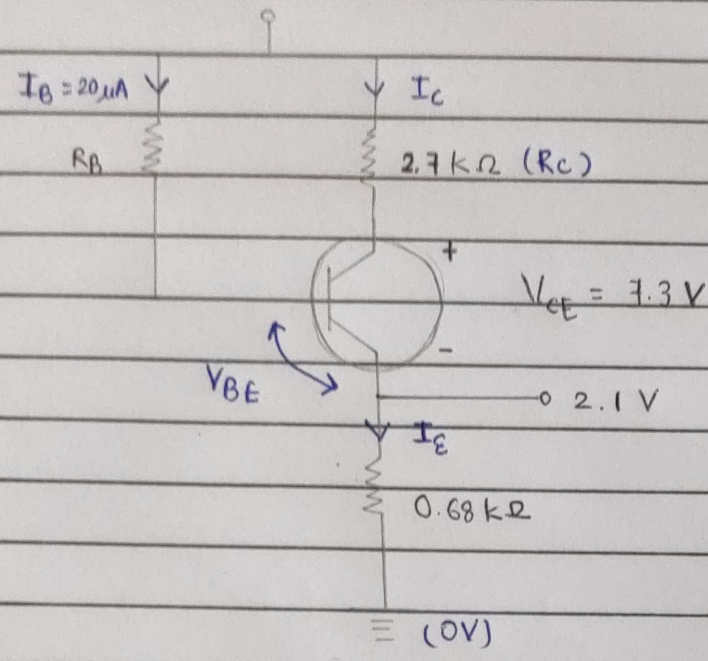
U19CS012

1)



Step ①

$$I_E = \frac{(2.1 - 0)\ V}{0.68 \times 10^3\ \Omega}$$

$$= 3.088 \times 10^{-3}\ A$$

$$I_E = \boxed{3.088\ mA} \quad — ①$$

Step ②

$$\therefore I_E = I_B + I_C$$

$$3.088\ mA = 0.020\ mA + I_C$$

$$\underline{I_C = 3.068\ mA} \quad — ②$$

Step 3 : Applying KVL,

1) $V_{cc} - (I_C R_C) - V_{CE} = 2.1$

$V_{cc} = (2.1) + (7.3) + ((3.068\ mA) \times (2.7\ k\Omega))$

$V_{cc} = 17.6836\ V \approx \underline{17.684\ V}$ — Ans (1)

2) $V_{cc} - (I_B R_B) - V_{BE} = 2.1\ V$

$17.68 - (20 \times 10^{-6} \times R_B) - 0.7 = 2.1\ V$

$20 \times 10^{-6} \times R_B = 17.68 - 0.7 + 2.1$

$R_B = \frac{14.88}{20} \times 10^6$

$\underline{R_B = 744\ k\Omega}$ — Ans (2)

3) $\beta = \frac{I_B}{I_C} = \frac{3.068 \times 10^{-3}\ A}{20 \times 10^{-6}\ A} = \underline{153.4}$ — Ans (3)

Extra for multisim verification

$V_B = V_{cc} - I_B R_B = 17.68 - (20 \times 10^{-6} \times 744 \times 10^3) = 17.68 - 14.88 = 2.8\ V$

$V_C = V_{cc} - I_C R_C = 17.68 - (3.068\ mA \times 2.7\ k\Omega) = 17.68 - 8.28 = 9.4\ V$