. So, we implemented this Design on PCB after verifying it from a breadboard.

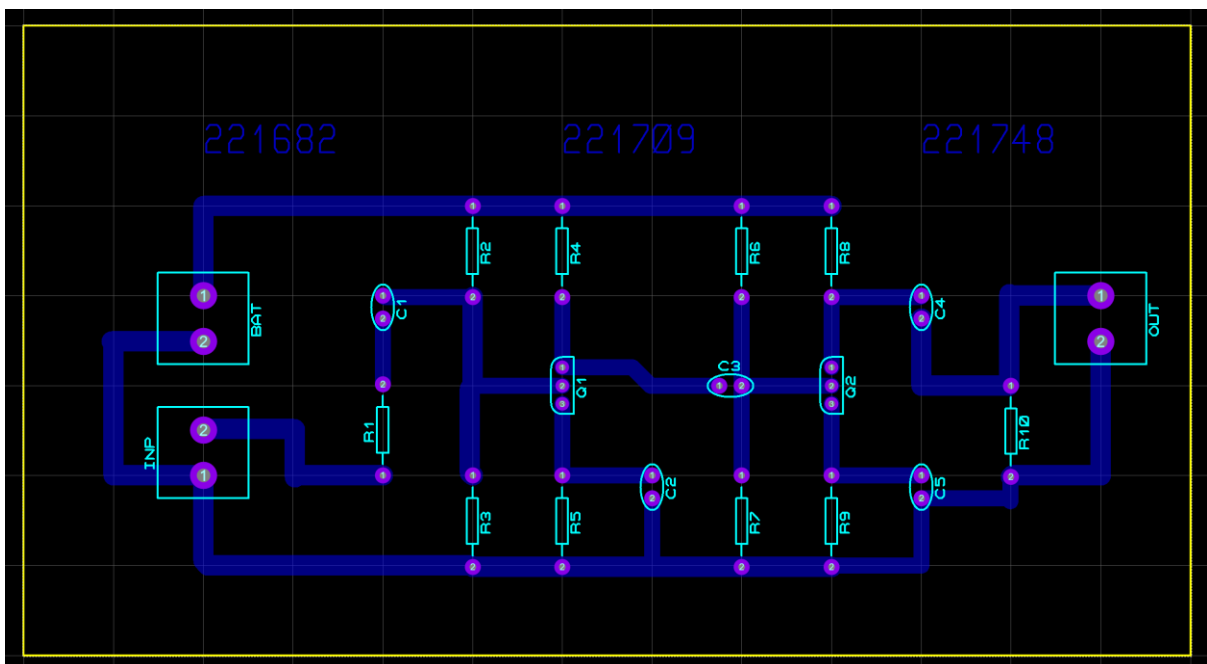
Schematic Layout:



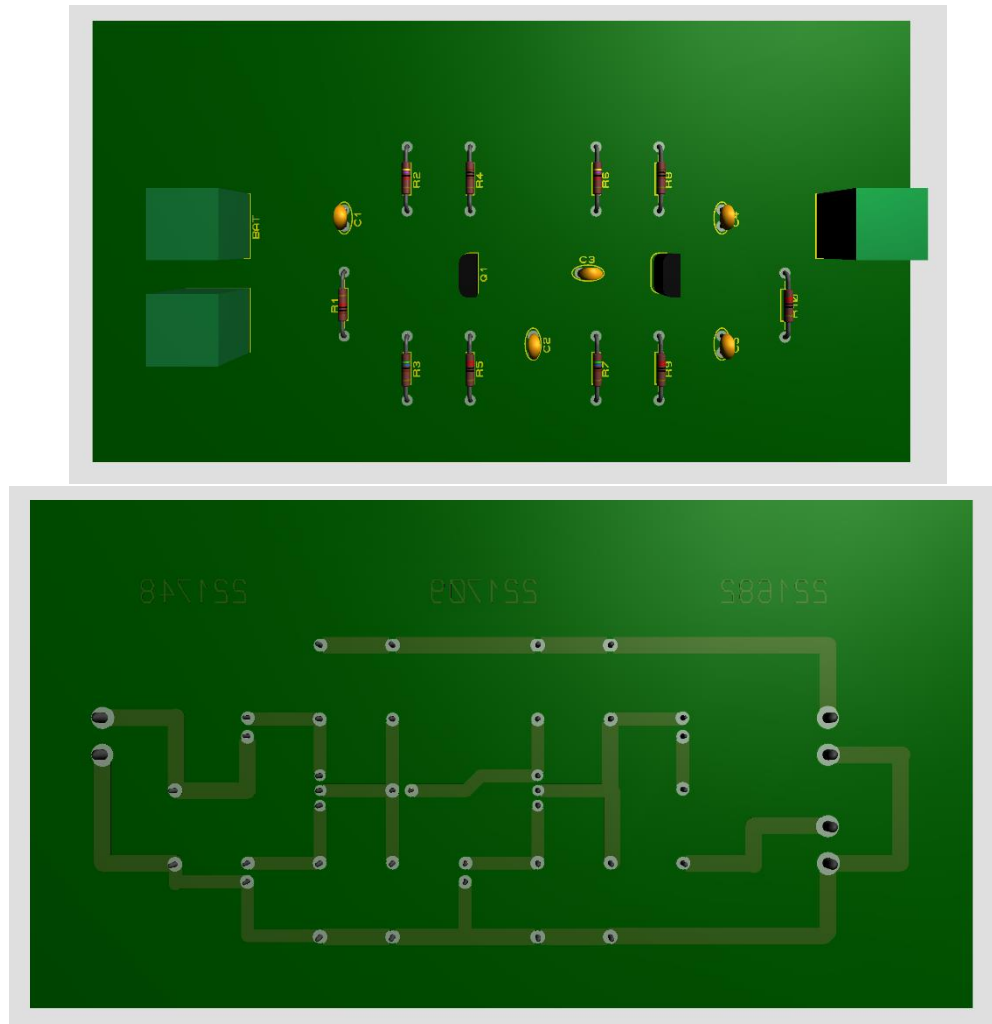
Circuitry:

This involves PCB and Hardware Design

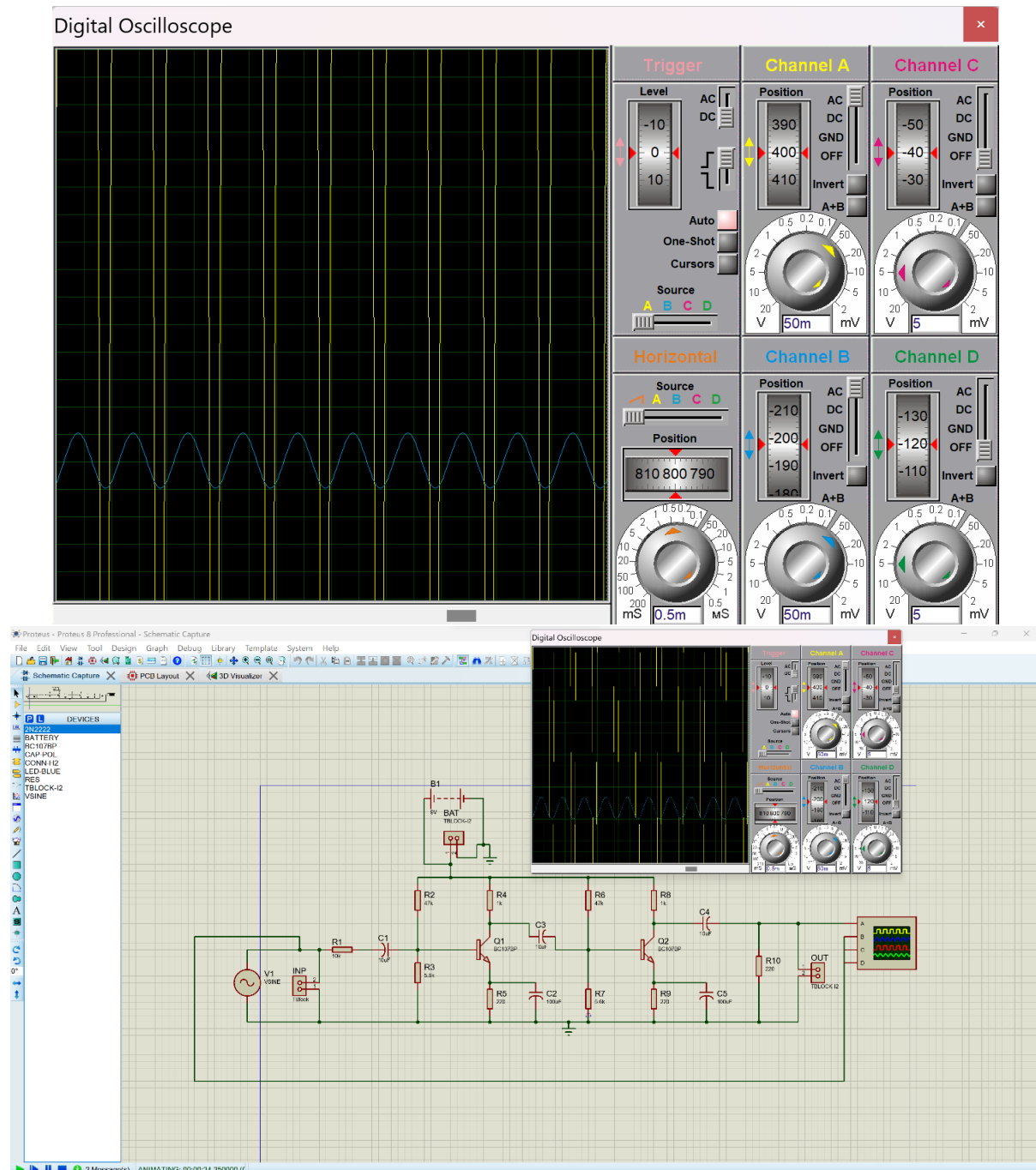
PCB:

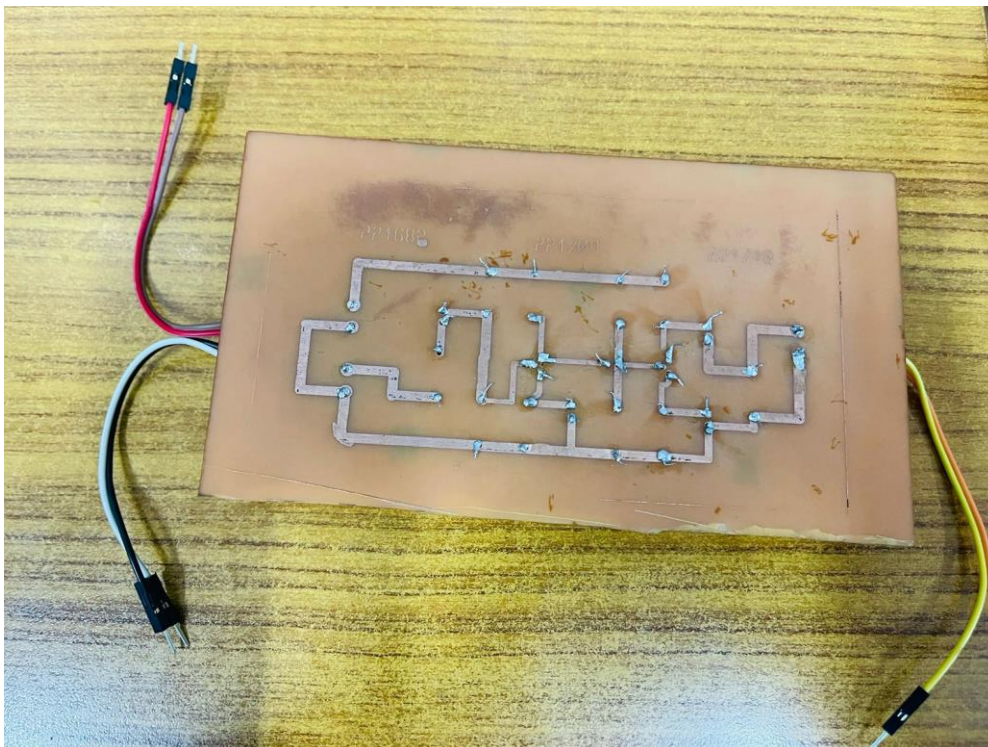
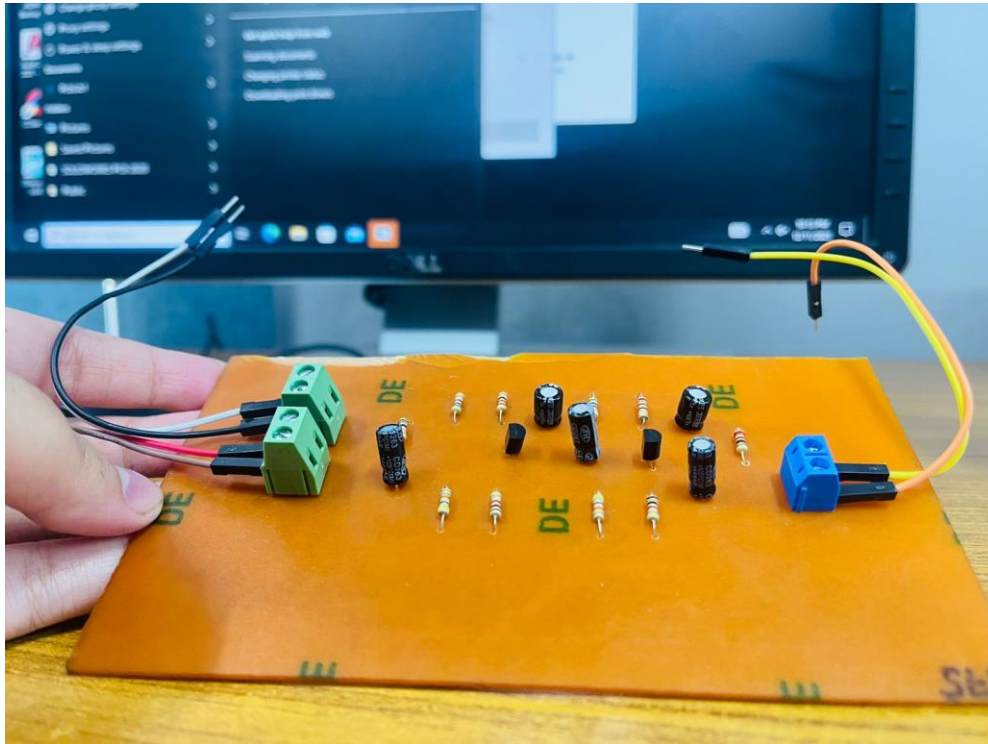


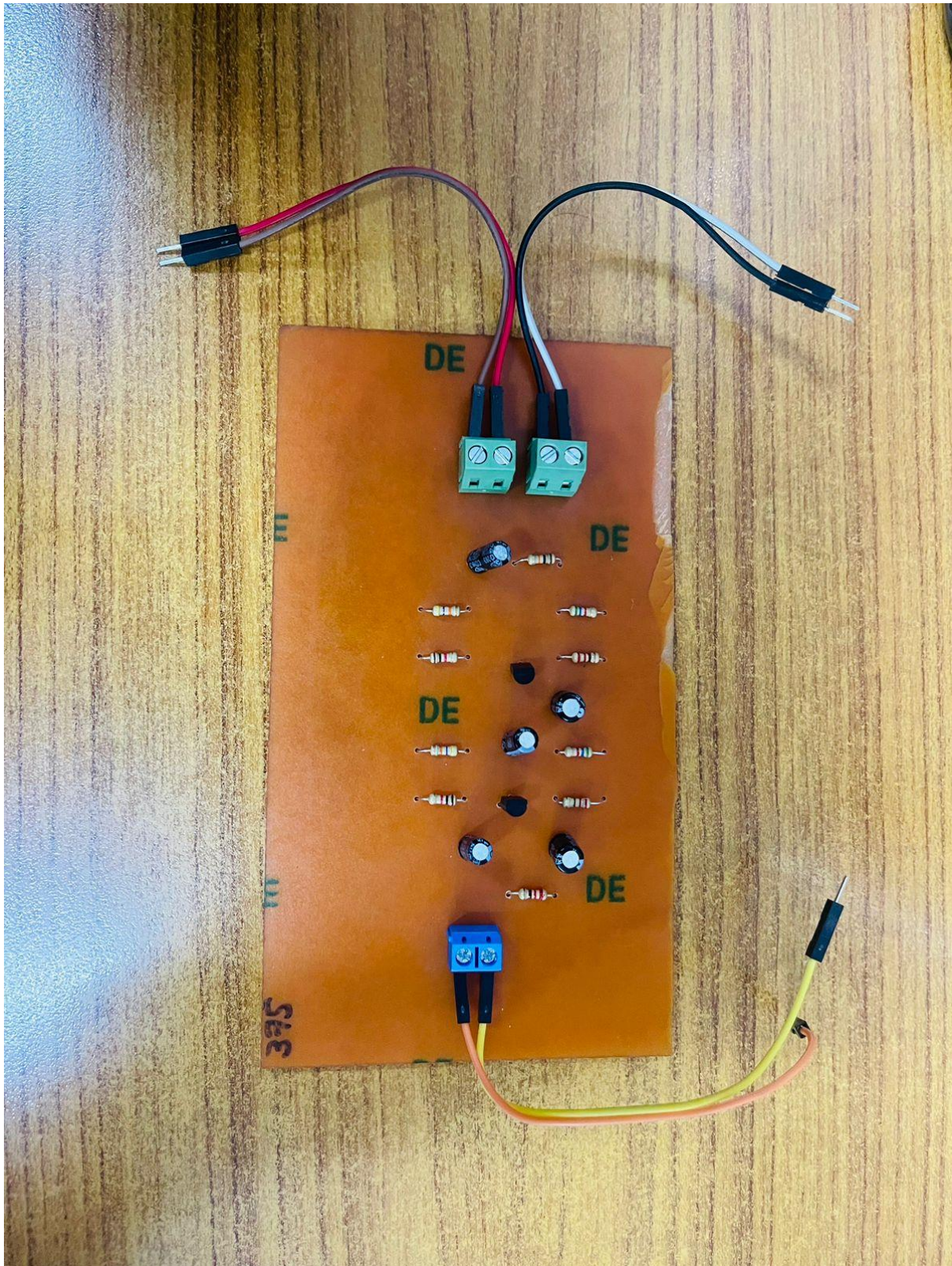
3D Visualizer:



Waveform:




HARDWARE PICTURES



Working:

The RC-coupled amplifier operates as a multi-stage amplifier to achieve increased voltage gain and bandwidth. In the first common emitter stage, the input AC signal is applied to the base of the transistor, undergoes amplification, and produces an inverted and amplified output at the collector. The output of this stage is then coupled to the input of the second stage through a coupling capacitor, which allows only the AC component to pass while blocking DC voltage. The second common emitter stage further amplifies the AC signal, resulting in an inverted and amplified output. The overall voltage gain is the product of the gains of each individual stage. The use of coupling capacitors between stages ensures AC coupling while preventing the transmission of DC biasing voltages. The load resistor connected to the output of the second stage determines the final output voltage. This cascaded configuration enhances the amplifier's performance, providing higher gain and improved bandwidth compared to a single-stage amplifier. The amplifier's design involves careful consideration of biasing, component values, and coupling capacitors to optimize its performance.

Cost Analysis:



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0341 0999707
051 2741714

INVOICE

Sayed Saffi
Islamabad Capital Territory
03125089025

Order Number: 60775
Order Date: December 8, 2023
Payment Method: Cash on delivery

Product	Quantity	Price
74LS86 Quad 2-Input EXCLUSIVE-OR Gate IC SKU: 0417	4	Pk 240
74LS08 Quadruple 2-Input AND Gate IC SKU: 0406	8	Pk 320
74LS32 Quad 2-Input OR Gate IC SKU: 0410	3	Pk 120
4 way DIP Switch Slide Switch SKU: 0653	4	Pk 120
DC 9V Battery Snap Connector SKU: 0657	1	Pk 20
Toshiba 9V Battery for Toys and DIY Projects SKU: 1736	1	Pk 130
LM7805 Voltage Regulator outputs +5V IC SKU: 0428	1	Pk 30
5mm Red LED SKU: 0352	5	Pk 10
5mm Green LED SKU: 0353	5	Pk 10
Pin to Pin 40 Jumper Wires Strip - 20cm Length: 20cm SKU: 0674	1	Pk 160
2N2222 NPN Transistor ✓ SKU: 0452	4	Pk 28

Product	Quantity	Price
10uf 50V Electrolytic Capacitor ✓ SKU: 0307	5	Rs 25
100uf 25V Electrolytic Capacitor ✓ SKU: 0313	5	Rs 25
10K Ohm Axial 1/4W Resistor 5% ✓ SKU: 009	10	Rs 10
220 Ohm Axial 1/4W Resistor ✓ SKU: 037	10	Rs 10
47K Ohm Axial 1/4W Resistor ✓ SKU: 023	10	Rs 10
4.7K Ohm Axial 1/4W Resistor ✓ SKU: 055	10	Rs 10
1K Ohm Axial 1/4W Resistor ✓ SKU: 048	10	Rs 10
2 Pin 5mm Pitch PCB Mount Screw Terminal Block Connector 250V 8A ✓ SKU: 0506	2	Rs 40
Subtotal		Rs 1,328
Total		Rs 1,328

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S.No.	DESCRIPTION	Qty	Rate	Amount
1				
2	PCB Bread	1	375	375

Conclusion and Applications:

The RC-coupled amplifier using two common-emitter stages offers a practical and effective solution for signal amplification. The design considerations, theoretical analysis, simulation results, and practical considerations discussed in this report provide a comprehensive overview of the circuit's performance. Further experimentation and optimization can be conducted based on the specific application requirements.

Audio amplification, RF signal processing, instrumentation, Hi-Fi preamplifiers, communication systems, low-frequency signal processing, oscillators, educational use, control system signal conditioning, and transmitter amplification.