Experiment 5

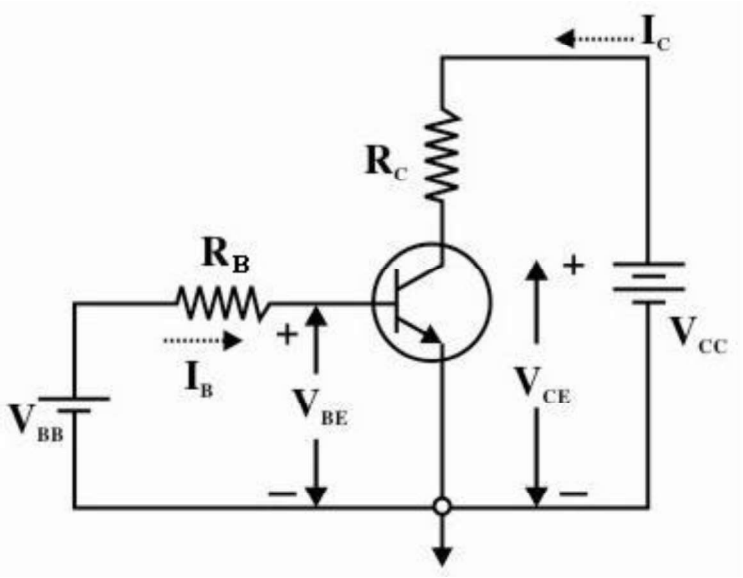
Aim: To study the input and output characteristics of a transistor in its various configurations (CE and CB).

Apparatus: Transistor kit, connecting wires, DC voltmeter (0-2V), DC voltmeter (0-20V), Ammeter (0-200μA), Ammeter (0-20mA)

Theory:

Common emitter characteristics of NPN transistor:

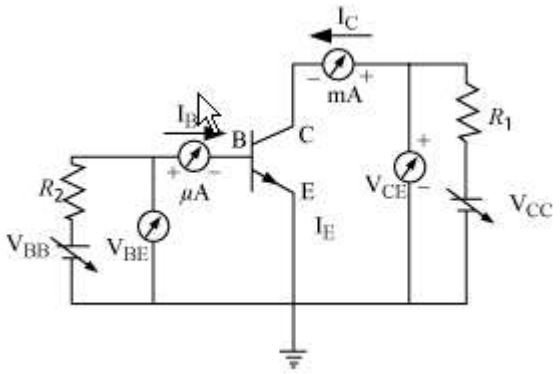
Transistor is three terminal active device having terminals collector, base and emitter. Transistor is widely used in amplifier, oscillator, electronic switch and so many other electronics circuits for variety of applications. To understand operation of the transistor, we use three configurations common emitter, common base and common collector. In this practical, we will understand common emitter configuration. As the name suggest, emitter is common between input and output. Input is applied to base and output is taken from collector.



We will obtain input characteristics and output characteristics of common emitter (CE) configuration. We will connect variable DC power supply at VBB and VCC to obtain characteristics. Input voltage in CE configuration is base-emitter voltage Vbe and input current is base current Ib. Output voltage in CE configuration is collector to emitter voltage VCE and output current is collector current Ic. We will use multi-meter to measure these voltages and currents for different characteristics. Collector to emitter junction is reverse biased and base to emitter junction is forward biased. The CE configuration is widely used in amplifier circuits because it provides voltage gain as well as current gain. In CB configuration current gain is less than unity. In CC configuration voltage gain is less than unity. Input resistance of CE configuration is less than CC configuration and more than CB

configuration. Output resistance of CE configuration is more than CC configuration and less than CB configuration.

Circuit setup:



Experiment Procedure (for input characteristics):
Connect circuit as shown in the circuit diagram for input characteristics

Connect variable power supply 0-15V at base circuit and collector circuit.

Keep Vcc fix at 0V (Or do not connect Vcc)

Increase VBB from 0V to 15V, note down readings of base current Ib and base to emitter voltage Vbe in the observation table.

Repeat above procedure for Vcc = +5V and Vcc = +10V

Draw input characteristics curve. Plot V_{BE} on X axis and I_B on Y axis.

Observation table:

Sr. No.	Vcc = 0V		Vcc = +5V		Vcc=+10V	
	Vbe	Ib	Vbe	Ib	Vbe	Ib
1						
2						
3						
4						
5						
6						

Circuit setup for output characteristics:

Experiment Procedure (for output characteristics):
Connect circuit as shown in the circuit diagram for output characteristics

Connect variable power supply 0-15V at base circuit and collector circuit.

Keep base current fix (Initially 0)

Increase VCC from 0V to 15V, note down readings of collector current Ic and collector to emitter voltage Vce in the observation table.

Repeat above procedure for base currents Ib = 5μA, 50 μA, 100 μA. Increase base current by increasing VBB.

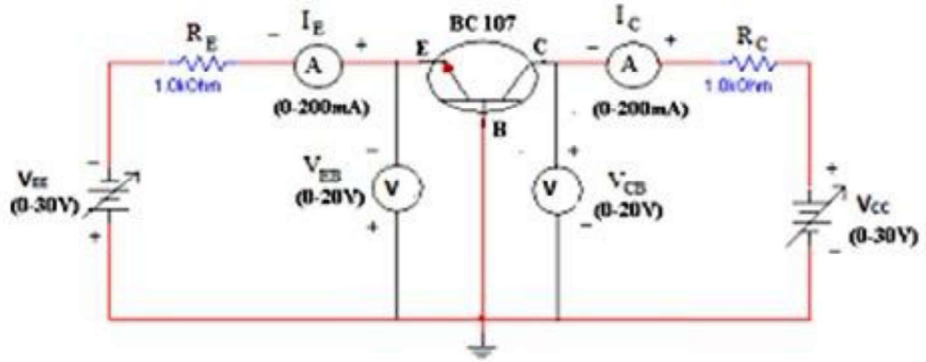
Draw output characteristics curve. Plot Vce on X axis and Ic on Y axis.

Sr. No.	Ib = 0		Ib = 5μA		Ib = 50μA		Ib = 100μA	
	Vce	Ic	Vce	Ic	Vce	Ic	Vce	Ic
1								
2								
3								
4								
5								
6								
7								
8								

Common Base characteristics of NPN transistor

In a common base configuration, base terminal is common between input and output. The output is taken from collector and the input voltage is applied between emitter and base. The base is grounded because it is common. To obtain output characteristics, we wil l measure collector current for different value of collector to base voltage (VCB). Input current is emitter current Ie and input voltage is Veb. To plot input characteristics we wi ll plot Veb versus Ie . Current gain for CB configuration is less than unity. CB configuration is used in common base amplifier to obtain voltage gain. Output impedance of common base configuration is very high. CB amplifier is used in multi-stage amplifier where impedance matching is required between different stages.

Circuit diagram to obtain input and output characteristics:



Experiment Procedure to obtain input characteristics:
Connect circuit as shown in the circuit diagram for input characteristics

Connect variable power supply 0-15V (VEE) at emitter base circuit and another power supply 0-30V at collector base circuit (Vcc).

Keep Vcc fix at 0V (Or do not connect Vcc)

Increase VEE from 0V to 15V, note down readings of emitter current Ie and emitter to base voltage Veb in the observation table.

Repeat above procedure for Vcc = +5V and Vcc = +10V

Draw input characteristics curve. Plot Veb on X axis and Ie on Y axis.

Experiment Procedure to obtain output characteristics:
Connect circuit as shown in the circuit diagram for output characteristics

Connect variable power supply 0-15V at emitter circuit and collector circuit.

Keep emitter current fix (Initially 0)

Increase VCC from 0V to 15V, note down readings of collector current Ic and collector to base voltage Vcb in the observation table.

Repeat above procedure for base currents Ie = 1mA, 5 mA and 10mA. Increase emitter current by increasing VEE.

Draw output characteristics curve. Plot Vcb on X axis and Ic on Y axis.

Observation table for input characteristics:

Sr. No.	Vcc = 0V		Vcc = +5V		Vcc=+10V	
	Veb	Ie	Veb	Ie	Veb	Ie
1						
2						
3						
4						
5						
6						

Observation table for output characteristics:

Sr. No.	Ie = 0		Ie = 1 mA		Ie = 5 mA		Ie = 10 mA	
	Vcb	Ic	Vcb	Ic	Vcb	Ic	Vcb	Ic
1								
2								
3								
4								
5								
6								
7								
8								

Result: Draw the input and output characteristics of CE and CB configuration.