Skill Experiment – 1: Study of BJT in Common Base (CB) Configuration

Aim:

To study and plot the input and output characteristics of an NPN transistor in common base configuration and determine input/output resistance and current gain (α).

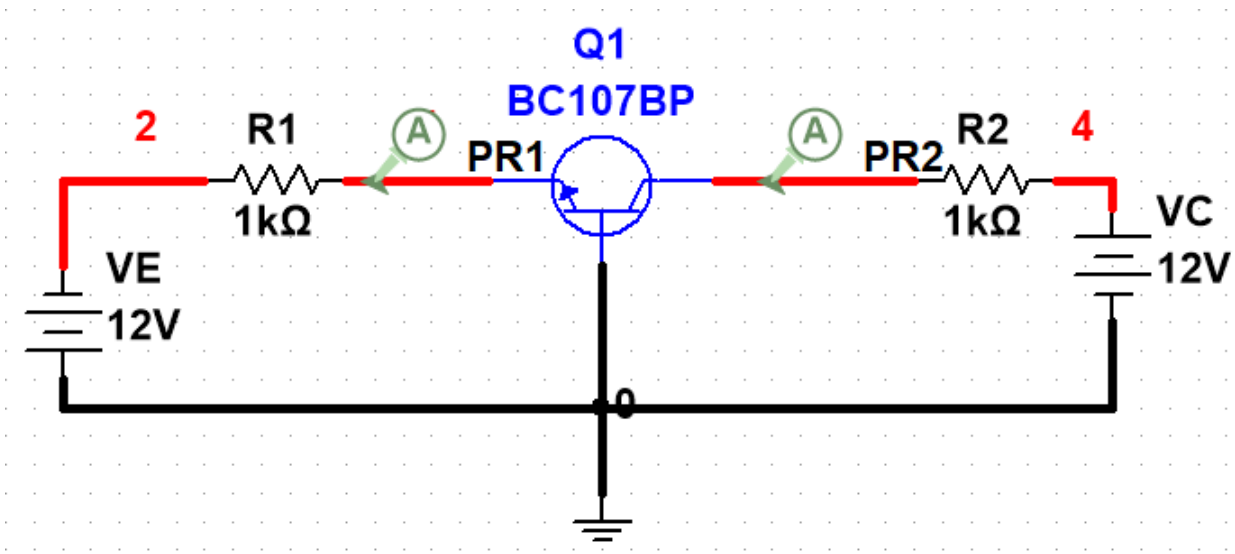
Apparatus Requirement:

S. No	Equipment/Component	Quantity
1	NPN Transistor (e.g., BC107)	1
2	Dual DC Power Supply (0–30V)	1
3	Resistors (e.g., 1kΩ, 10kΩ)	As req.
4	Voltmeter (0–10V)	2
5	Ammeter (0–10mA)	2

Pre-Lab Questions:

1. What is the role of each terminal in a BJT?
2. How does a common base configuration differ from common emitter or common collector?
3. What do you understand by input and output characteristics?
4. Define input resistance and output resistance.
5. What is current gain (α) in CB configuration?

Circuit Diagram



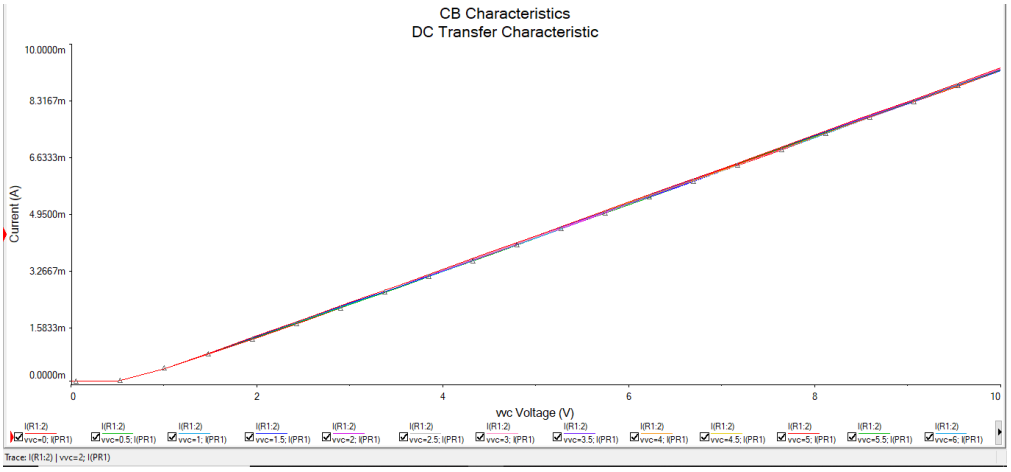
Procedure:

A: Input Characteristics (IE vs VBE for constant VCB)

- Open Multisim.
- Place the NPN transistor (e.g., BC107) from the component library.
- Connect the base to ground (via a base bias resistor, if needed).
- Connect V_E (variable DC source) between emitter and base (emitter negative with respect to base).
- Connect V_C between collector and base to keep V_{CB} constant (e.g., 1V, 2V, etc.).
- Place ammeter/multimeter in series with the emitter to measure I_E.
- Place voltmeter across base and emitter to measure V_{EB}.
- Vary V_E gradually (e.g., from 0 to 1V) and record the values of V_{EB} and corresponding I_E for fixed V_{CB}.
- Repeat for different values of V_{CB} (1V, 2V...).
- Plot I_E vs V_{EB} curves for constant V_{CB} values.

DC Sweep:

1. Click Simulate → Analyses → DC Sweep.
2. Set up a single sweep:
   - Source to sweep: Select V_E
   - Start value: 0V
   - Stop value: 1V
   - Increment: 0.05V or 0.1V
3. Run the simulation.
4. Plot I_E (Y-axis) vs V_{EB} (X-axis).
5. Repeat for different V_{CB} values (e.g., 1V, 2V, 4V) by changing V_C and running the sweep again.

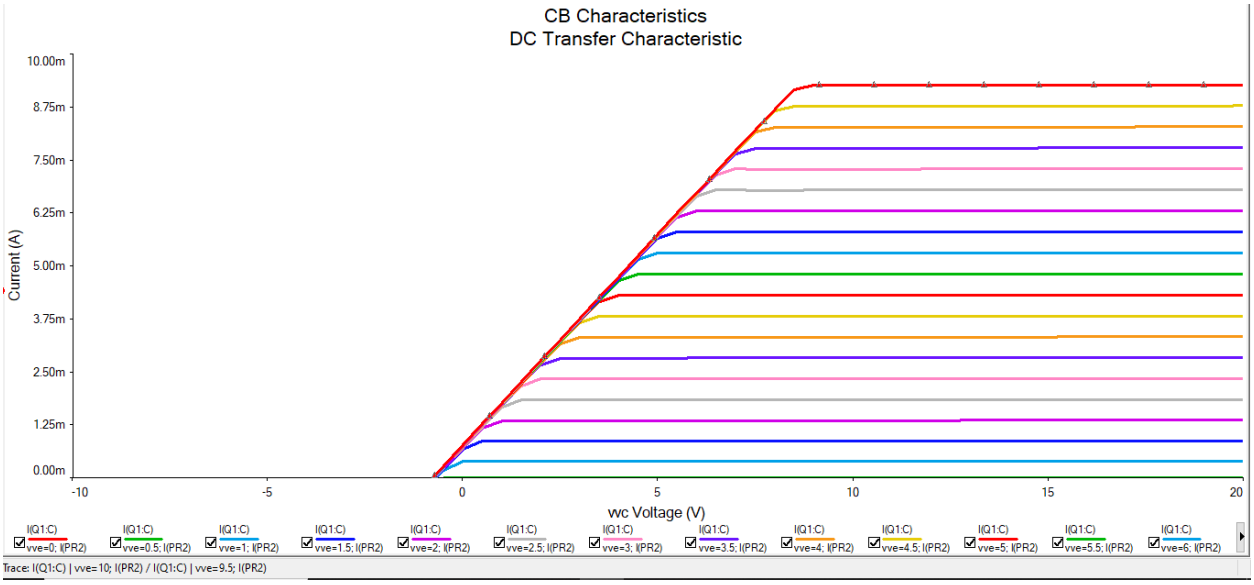


B: Output Characteristics (I_C vs V_{CB} for constant I_E)

- Reuse the same circuit or make modifications:
- Apply a fixed emitter current I_E by using a fixed V_{EB} (choose V_{EB} to get desired I_E using a DC sweep or fixed input).
- Connect V_C across collector and base, with the collector positive.
- Place a voltmeter across collector and base to measure V_{CB}.
- Place a multimeter or ammeter in series with collector to measure IC.
- Vary V_{CB} (e.g., from 0V to 10V) and record corresponding I_C for a fixed I_E.
- Repeat the above step for different I_E values (e.g., 1 mA, 2 mA, etc.).
- Plot I_C vs V_{CB} curves for constant I_E values.

DC Sweep:

1. Go to Simulate → Analyses → DC Sweep.
2. Sweep the V_C source (collector supply):
   - Source to sweep: V_C
   - Start value: 0V
   - Stop value: 10V
   - Increment: 0.1V
3. Keep I_E fixed by adjusting V_E (try 0.7V–0.8V).
4. Run the simulation.
5. Plot I_C (Y-axis) vs V_{CB} (X-axis).
6. Repeat for multiple I_E values (e.g., 1mA, 2mA, 3mA) by changing emitter bias (V_E).



Post Lab Tasks:

Draw and label characteristic curves.

Viva Questions:

1. Why is it called a common base configuration?
2. What is the typical value of current gain α in CB mode?
3. Why is the input resistance low in CB configuration?
4. What are the practical applications of CB configuration?
5. How does CB configuration behave as a voltage amplifier?