

Experiment 1: CE CHARACTERISTICS

Aim/Objective: To study the input and output characteristics of a transistor in common emitter configuration.

Components required:

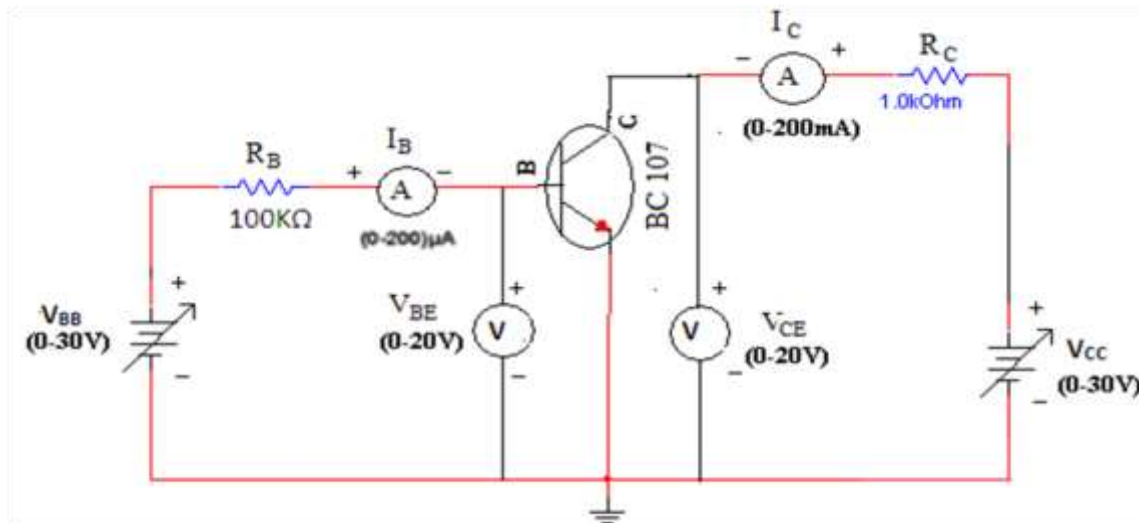
BC107 Transistor	1 No
Resistors	100k ohm, 1k ohms
Ammeters	I_B (0 – 200) μ A, I_C (0 – 2) mA
Voltmeters	V_{BE} (0 – 2) V, V_{CE} (0 – 20) V
Function Generator	
Regulated Power Supply	
Oscilloscope	
CRO Probes	
Connecting Wires	

Description:

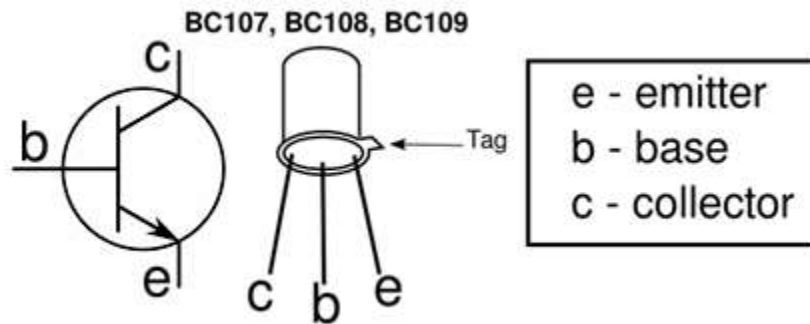
The basic circuit diagram for studying input and output characteristics are shown in fig (1) & fig (2). In this the input is applied between base and emitter and the output is taken from collector and emitter. Here emitter is common to both input and output and hence the name common emitter configuration.

Input characteristics are obtained between the input current and input voltage taking output voltage as parameter. It is plotted between V_{BE} and I_B at constant V_{CE} in CE configuration. Output characteristics are obtained between the output voltage and output current taking input current as parameter. It is plotted between V_{CE} and I_C at constant I_B in CE configuration.

Circuit diagram



Pin assignment of transistor:



Pre lab session

- 1) What are the input and output terminals in a Common Emitter configuration?

- 2) What is the significance of the active, cutoff, and saturation regions in the output characteristics of a BJT?

- 3) How does varying the base current I_B affect the collector current I_C in the CE configuration? Explain using the concept of current gain β .

- 4) Explain how the common emitter configuration can be used to determine the DC current gain β of a transistor. What part of the output characteristics is used for this?

In-Lab Session

Procedure:

Input Characteristics

1. Make the connections as per circuit diagram fig (1).
2. Keep output voltage $V_{CE} = 2V$ by varying V_{CC} .
3. Varying V_{BB} gradually, note down both base current I_B and base - emitter voltage (V_{BE}).
4. Step Size is not fixed because of non linear curve and vary the X-axis variable (i.e if output variation is more, decrease input step size and vice versa).
5. Repeat above procedure (step 3) for $V_{CE} = 4V$.

Output Characteristics

1. Make the connections as per circuit diagram fig (2).
2. By varying V_{BB} keep the base current $I_B = 10\mu A$.
3. Varying V_{CC} gradually, note down the readings of collector-current (I_C) and collector-emitter voltage (V_{CE}).
4. Step Size is not fixed because of non linear curve and vary the X-axis variable (i.e if output variation is more, decrease input step size and vice versa).
5. Repeat above procedure (step 3) for $I_B = 20\mu A$.

Tabular column:

Input Characteristics

$V_{CE} = 2 V$			$V_{CE} = 4 V$	
S.No	$I_B (\mu A)$	$V_{BE} (V)$	$I_B (\mu A)$	$V_{BE} (V)$
1				
2				
3				
4				
5				
6				
7				
8				
9				

Output Characteristics

$I_B = 10\mu A$			$I_B = 20\mu A$	
S. No	V_{CE} (V)	I_C (mA)	V_{CE} (V)	I_C (mA)
1				
2				
3				
4				
5				
6				
7				
8				
9				

Graphs:

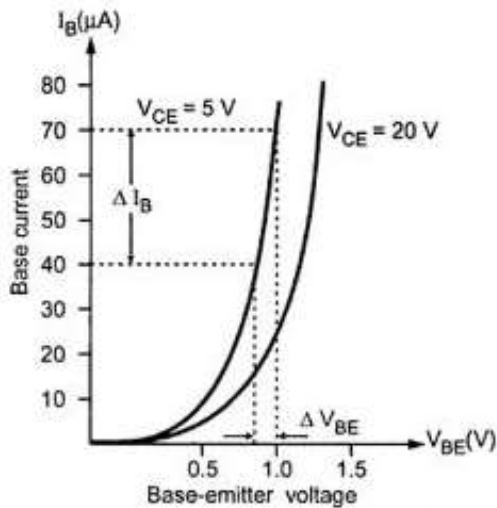


Fig 1: Input Characteristics

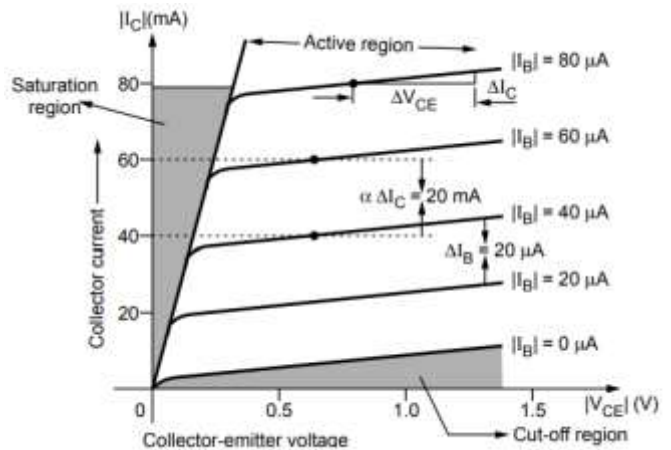


Fig 2: Output Characteristics

1. Plot the input characteristics by taking V_{BE} on Y-axis and I_B on X-axis at constant V_{CE} .
2. Plot the output characteristics by taking V_{CE} on x-axis and I_C on Y-axis by taking I_B as a parameter.

Analysis and Inferences:

1. **Input resistance:** To obtain input resistance find ΔV_{BE} and ΔI_B at constant V_{CE} on one of the input characteristics.

$$\text{Then } R_i = \Delta V_{BE} / \Delta I_B \text{ (} V_{CE} \text{ constant)}$$

2. **Output resistance:** To obtain output resistance, find ΔI_C and ΔV_{CE} at constant I_B .

$$R_o = \Delta V_{CE} / \Delta I_C \text{ (} I_B \text{ constant)}$$

Viva-Voce

- 1) **In a CE configuration, which terminal is common to both input and output?**
 - A) Base
 - B) Emitter
 - C) Collector
 - D) None
- 2) **The input characteristics of a CE configuration resemble the characteristics of a:**
 - A) Zener diode
 - B) Reverse-biased PN junction
 - C) Forward-biased PN junction
 - D) None of the above
- 3) **The output characteristics are plotted between:**
 - A) V_{CE} vs I_B
 - B) V_{CE} vs I_C (at constant I_B)
 - C) V_{BE} vs I_C
 - D) I_B vs I_C
- 4) **In the active region of a CE transistor, the base-emitter junction is ____ and the collector-base junction is ____.**
 - A) Reverse-biased, reverse-biased
 - B) Forward-biased, forward-biased
 - C) Reverse-biased, forward-biased
 - D) Forward-biased, reverse-biased
- 5) **Which region of CE characteristics is used for amplification?**
 - A) Cut-off
 - B) Active
 - C) Saturation
 - D) Breakdown

Post-Lab Session

Analysis and Inference

Result:

Evaluator Remark (if Any):	Marks Secured: _____ out of 50
	Signature of the Evaluator with Date