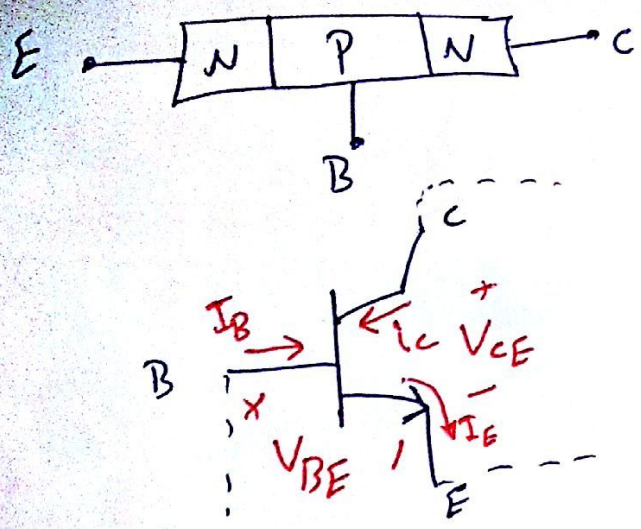
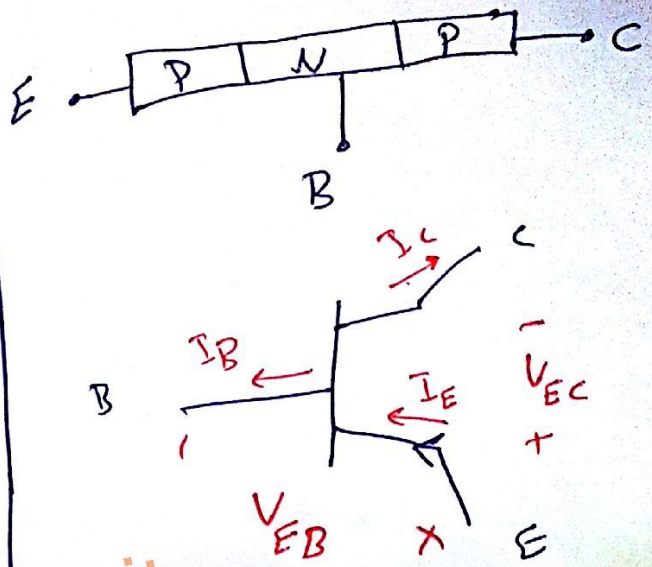
Amplifier
first material

NPN



$V_{BE} = 0,7\,V$

PNP



$I_C = \beta I_B$

$I_C = \alpha I_E$; $\alpha = \frac{\beta}{1+\beta}$

Thermal Voltage (V_T)

; $V_T \approx 0,026$

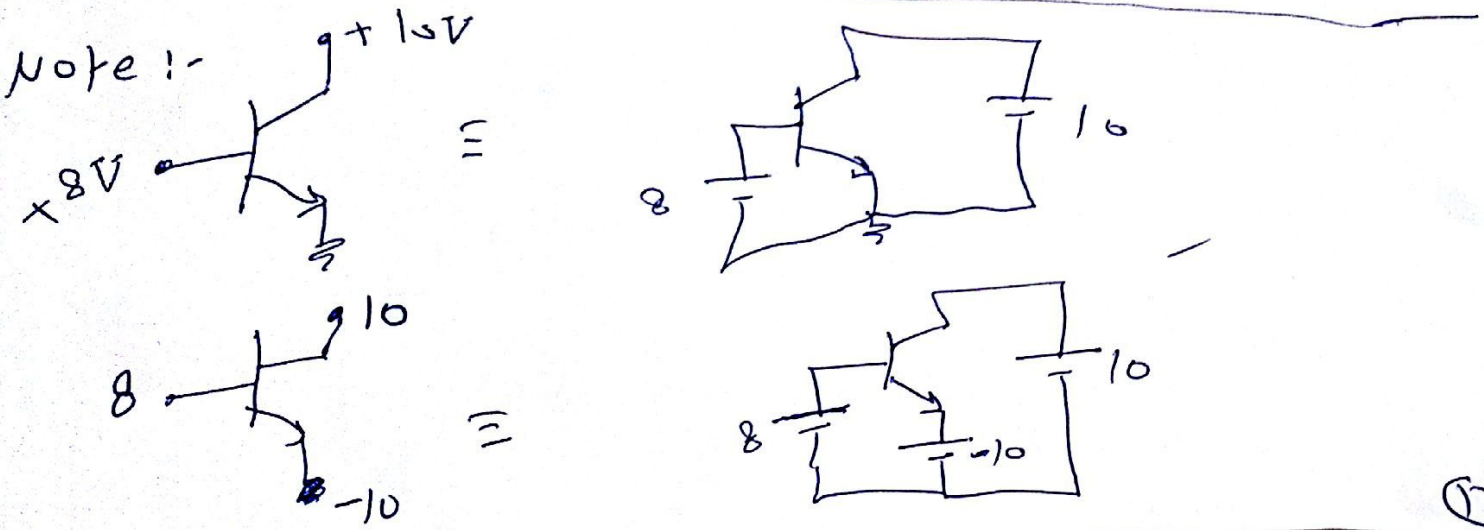
$I_E = I_C + I_B = \beta I_B + I_B = I_B(\beta + 1)$

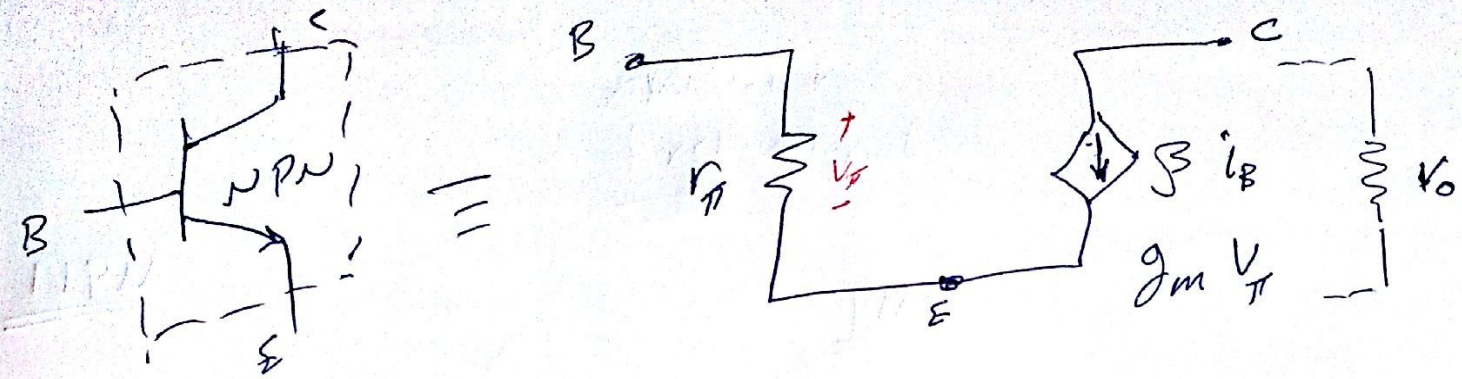
* Amplifier work in Forward active mode (BJT)

⇒ BE ⇒ forward - biased

BC ⇒ Reverse - biased

Note :-





$$r_\pi = \frac{V_T}{I_{BQ}} \Omega \quad , \quad g_m = \frac{I_{CQ}}{V_T} \mho$$

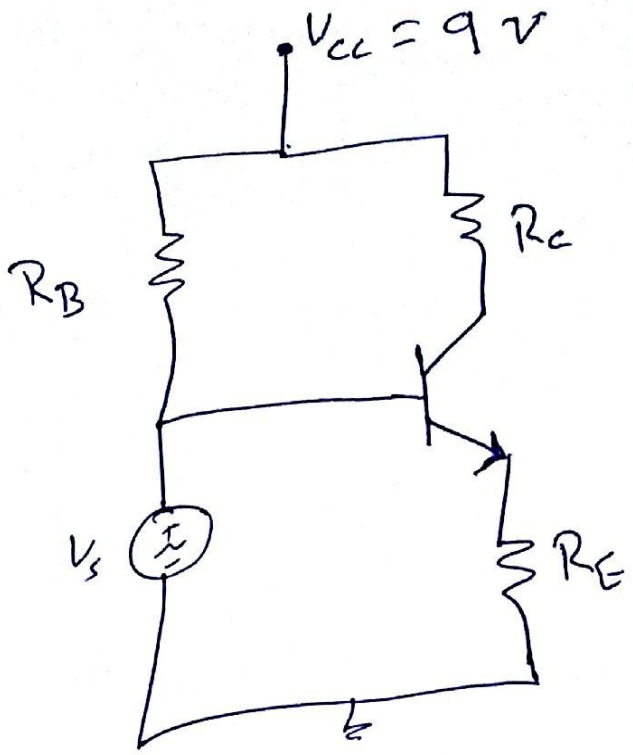
$$r_o = \frac{V_A \Leftarrow \text{given}}{I_{CQ}} \Omega$$

* The Steps to solve AMP. CKT

① solve the DC Analysis. and find $I_E, I_B, I_C, r_\pi, g_m$ and r_o

② Draw the AC CKT and find the (A_V) or any Think you want. ; $A_V = \frac{V_o}{V_{in}} \equiv \frac{AC}{AC}$

Q_1 :-



→ What the type of this CKT ??

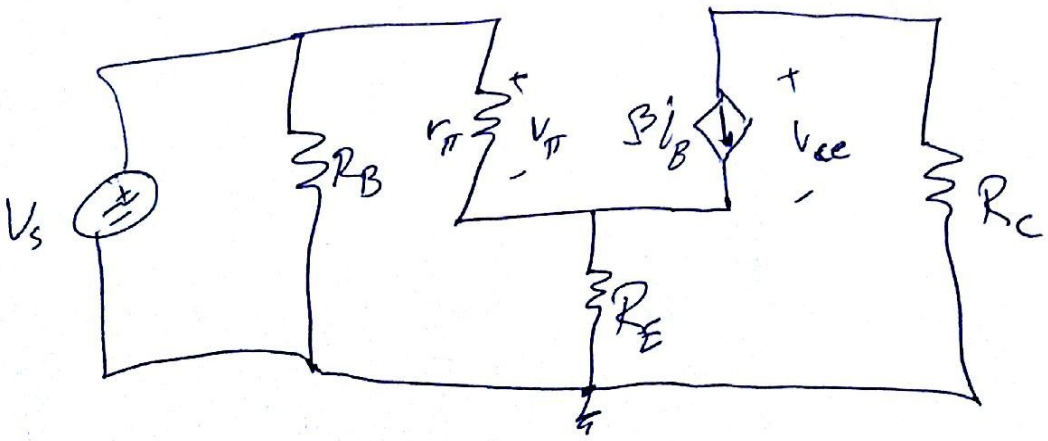
⇒ we need to specify the output

→ Draw the Ac CKT :-

→ find the exp. of V_{ce} ??

→ find the exp. of V_s

→ find the exp. of R_{in}



→ $V_{ce} = ?$

$$R_c i_c + V_{ce} + \frac{(1+\beta)}{\beta} i_c R_E = 0$$

(2) $$\Rightarrow V_{ce} = -\left(R_c + \frac{(1+\beta)}{\beta} R_E\right) i_c$$

(3)

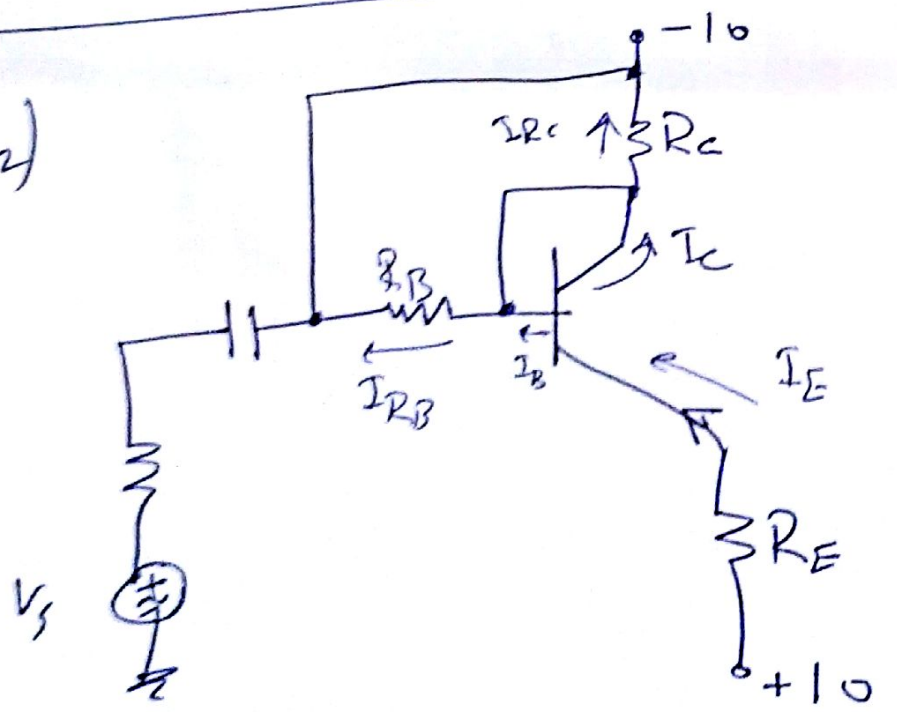
$$-V_s + i_b r_\pi + i_e R_E = 0$$

$$\Rightarrow V_s = i_b r_\pi + i_e R_E$$

(4)

$$R_{in} = R_B \,//\, (r_\pi + (1+\beta) R_E)$$

Q2)



Anas Kat3
Power Unit

if $I_E = 1mA$, $\beta = 100$ find I_{Rc}

$$I_{R_B} = I_B + (I_c - I_{R_C})$$

$$\Rightarrow -10 + I_E R_E + 0.7 + R_B I_{R_B} - 10 = 0$$

$$\Rightarrow I_{R_B} = \frac{19.3 - R_E}{R_B}$$

$$\Rightarrow I_{R_C} = I_C + (I_B - I_{R_B})$$

$$= \frac{R_B + \beta R_E - 19.3}{R_B} \quad \#\#$$

Anas Kat 3
Power Unit

② if R_E = zero find the DC slope ??

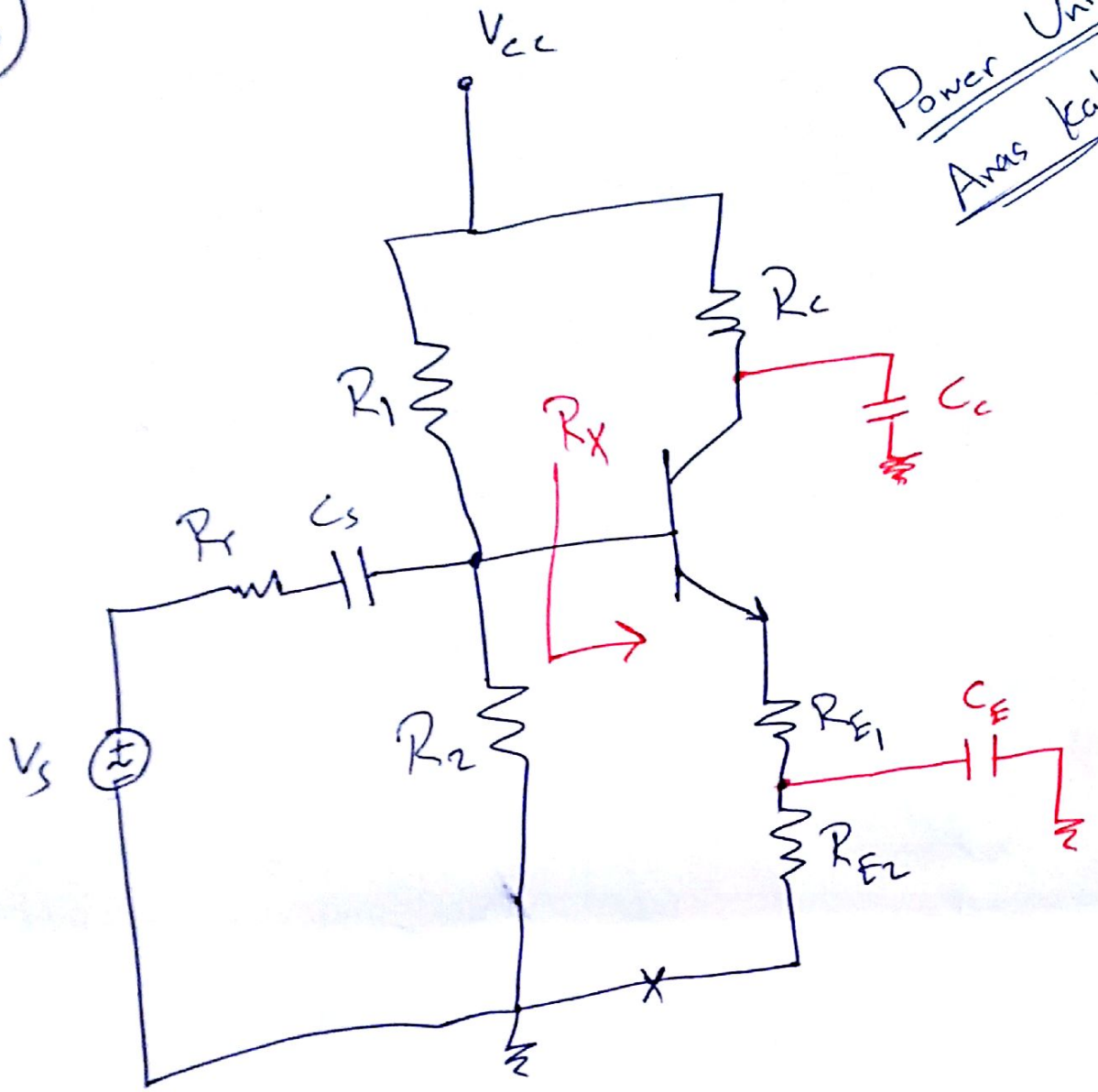
~~DC slope from one loop~~

$$\Rightarrow \begin{cases} -10 + V_{EC} + I_{R_C} R_C - 10 = 0 \\ -10 + 0.7 + I_{R_B} R_B - 10 = 0 \end{cases}$$

$$\text{slope} = \frac{-\beta}{(1+\beta) R_C}$$

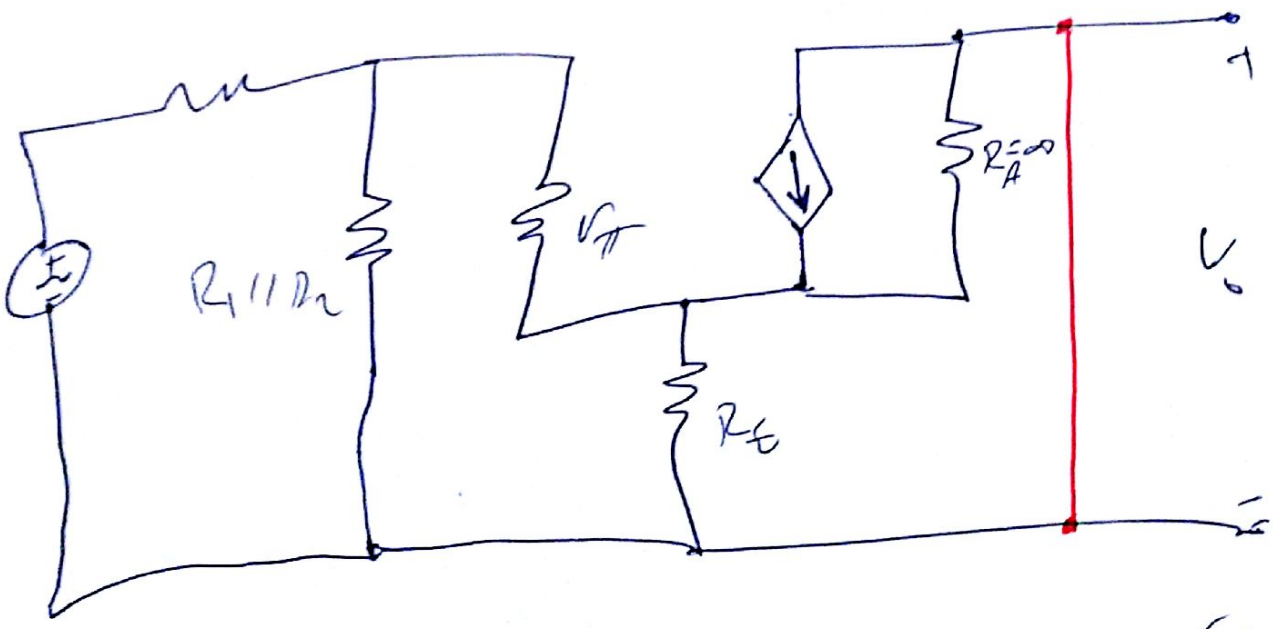
Q3)

Power Unit
Anas kat3



find R_o , R_x , A_V ??

Soln. :-



$R_{out} = Zero$

$A_V = \frac{V_o}{V_{in}} = \frac{Zero}{V_{in}} = Zero$

Power Unit
Anas Kat3

$R_x = r_\pi + (1+\beta) R_{E_1}$