Numerical based on BJT

Q1) If $\alpha = 0.998$, $I_E = 10mA$, Calculate I_B & I_C.

Soln We know $\alpha = \frac{I_C}{I_E} \Rightarrow 0.998 = \frac{I_C}{10mA}$

$$\boxed{I_C = 9.98mA}$$

$\Rightarrow I_E = I_B + I_C \Rightarrow I_B = I_E - I_C$

$= 10 - 9.98$

$$\boxed{I_B = 0.02mA}$$ Ans

Q2) For a BJT, $\alpha = 0.992$, $I_C = 10.2mA$. Calculate β, I_B, I_E.

Soln We know $\beta = \frac{\alpha}{1-\alpha} = \frac{0.992}{1-0.992} \Rightarrow \boxed{\beta = 124}$

$\Rightarrow \beta = \frac{I_C}{I_B} \Rightarrow I_B = \frac{I_C}{\beta} = \frac{10.2mA}{124} \Rightarrow \boxed{I_B = 0.0822mA}$

or $\boxed{I_B = 82.2\mu A}$

$\Rightarrow \boxed{I_E = I_B + I_C} \Rightarrow I_E = 0.0822 + 10.2$

$$\boxed{I_E = 10.28mA}$$ Ans

Q3 In a BJT, $I_C = 18.5\,mA$, $I_E = 19.8\,mA$, $I_{CO} = 21\,\mu A$.
Calculate - α, β & I_{CEO}

Soln: $\because I_E = I_B + I_C$

$$I_B = I_E - I_C = 19.8\,mA - 18.5\,mA$$

$$\boxed{I_B = 1.3\,mA}$$

$$\Rightarrow \beta = \frac{I_C}{I_B} = \frac{18.5\,mA}{1.3\,mA} \Rightarrow \boxed{\beta = 14.2}$$

$$\Rightarrow \boxed{\alpha = \frac{\beta}{1+\beta}} \Rightarrow \alpha = \frac{14.2}{1+14.2} \Rightarrow \boxed{\alpha = 0.93}$$

$\Rightarrow$ We know $I_{CEO} = (1+\beta) I_{CBO}$

$$= (1+14.2) \times 21\,\mu A$$

$$\boxed{I_{CEO} = 319.2\,\mu A}$$ Ans

Q4) The Value of α changes from 0.980 to 0.989. Calculate % change in β.

Soln Given $\alpha_1 = 0.980$
$\alpha_2 = 0.989$

$$\beta_1 = \frac{\alpha_1}{1-\alpha_2} = \frac{0.980}{1-0.980}$$

$$\beta_2 = \frac{\alpha_2}{1-\alpha_2} = \frac{0.989}{1-0.989}$$

$$\boxed{\%\text{ change in } \beta = \frac{\beta_2 - \beta_1}{\beta_1} \times 100}$$

Ans