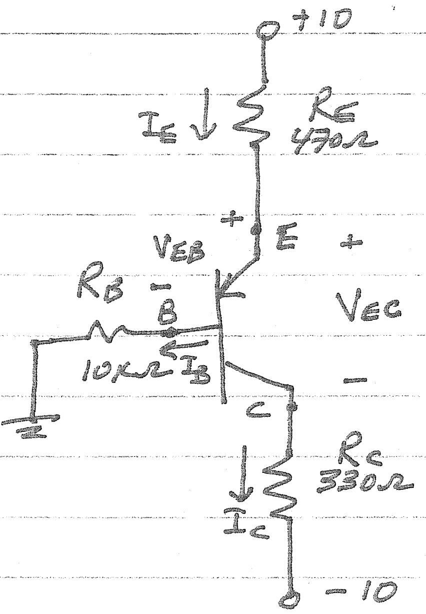
25.



Solution 1

- Since $V_E > V_B$ (EB junction is forward biased), ∴ BJT can be either in linear mode or in saturation mode

- Assume BJT in linear (Active) mode

KVL for input loop

$$10 - I_E R_E - V_{EB} - I_B R_B = 0$$

$$I_E = (\beta+1) I_B$$

$$I_E = \frac{10 - V_{EB}}{R_E + \frac{R_B}{\beta+1}} = \frac{10-0.7}{470 + \frac{10K\Omega}{101}} = 16.344 \text{ mA}$$

$$I_C = \alpha I_E = \frac{\beta}{\beta+1} I_E = 16.182 \text{ mA}$$

KVL for Output loop

$$10 - I_E R_E - V_{EC} - I_C R_C + 10 = 0$$

$V_{EC} = 20 - I_E R_E - I_C R_C = 6.978\ V$ which is higher than $V_{EC(sat)} \Longrightarrow$

$\therefore$ BJT is in linear mode

Solution 2

- If we assume BJT in Saturation

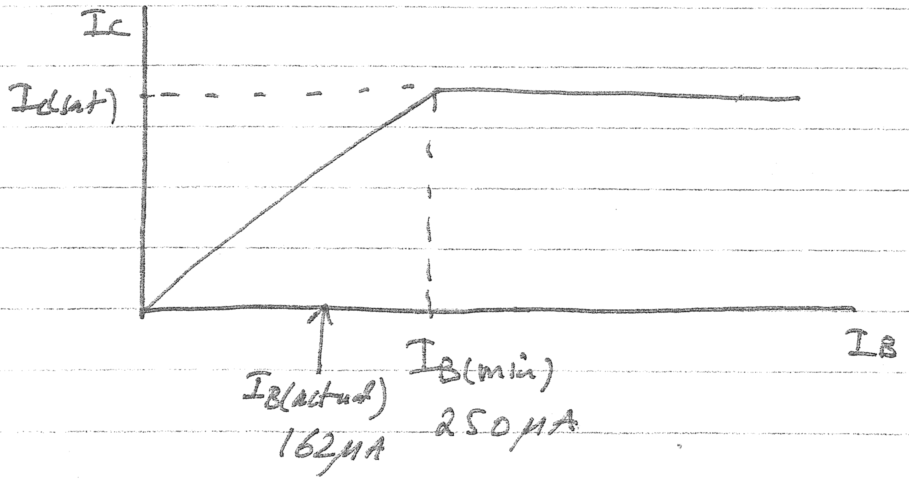
$$I_{C(sat)} \approx \frac{V_{EE} + V_{CC}}{R_C + R_E} = \frac{20}{330 + 470} = 25\ mA$$

$$I_{B(min)} = \frac{25\ mA}{100} = 250\ \mu A$$

Now actual value of I_B ?

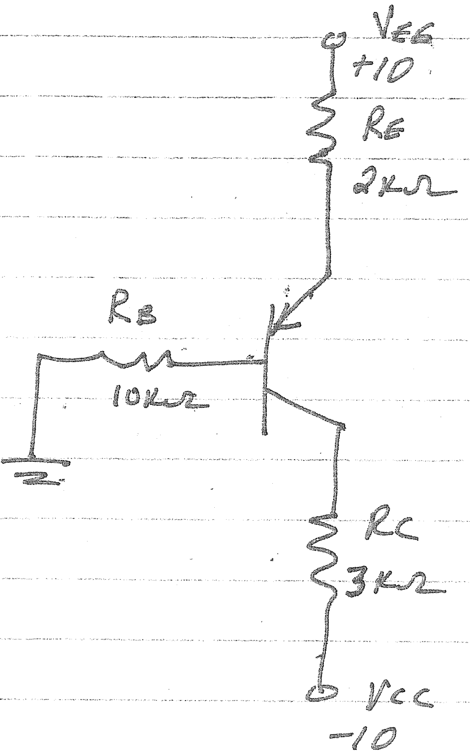
$$I_E = \frac{10 - 0.7}{470 + \frac{10k\Omega}{101}} = 16.344\ mA$$

$$I_{B(actual)} = \frac{I_E}{\beta + 1} = 162\ \mu A$$



$\therefore$ Since $I_{B(actual)} < I_{B(min)}$, BJT is not in Saturation

26.



Solution : BJT is either in Saturation or linear Mode since EB junction is forward biased

- Assume it is in linear Mode

$$I_E = \frac{10 - 0.7}{2k\Omega + \frac{10k\Omega}{101}} = 4.43 \text{ mA}$$

$$I_C = \frac{\beta}{\beta+1} I_E = \alpha I_E = 4.39 \text{ mA}$$

$$I_B = \frac{I_C}{\beta} = 43.9 \text{ μA}$$

- $V_{EC} = 20 - I_E R_E - I_C R_C$

$= -2.02 \text{ V} < V_{EC(sat)} \Longrightarrow$ BJT is in saturation Mode &

$V_{EC} = V_{EC(sat)} \cong 0.2\text{V}$

$$I_C = I_{C(sat)} = \frac{V_{EE} + V_{CC} - V_{EC(sat)}}{R_C + \frac{1}{\alpha} R_E} = \frac{20 - 0.2}{3k\Omega + 2k\Omega \times 1.01} =$$

$$= 3.944 \ mA$$