Oza Dheirya M (B108-U20CS108)

DELD Tutorial-3

Q-1 In a common base connection, $I_E = 1\,mA$, $I_C = 0.95\,mA$, $I_B = (?)$

→ In common base connection, $I_E = I_B + I_C$

$\therefore I_B = I_E - I_C$
$= 1\,mA - 0.95\,mA$
$= \underline{0.05\,mA}$

Q-2 In a common base connection, $\alpha = 0.9$, $I_E = 1\,mA$, determine I_B:

— In a common base connection $\alpha = 0.9$, $I_E = 1\,mA$

Now $\alpha = \dfrac{I_C}{I_E}$

$\therefore I_c = \alpha I_C$
$= 0.9 \times 1 = 0.9\,mA$

Now, $I_E = I_B + I_c$
$\therefore I_B = I_E - I_c$
$= 1 - 0.9$
$= \underline{0.1\,mA}$

Q-3 In a common base connection, $I_C = 0.95\,mA$, $I_B = 0.05\,mA$, $\alpha = (?)$

→ $I_E = I_B + I_C = 0.05 + 0.95 = 1\,mA$

$\therefore \alpha = \dfrac{I_C}{I_E} = \dfrac{0.95}{1} = \underline{0.95}$

U20S108

Page No.: 2

Date: 17/08/21

Q. (4) In a CB connection, $I_E = 1mA$, $I_{CBO} = 50\mu A$, $\alpha = 0.92$, Find total collector current.

→ Here $I_E = 1mA$, $\alpha = 0.92$, $I_{CBO} = 50\mu A$

→ Total collector current $I_C = \alpha I_E + I_{CBO}$

$= (0.92 \times 1 + 50 \times 10^{-3})\ mA$

$= \underline{0.97\ mA}$

Q. (5) Find β if (i) $\alpha = 0.9$ (ii) $\alpha = 0.98$ (iii) $\alpha = 0.99$

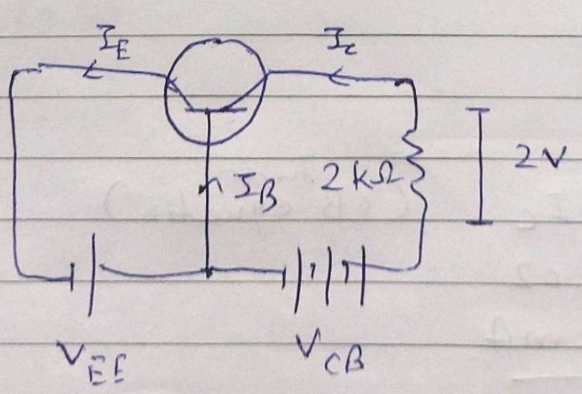
$\beta = \frac{\alpha}{1-\alpha}$

(i) $\alpha = 0.9 \rightarrow \beta = \frac{0.9}{1-0.9} = \frac{0.9}{0.1} = \underline{9}$

(ii) $\alpha = 0.98 \rightarrow \beta = \frac{0.98}{1-0.98} = \frac{0.98}{0.02} = \underline{49}$

(iii) $\alpha = 0.99 \rightarrow \beta = \frac{0.99}{1-0.99} = \frac{0.99}{0.01} = \underline{99}$

Q. (6) In a CB junction, $\alpha = 0.95$, Voltage drop across $2k\Omega$ resistance which is connected in the collector is 2V. Find I_B.



→ $V_{RC} = 2V$ (across $2k\Omega$)

∴ $I_C = \dfrac{2}{2k\Omega} = 1\ mA$

— $\alpha = \dfrac{I_C}{I_E}$

∴ $I_E = \dfrac{I_C}{\alpha}$

$= \dfrac{1}{0.95} \simeq 1.05\ mA$

— Now $I_E = I_B + I_C$

∴ $I_B = I_E - I_C = 1.05 - 1.$

$= 0.05\ mA$

Q. 7 Calculate I_E, $\beta = 50$, $I_B = 20\ \mu A$.

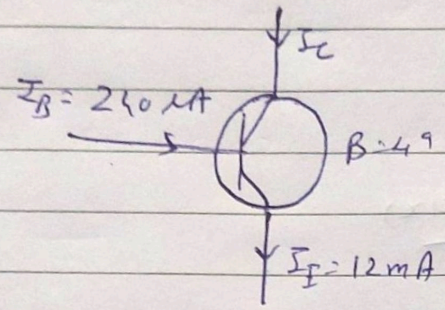
— $\beta = \dfrac{I_C}{I_B}$

$I_C = \beta I_B$
$= 50 \times 0.02$
$= 1 mA$

~~Us~~ $I_E = I_B + I_C$ (CB junction equation)
$= 1 + 0.02$
$= 1.02\ mA$

U20CS108

Q-8 Find the α rating of the transistor shown in fig. Hence find I_C both using α, β.



$\rightarrow$ $\beta = \dfrac{\alpha}{1-\alpha}$

$\therefore (1-\alpha)\beta = \alpha$

$\therefore \beta - \alpha\beta = \alpha$

$\therefore \beta = \alpha(1+\beta)$

$\therefore \alpha = \dfrac{\beta}{1+\beta}$

$\therefore \alpha = \dfrac{49}{1+49}$

$= \underline{0.98}$

Now, $\alpha = \dfrac{I_C}{I_E}$, $\beta = \dfrac{I_C}{I_B}$

$\therefore I_C = \alpha I_E = 0.98(12) = \underline{11.76\ mA}$

$\therefore I_C = \beta I_B = 240(\mu A)(49) = \underline{11.76\ mA}$

Q. 9 A transistor has the following ratings

$I_C(max) = 500$ mA
$\beta\ (max) = 300$
$I_B(max) = (?)$

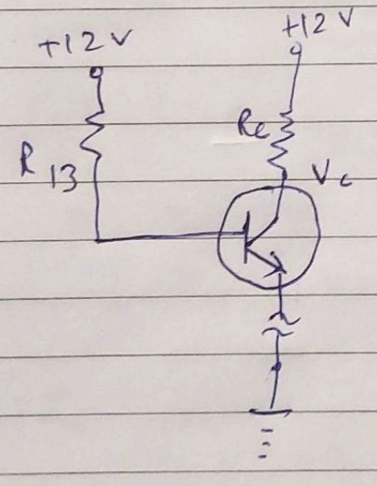
→ $I_{B(max)} = \dfrac{I_{C(max)}}{\beta}$

∴ $I_{B(max)} = \dfrac{500}{300}$ mA

$= \underline{1.67 \text{ mA}}$

Q 10 Fig shows open circuit failures. Explain behaviour.

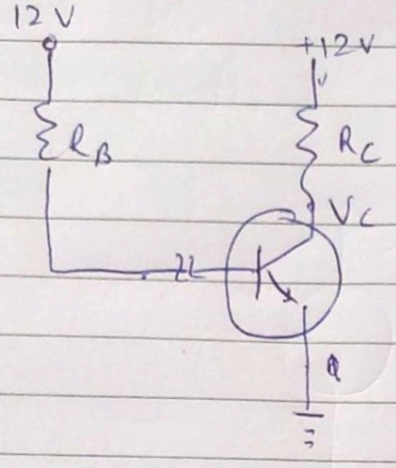
(i)



→ This circuit is basically open emmitter failure here Collector diode is not forward biased, it is off and there can be neither collector current nor base current. Therefore No Voltage drop across R and V_B and V_c will be 12 V

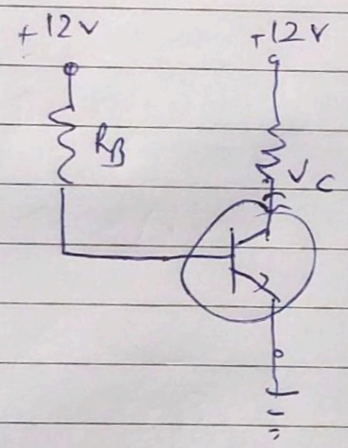
U20CS108

(ii)



→ This figure is basically open base failure in a transistor. Here No I_B because Base is open and therefore transistor is in cut-off and all ~~4~~ currents are 0 A, V_B and $V_C = 12$ V ~~is~~ Here.

(iii)



→ This figure shows open collectore failure in a transistor. Here emitter diode is still ON, so we expect to see 0.7 V at the base, we will see $V_B = 12$ V becau of No ~~...~~ I_B.