Tutorial-3

Kirti Chaudhary
B073 073

1) $I_E = 1mA$, Collector current $= I_C = 0.95mA$, calculate the base current value I_B.

Ans) $I_E = I_B + I_C$

$I_B = I_E - I_C$

$I_B = 1 - 0.95$

$I_B = 0.5mA$

2) For a given circuit → Current amplification is given $\alpha = 0.9$, ammeter current $= I_E = 1mA$. Calculate the value of I_B.

Ans) $I_E = 1mA$, $\alpha = 0.9$, $I_B = ?$

Relationship between α; $I_E \rightarrow \alpha = \frac{I_C}{I_E}$

$\rightarrow \alpha \times I_E = I_C$

$\rightarrow I_C = 0.9mA$

$\rightarrow I_E = I_B + I_C$

$\rightarrow I_B = I_E - I_C$

$\rightarrow I_B = 1 - 0.9$

$\rightarrow I_B = 0.1mA$

3) In a CB connection, $I_C = 0.95mA$, $I_B = 0.05mA$. Find value of α.

Ans) $I_C = 0.95mA$, $I_B = 0.05mA$.

$\rightarrow I_E = I_B + I_C$

$= 1mA$

$$\rightarrow \alpha = \frac{I_C}{I_E} = 0.95mA$$

4) In a CB connection, the emitter current is 1mA. If the emitter circuit is open, the collector current is 50μA. Find the total collector current. $\alpha = 0.92$.

Soln) Given → $I_E = 1mA$, $I_C = 0.50mA$, $\alpha = 0.92$

$I_{CBO} = ?$

$$\rightarrow I_E = I_C + \alpha I_{CO}$$
$$\rightarrow 1 = 0.50 + 0.92 \times I_{CO}$$
$$\rightarrow 0.5 = 0.92 \times I_{CO}$$
$$\rightarrow I_{CO} = 0.54mA$$

5) Find value of β if →

(i) $\alpha = 0.9$

$$\rightarrow \beta = \frac{\alpha}{1-\alpha} = \frac{0.4}{0.1} = 9$$

(ii) $\alpha = 0.98$

$$\beta = \frac{\alpha}{1-\alpha} = \frac{0.98}{0.02} = 49$$

COMET

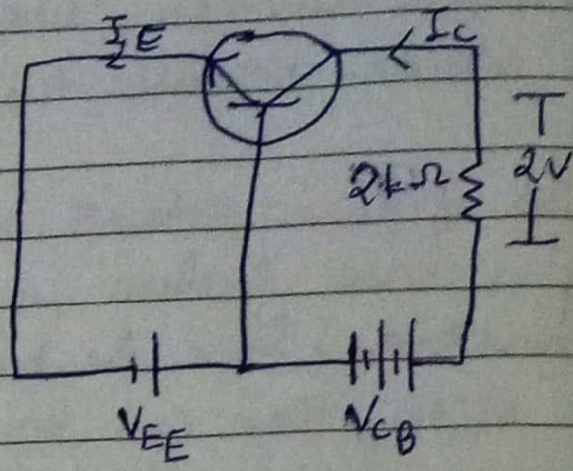
$\beta_{max} = 1.16 - \alpha$

(iii) $\alpha = 0.99$

$$\beta = \frac{\alpha}{1-\alpha} = \underline{99}$$

6) In a common base connection, $\alpha = 0.95$. The voltage drop across 2kΩ resistance which is connected in the collector is 2V. Find the base current.

Ans) Voltage drop across RC = 2V



$\rightarrow I_C = 2V/2k\Omega = 1mA$

$\rightarrow \alpha = \frac{I_C}{I_E} \Rightarrow I_E = \frac{I_C}{\alpha}$

$\rightarrow I_E = \frac{1}{0.95} = 1.05mA$

$\rightarrow$ Using the relation $\rightarrow$

$$I_E = I_B + I_C$$

$$I_B = I_E - I_C$$

$$I_B = 1.05 - 1$$

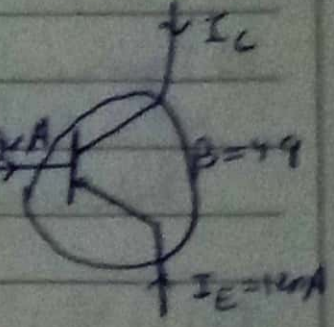
$$I_B = 0.05mA$$

7) Calculate IE in a transistor for which $\beta = 50$ and $I_B = 20\mu A$.

Ans) $I_C = \beta I_B = 50 \times 20\mu A = 1mA$.

$\rightarrow I_E = I_C + I_B = 20\mu A + 1mA = 1.02mA$

8) Find the α rating of the transistor shown in Figure below. Hence determine the value of IC using both α and β rating of the transistor.



Ans) $I_C = \alpha I_E$, $I_C = \beta I_B$

$\rightarrow \alpha = \frac{I_C}{I_E}$

$\rightarrow I_C = I_E - I_B$

$= 12 - 0.24$

$= 11.76mA$

$\alpha = \frac{I_C}{I_E} = \frac{11.76}{12} = 0.98$

$\rightarrow \beta = \frac{I_C}{I_E}$

$\rightarrow I_C = \beta I_E = 49 \times 0.24 = 11.76mA$

COMET

$I_c =$

9) A transistor has the following ratings:- $I_{C(max)} = 500mA$, $\beta_{max} = 300$. Determine the maximum allowable value for I_B for the device.

Ans) $I_c = 500mA$, $\beta = 300$.

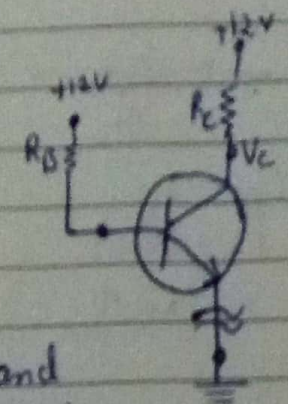
$\rightarrow \beta = \frac{I_c}{I_B}$

$\rightarrow I_B = \beta \times I_B$

$= 50 \times 10^{-3} \times 300$

$\rightarrow \underline{I_B = 15mA}$

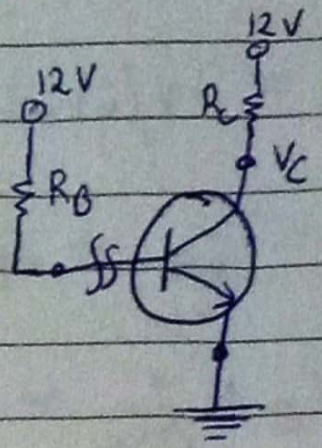
10) Figure following shows the open circuit failures in a transistor. What will be the circuit behaviour in each case.



Ans) a) This figure shows an open emitter failure in a transistor. Since the collector diode is not forward biased, it is off and there can be neither collector current nor base current.

Therefore, there will be no voltage drop across the resistor and the voltage at the base and at the collector leads to 12V.

b) This figure shows an open base failure in a transistor. Since the base is open, there can be no base current so that the transistor is in cut-off. Thus all the transistor current are OA.
In case the base and collector voltage both will be 12V.



c) This figure shows an open collector failure in a transistor. In this case, the emitter diode is still ON, so we expect to see 0.7V at the base. However, we will see 12V at the collector because is no collector current.