STATIC CHARACTERISTICS OF TRANSISTOR

OBJECTIVE

The purpose of the experiment is to study the characteristics of bipolar transistor in common emitter (CE) configuration. From the characteristic curve it is expected to determine the hybrid parameters: input impedance h_{ie}, output admittance h_{oe}, forward current gain h_{fe}, reverse voltage gain h_{re} and to draw the hybrid equivalent model.

EQUIPMENT AND COMPONENTS USED

BC107 Bipolar junction transistor

(0-30V) Dual Regulated Power Supply

330Ω, 1kΩ resistor, ½ W

(0 - 30)mA,(0-500)µA DC Ammeters

(0 - 30)V, (0-1)V DC Voltmeters

Breadboard

THEORY

- Emitter is common or reference to both the input and output terminals.
- The base–emitter circuit is the input network and the collector–emitter circuit is the output network.
- The input and output characteristics describe the behavior of common – emitter configuration.

Input characteristics

- The plot between base current I_B and base emitter voltage V_{BE} at constant collector-emitter voltage V_{CE} represents input characteristics.
- Input characteristics resembles that of a forward-biased diode, as the base-emitter section of transistor is a diode.

Output characteristics

- The plot between collector current I_C and collector emitter voltage V_{CE} at constant base current I_B represents output characteristics.
- In the cutoff region, a small amount of collector current flows even when base current is zero.
- When V_{CE} has very low value, the transistor is said to be saturated.
- In active region, for small values of base current, the effect of collector voltage on collector current is small.
- The function of Zener diode is to keep the output voltage fairly constant over a wide variation of load current.

Current transfer characteristics

- The current transfer characteristics shows the variation of collector current I_C with base current I_B keeping collector emitter voltage V_{CE} as constant.
- The ratio is referred to as common-emitter current gain β and is always greater than 1.

Hybrid Parameters

- The quantities h_{ie}, h_{re}, h_{oe}, h_{fe} are called hybrid parameters and are the components of a small signal equivalent circuit.

- The h-parameters for small signal transistor equivalent circuit in the region of operation for common-emitter configuration can be found using the following equation.

$h_{ie} = \Delta V_{be} / \Delta i_b$ at V_{CE} is Constant

$h_{re} = \Delta V_{be} / \Delta V_{ce}$ at I_B is Constant

$h_{fe} = \Delta i_c / \Delta i_b$ at V_{CE} is Constant

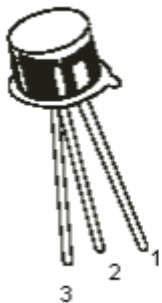$h_{oe} = \Delta i_c / \Delta V_{ce}$ at I_B is Constant

FURTHER READING

1. Theodore F.Bogart, Jeffrey S.Beasley, "Electron Devices and Circuits, PHI
2. Robert Diffenderfer, "Electronic Devices", Delmar Cengage Learning, 2005
3. Robert Boylstad, Louis Nashelsky, "Electronic Devices and Circuit Theory", PHI, 2008
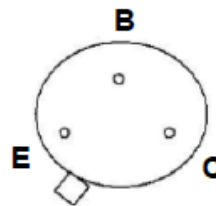
CIRCUIT DIAGRAM
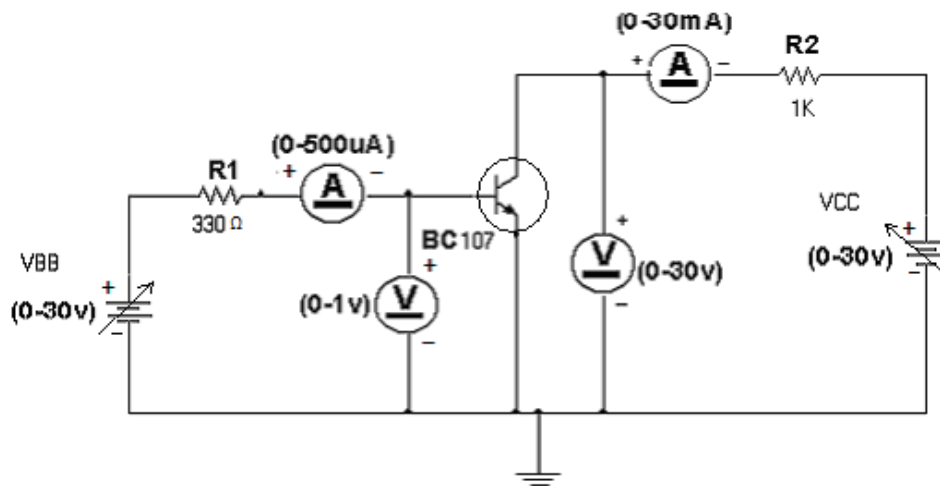
PIN CONFIGURATION
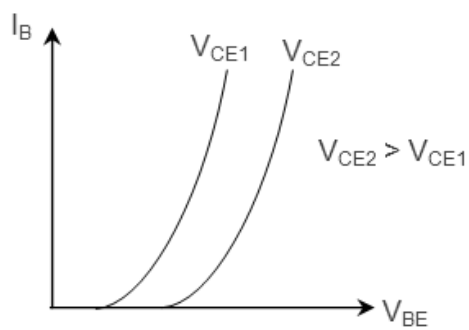

Pin Configuration:
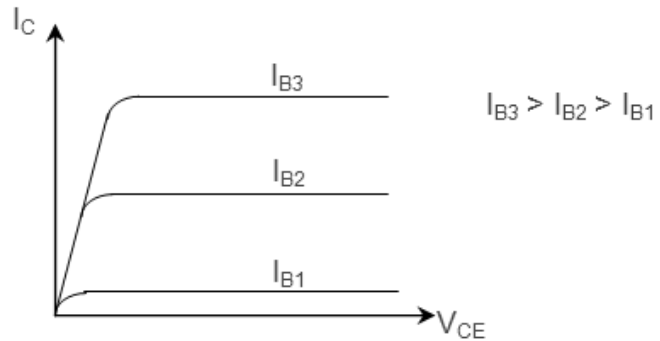1. Emitter
2. Base
3. Collector

Bottom View

Model Graph

(a) Input characteristics   (b) Output characteristics
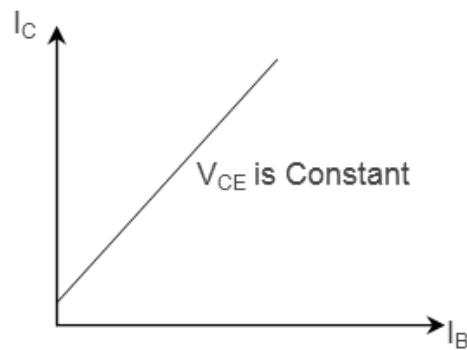
(c) Transfer characteristics

PRELAB

1. Read the specifications of BC107 transistor from its datasheet.

Device Part Number: BC107

Device Manufacturer: _____

Maximum Collector to emitter voltage, V_{CEO} =

Maximum Emitter-base voltage , V_{EBO} =

Maximum Collector current, I_C =

Collector-Cut off Current, I_{CBO} =

DC current gain, hfe =

Base Emitter Saturation Voltage, $V_{BE(Sat)}$ =

Collector Emitter Saturation Voltage, $V_{CE(sat)}$ =

Base Emitter On Voltage, $V_{BE(ON)}$ =

Input impedance, hie =

Reverse Voltage ratio, hre =

Output admittance, hoe =

Total power dissipation, P_{tot} =

Exp. No. :   Date:

STATIC CHARACTERISTICS OF TRANSISTOR

OBJECTIVE

OBSERVATION
        Circuit Diagram

        Practice Procedure

Input Characteristics

1. Keeping the output voltage constant (V_{CE} = constant), vary the input voltage and note down the corresponding V_{BE} voltage and I_B current.

2. Repeat the above step for different values of V_{CE}.

3. Plot the graph: I_B against V_{BE} for different values of V_{CE}.

4. From the plot, find the h-parameters: i) h_{fe}: forward current gain

                                ii) h_{ie}: input impedance

Output Characteristics

1. Keeping the input current (I_B) constant (I_B = constant), vary the output voltage (V_{CE}) and note down the corresponding collector (I_C) current.

2. Repeat the above step for different values of I_B current.

3. Plot the graph: I_C against V_{CE} for different values of I_B.

4. From the plot, find the h-parameters: i) h_{oe}: output admittance

                                ii) h_{re}: reverse voltage gain

Current Transfer Characteristics

1. Keeping the output voltage constant (V_{CE} = constant), vary the input voltage and note down the I_B current and corresponding I_C current.

2. Plot the graph: I_C against I_B for constant V_{CE}.

Table1: Input Characteristics

V_{CE} = 0 V		V_{CE} = V	
V_{BE} (volts)	**I_B (μA)**	**V_{BE} (volts)**	**I_B (μA)**

Table2: Output Characteristics

I_B= μA		I_B= μA		I_B= μA	
V_{CE} (volts)	**I_C (mA)**	**V_{CE} (volts)**	**I_C (mA)**	**V_{CE} (volts)**	**I_C (mA)**

Table3: Transfer Characteristics

V_{CE} = 5 V	
I_B (μA)	**I_C (mA)**

I_B (μA)	**I_C (mA)**

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Inference

UNDERSTANDING & LEARNING

RESULTS AND CONCLUSION

Prepared by:
Name: _____   Reg. No.: _____

Experiment Date: ……………   **ASSESSMENT**

Report Submission Date: ……………

Student Task	Max. Marks	Graded Marks
Pre-lab Preparation	20	
Inference	10	
Results & Conclusion	10	
Post-lab / Viva-voce	10	
Total	50	

Submission Delay: …..........

Signature