EXPERIMENT NO.7

OBJECT:

I. To study & plot the input, output & transfer characteristics of NPN Transistor in common emitter configuration.
II. To determine the transistor parameters.

APPARATUS:

1. Two continuously variable DC regulated power supplies of 0- 1 V and 0-10 V are provided in ME 533, ME 533D & ME 533P..
2. Four meters to measure voltage & current are mounted on front panel & connection brought out on 4mm sockets.

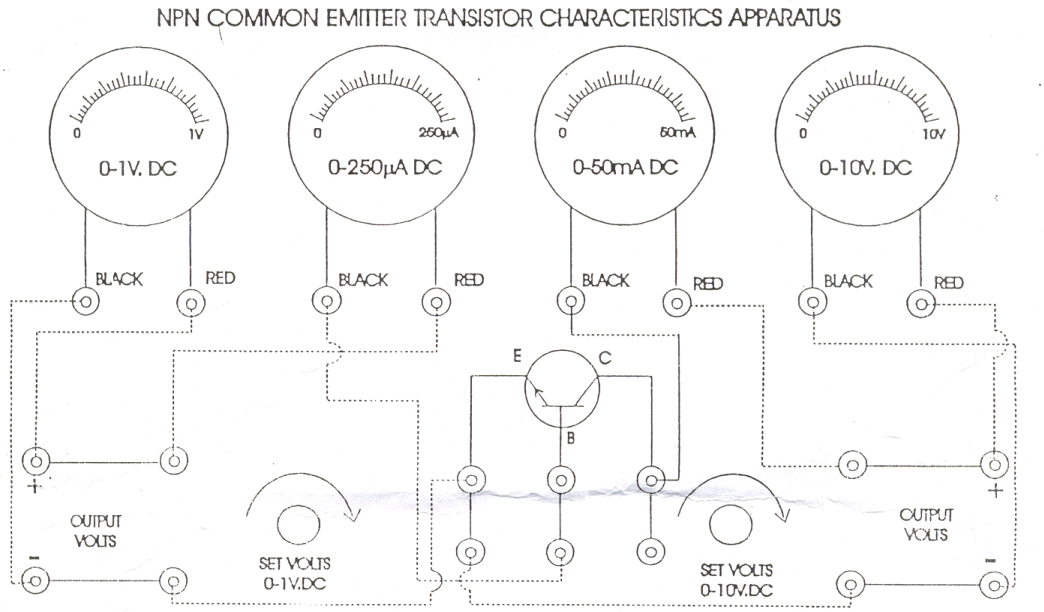


FIG.1

CIRCUIT ARRANGEMENT OF NPN TRANSISTOR IN CE CONNECTION

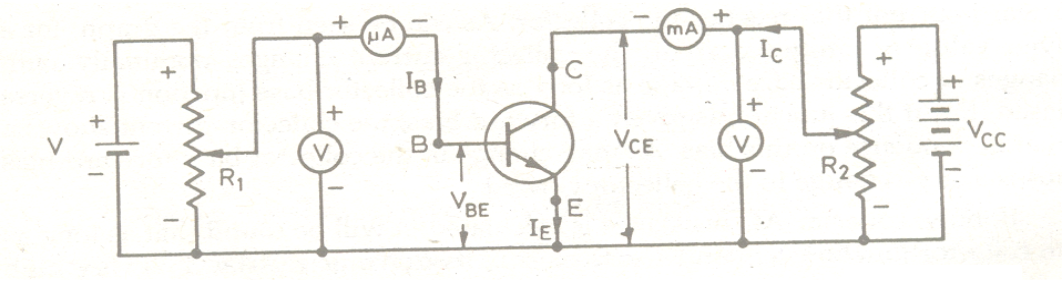


FIG.2

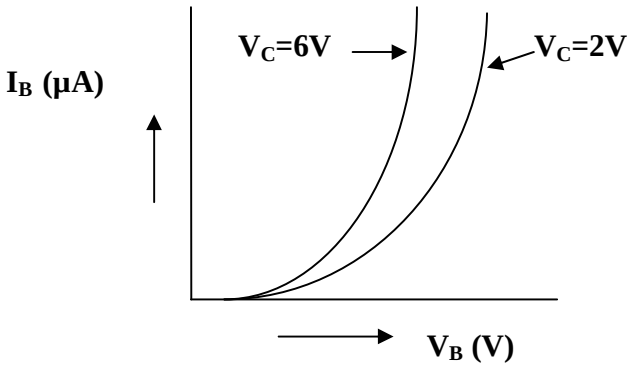
PROCEDURE:

INPUT CHRACTERSTICS:

1. Adjust collector to emitter voltage V_{CE} (using VR_2) at some suitable value (say at 2 V) and keep it constant.
2. By adjusting input supply, (using VR_1) set the base to emitter voltage, so that base current shows value say 20μ A. Note down base to emitter voltage V_{BE} .Increase V_{BE} in small steps and note the corresponding base current I_B.
3. Repeat step no. 1 & 2 for other values of V_{CE} (say 6V,8V etc.)
4. Plot a graph by taking base voltage V_{BE} along X-axis and base current I_B along Y- axis as shown in fig.3.
5. Draw a tangent to $V_{BE} - I_B$ curve & determine its slope .The reciprocal of the slope gives the value of input resistance of transistor.

NOTE:

While varying the base to emitter voltage V_{BE} output voltage V_{CE} may drop in case of ME 533E .Readjust it to desired value.



INPUT CHARACTERSTIC

FIG.3

OUTPUT CHARACTERISTICS:

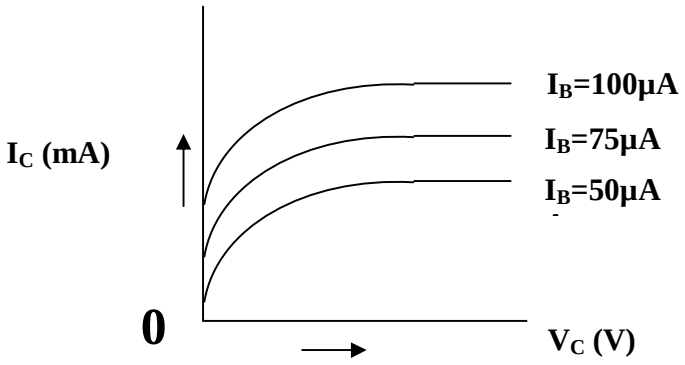
6. Adjust the base current I_B to 50µA using V_{R1}.
7. Set collector voltage V_{CE} to 0.5V and note down the corresponding collector current Ic. Gradually increase the collector voltage in small steps (i.e. make it 2V,2.5V,3.0V,……,10V etc) and note the corresponding values of the collector current I_C keeping the base current I_B constant.

NOTE:- While varying output voltage V_{CE} ,input current I_B can drop in case of ME533E.Readjust it before observation.

8. Repeat steps 6&7 for other value of base current I_B (say 75µA, 100µAetc.)
9. Plot a graph by tacking collector voltage V_{CE} along X-axis)& collector current I_C along y-axis as in fig.4 .
10. Draw a tangent on a V_{CE}-I_C curve and determine its slope. Reciprocal of the slope gives the value of output resistance of transistor.

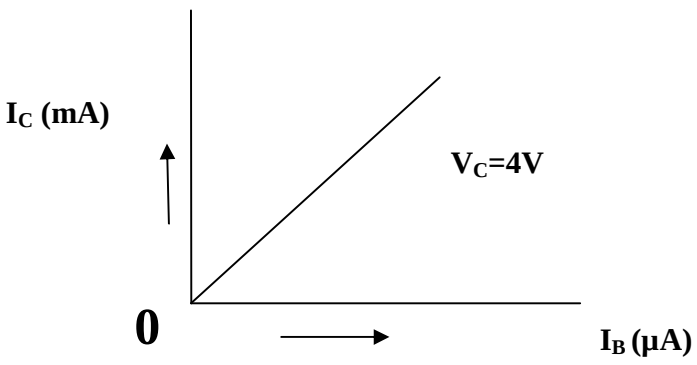
TRANSFER CHARACTERISTICS:-

11. Adjust collector voltage at suitable value (say V_C=4v) and maintain it constant.
12. Adjust base current I_B to a suitable small but measurable value and note down the corresponding collector current Ic.Increase I_B in small steps and note down the collector current Ic each time.
13. Plot a graph by taking base current I_B along x-axis and collector current I_C along y- axis as shown in fig.5. The slope of the graph gives the value of current gain β.



OUTPUT CHARACTERSTIC

FIG.4



TRANSFER CHARACTERISTIC

FIG.5

OBSERVATION (COMMON EMITTER CHARACTERISTICS):-

A. For input characteristics i.e. V_{BE} -I_B for constant V_{CE}

S.NO.	BASE VOLTAGE V_{BE} (V)	BASE CURRENT I_B IN µA		
		V_{CE}=2V	V_{CE}=6V	V_{CE}=8V
1 2 3 4 5				

B. For output characteristics i.e. V_{CE} – Ic for constant I_B:-

S.NO.	COLLECTOR VOLTAGE V_{CE}(mV)	COLLECTOR CURRENT IN mA		
		I_B=50µA	I_B=75µA	I_B=100µA
1. 2. 3. 4. 5.				

C. For transfer characteristics i.e. I_B- IC for constant V_{CE}

Constant value of collector V_{CE} =……..Volts

S.NO.	BASE CURRENT	COLLECTOR CURRENT
1. 2. 3. 4. 5.		

CALCULATION:

Common Emitter Configuration:

From the input characteristics

$r_i = \Delta V_{BE} / \Delta I_B$] $V_{CE\ =constant}$ volts /μA =……. /.....x 10^6 volts / A

From the output characteristics

$r_o = \Delta V_{CE} / \Delta I_C$] $I_{B\ =constant}$ volts /mA =……. /.....x 10^3 volts / A

From the transfer characteristics

$\beta = \Delta I_C / \Delta I_B$] $_{VCE\ =constant}$ =…….

RESULT:

1. Plot of input characteristics, output characteristics and transfer characteristics of NPN transistor in CE configuration, is shown on the graph paper.
2. Transistor parameters are :
   Common emitter configuration:
   r_i =…ohm
   r_o =…ohm
   β =…

PRECAUTIONS:

1. Make the connections properly.
2. While varying the base to emitter voltage V_{BE} ,output voltage V_{CE} may drop, readjust it to desired value.
3. While varying output voltage V_{CE} input current I_B can drop, readjust it before taking observation.
4. Over heating of the transistor should be avoided.