Experiment 7: Observing of BJT as an amplifier.

Theory:

A Bipolar Junction Transistor (BJT) functions as an amplifier by leveraging the principles of controlled current amplification, with NPN BJTs being a commonly used type. This operation can be understood through the following equation, which defines the current gain (β or h_{fe}):

$$\beta = \frac{\Delta I_C}{\Delta I_B}$$

Here, ΔI_C represents the change in collector current, and ΔI_B represents the change in base current. In the active region of BJT operation, where the transistor is neither fully off (cut-off region) nor fully on (saturation region), a small change in the base current, ΔIB, results in a much larger change in collector current, ΔI_C. This property is at the heart of BJT amplification.

Additionally, another critical equation to consider is Ohm's Law for the collector current (I_C), which relates the collector current to the collector-emitter voltage (V_{CE}) and the collector resistor (R_C):

$$I_C = \frac{V_{CC} - V_{CE}}{R_C}$$

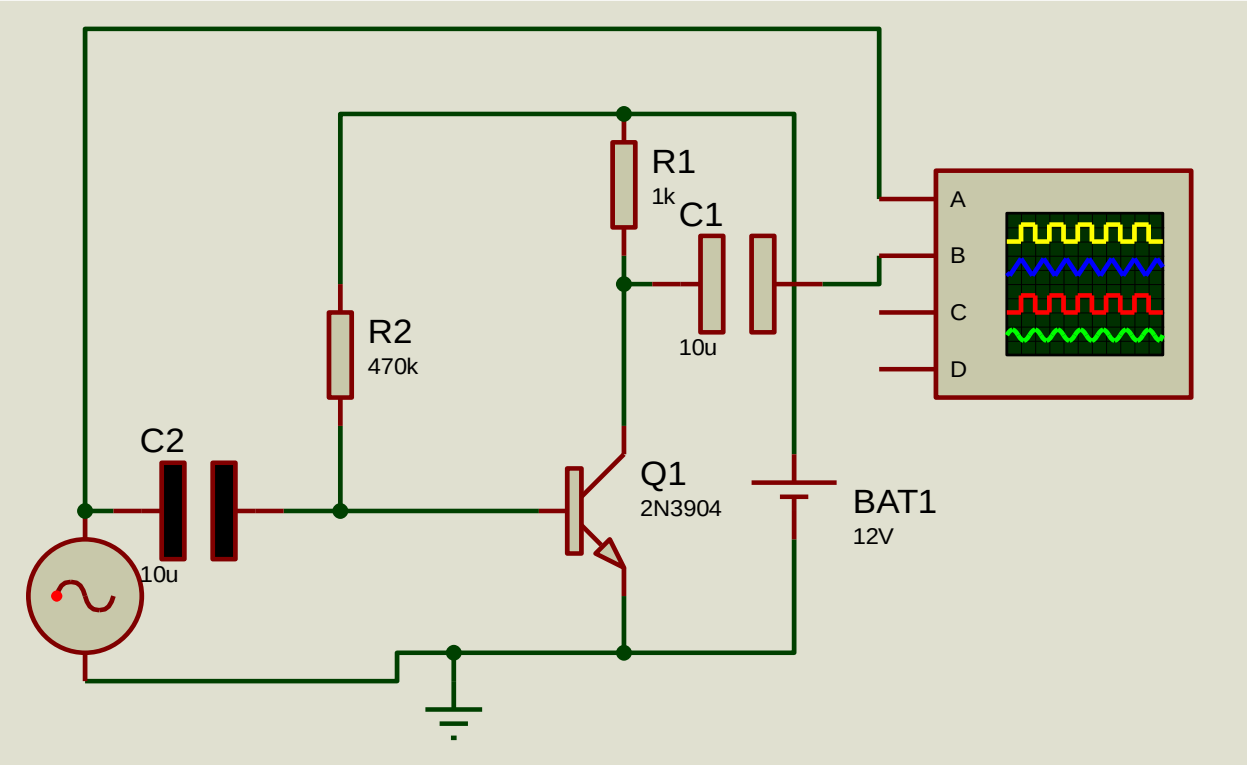
Where I_C is the collector current, V_{CC} is the supply voltage, V_{CE} is the collector-emitter voltage, and R_C is the collector resistor.

These equations highlight the fundamental principles behind BJT amplification, illustrating the relationship between input and output currents and the role of biasing and external components in shaping the amplifier's behavior. Properly configuring these elements is essential to design amplifiers for various applications with desired gain and performance characteristics.

Equipment and Software Requirements:

- Proteus simulation software
    - 2N3904
    - Capacitor (Animated)
    - Resistor (1k, 470k)
    - Oscilloscope
    - Battery (12 V)
    - Alternator (1 mv, 100 Hz)
- Computer with Proteus installed

Circuit Diagram:



Data Collection and Analysis:

- Observe the input and output waveshape from oscilloscope.
- Measure how much amplification is done.

Precautions:

- Ensure proper connections in the circuit.
- Use appropriate units and scales for measurements.
- Be cautious when using simulation software to avoid incorrect configurations.

Questions and Exercises:

1. What are the functions of capacitors in the experiment?
2. Why is the battery used?
3. How the voltage gain can be regulated?