Precautions

(1) All the equipments must be properly earthed before starting the experiment.

(2) The plate current should never exceed 10 *mA*.

(3) While drawing the plate characteristics, values of e_g should be chosen at intervals of 2 volts so that a grid signal of 2 volt amplitude can be superimposed properly.

Questions

(i) How will you determine the operating point ? (ii) What will be the effect on the D.C. load line of applying an A.C. signal ? (iii) What is the effect on the A.C. load line of connecting a load to the amplifier ? What effect is there on the voltage gain ?

EXPERIMENT No. 79

Object : (*a*) *To study the input and output static characteristics of an AC 125 (PNP, G_e type) transistor in CE configuration.*

(*b*) *To calculate the various parameters of transistor from the stutic characteristic.*

Apparatus : (A) *Omega Training Board Consisting of :*

1. 0—10V. continuously variable power supply for base emitter junction.

2. 0—10V. continuously variable power supply for collector-emitter junction.

3. 0—10 V/IV full scale voltmeter for collector emitter voltage measurement (switch to be kept in 10 V range).

4. 0—10 *mA*/200 μA full scale meter for base current measurement (switch to be kept in 200/μA range).

5. 0—10 *mA*/200 μA full scale meter for collector current measurement (switch to be kept in 10 *mA* range).

6. 0—2 V digital voltmeter for V_{BE} measurement.

Formula : Let V_{BE} and V_{CE} represent the potential difference between base-emitter and collector-emitter respectively and let I_B and I_C are respectively the base and collector currents.

Then (i) Current gain $= \left.\frac{I_C}{I_B}\right|$ keeping V_{CE} constant.

(ii) Input impedance $= \left.\frac{V_{BE}}{I_B}\right|$ keeping V_{CE} constant.

(iii) Output impedance $= \left.\frac{V_{CE}}{I_C}\right|$ keeping I_B constant.

and (iv) Reserve feed-back ratio $= \left.\frac{V_{BE}}{V_{CE}}\right|$ keeping I_B constant.

Procedure :

(*i*) *Variation of* V_{BE} *with* I_B (Input characteristics). At first, the room temperature is recorded. The connections are then made as shown in fig. 79.1. Keeping V_{CE} constant say at 0 volt, th

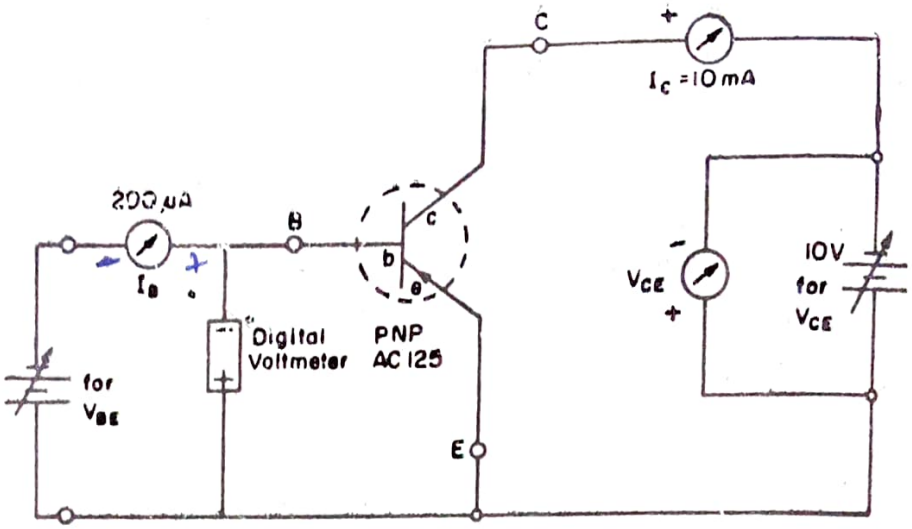

Fig. 79.1

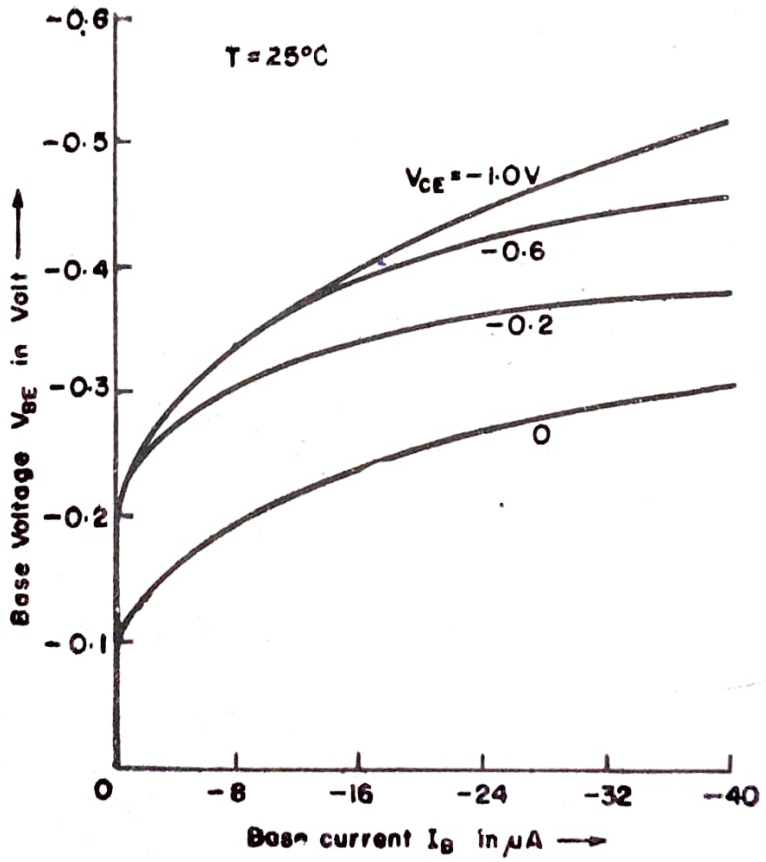

Fig. 79.2

base current I_B is kept as $8\mu A$ (say) and the corresponding V_{BE} is recorded. The base current is gradually varied in steps of 8 μA (say) and the corresponding V_{BE} readings are recorded with the help of a digital voltmeter. The experiment is also repeated keeping V_{CE} as 0.2, 0.6 and 1.0 volt. The input characteristic curves of the transistor are drawn between V_{BE} and I_B for four different values of V_{CE} (fig. 79.2).

(*ii*) *Variation of* V_{CE} *with* I_C (*Output characteristics*). The connections are made as before. Now V_{CE} is gradually varied and the corresponding collector currents I_C are noted for a fixed value of base current I_B (say 8 μA). The values of V_{CE} may be taken as say, 0.2 V, 0.6 V, 1.0 V, 2.0 V, 3.0 V, 5.0 V, 7.0 V and 10.0 V. The procedure is repeated for other I_B values say, 16, 24, 32 and 40 μA. Output characteristic curves are drawn between V_{BC} and I_C for five different values of I_B (fig. 79.3).

(*iii*) The different parameters of the given transistor are then obtained from the input and output characteristic curves. However, the calculations of the required parameter are made in the linear portion of the characteristics.

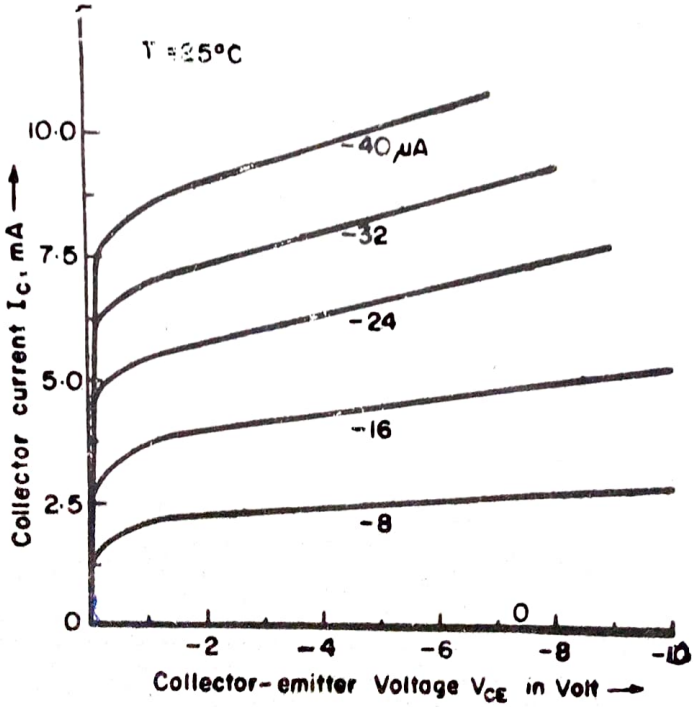

Fig. 79.3

Observation Table

Transistor : *PNP — AC 125 (Common-emitter configuration).*

Room Temperature ... ... °C.

(I) Input Characteristics :

S. No.	I_B in μA	V_{BE} for V_{CE} = ... V	V_{BE} for V_{CE} = ... V	V_{BE} for V_{CE} = ... V	V_{BE} for V_{CE} = ... V
1	...				
2	...				
3	...				
⋮					

(II) Output Characteristics :

S. No.	For I_B = ... μA		For I_B = ... μA		For I_B = ... μA		For I_B = ... μA		For I_B = ... μA	
	V_{CE} (volt)	I_C (mA)	V_{CE} (volt)	I_C (mA)	V_{CE} (volt)	I_C (mA)	V_{CE} (volt)	I_C (mA)	V_{CE} (volt)	I_C (mA)
1										
2										
3										
4										
⋮										
⋮										
⋮										
⋮										

Calculations :

(i) Current gain =

(ii) Input impedance =

(iii) Output impedance =

(iv) Reverse feed-back ratio =

% error for each parameter of the transistor :

Result : The input and the output characteristics curves are shown in Figs. 79.2 and 79.3.

The transistor parameters (AC. 125) (correct to significant figures) are

(i) Current gain =...
(ii) Input impedance =... ohm
(iii) Output impedance =... Kohm.
(iv) Reserve feed-back ratio=...

Precautions : (i) The connections should be properly made.

(ii) In the case of output characteristics, the collector current I_c should not exceed 10 *mA* in any case.

(iii) The digital voltmeter should be disconnected while measuring the output characteristics.

Questions

(i) How do you distinguish between a *PNP* and a *NPN* transistor ? (ii) How amplifier action can be achieved in a transistor ? (iii) What is the order of current gain in *CE* configuration ? (iv) Why the base current in a transistor is small ? (v) What do you understand by reverse saturation current ? (vi) How the *CE* current gain is related to the *CB* current gain in a transistor ? (vii) If a transistor used in the *CE* connection has its collector voltage increased, what will happen to the base current if the base voltage is held constant ? Why ?

EXPERIMENT No. 80

R.C. Coupled Amplifier

Object : (i) *To study the operation of output voltage with input voltage of the R-C coupled amplifier and to measure the voltage gain.*

(ii) *To draw the frequency response curve of the R-C coupled amplifier.*

Apparatus :

(i) AEC Audio Voltage R.C. coupled amplifier,
(ii) Regulated Power Supply, +300 Volt,
(iii) Audio Signal Generator,
(iv) AEC-AC Millivoltmeter, Model MV—3.

Circuit Diagram

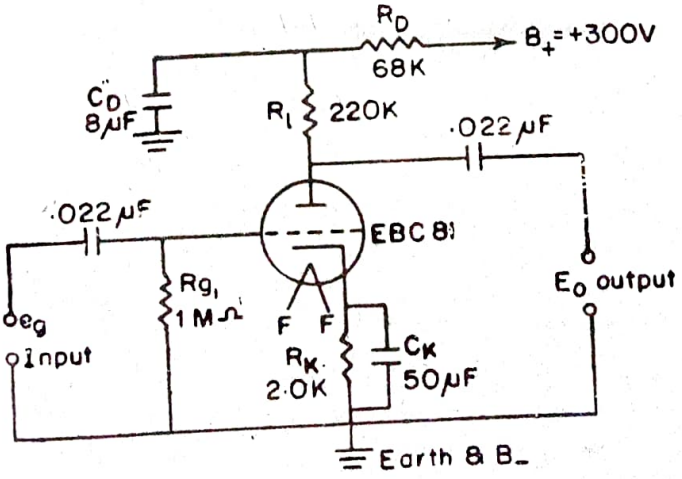

Fig. 80.1