বিদ্যুৎ ইলেকট্রনিক্স পরীক্ষা

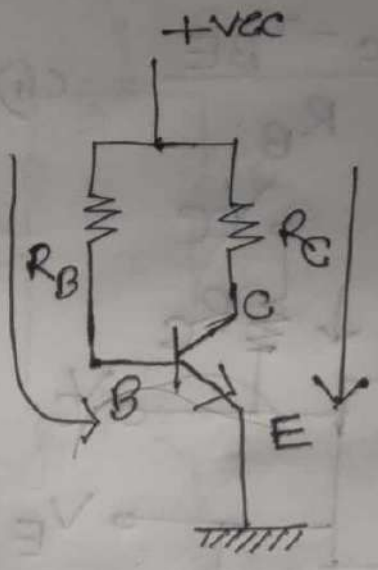
Date: 13.06.2024 EEE 1253

⊛ BJT Biasing

1) Technique:

Fixed Bias Configuration :-

DC Analysis মানে → Biasing related.



মানে current and node voltage বের করতে হবে।

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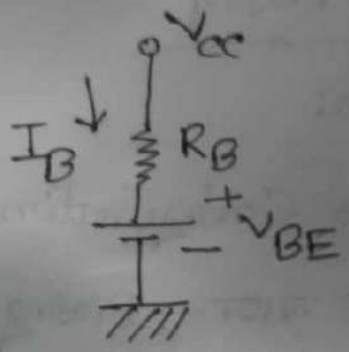
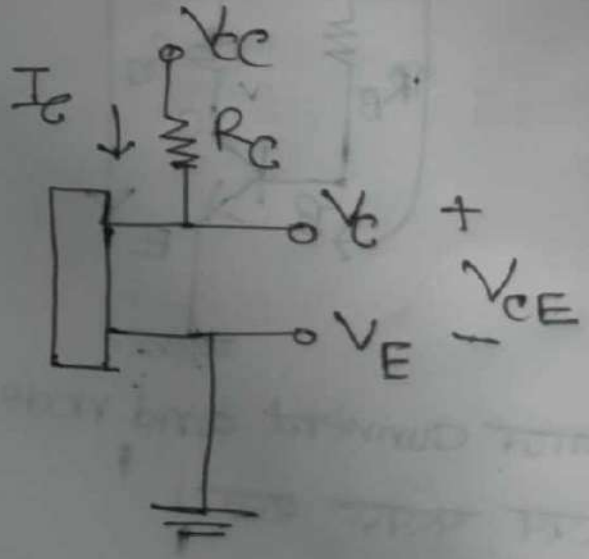
1)

$$V_{BE} = 0.7\,V = V_B - V_E$$



2)

$$\therefore I_B = \frac{V_{cc} - V_{BE}}{R_B} \quad \text{---(ii)}$$



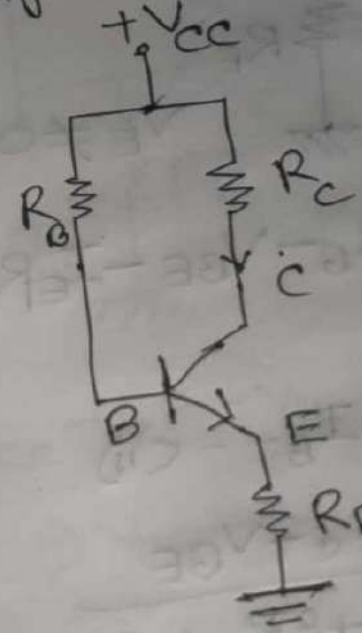
3)

$$I_c = \beta I_B \quad \text{---(iii)}$$

$$+V_{CC} - I_C R_C - V_{CE} = 0$$

$$\Rightarrow V_{CE} = V_{CC} - I_C R_C \quad \text{--- (iv)}$$

(ii) Emetter stabylized Bias Configuration:



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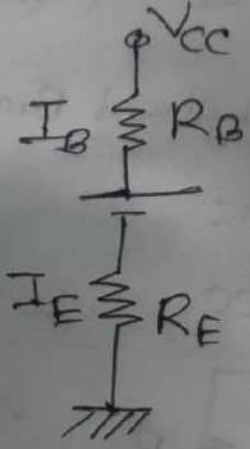
(1)

$V_{BE} = 0.7 = V_B - V_C$

1)



$V_E \neq 0$

2)

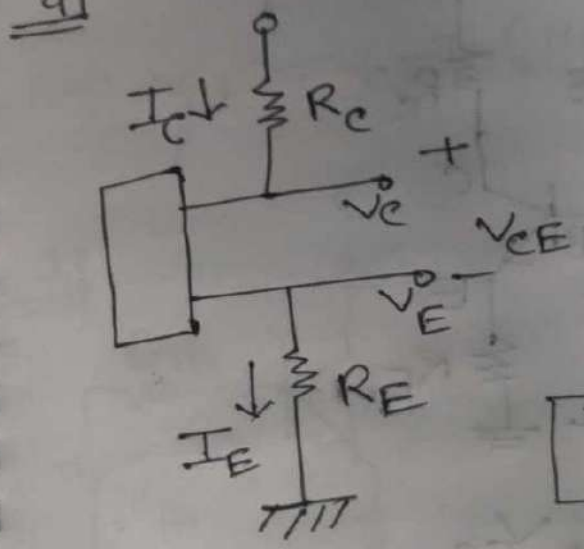
$V_{CC} - I_B R_B - V_{BE} - I_E R_E = 0$

3)

(i) $I_E = (1+\beta) I_B$ --- (ii)

$\therefore I_B = \dfrac{V_{CC} - V_{BE}}{(1+\beta)R_E + R_B}$

$I_C = \beta I_B$



$I_E \approx I_C$

$+V_{CC} - I_C R_C - V_{CE} - I_E R_E = 0$

$\Rightarrow V_{CE} = V_{CC} - I_C(R_C + R_E)$

...(iv)

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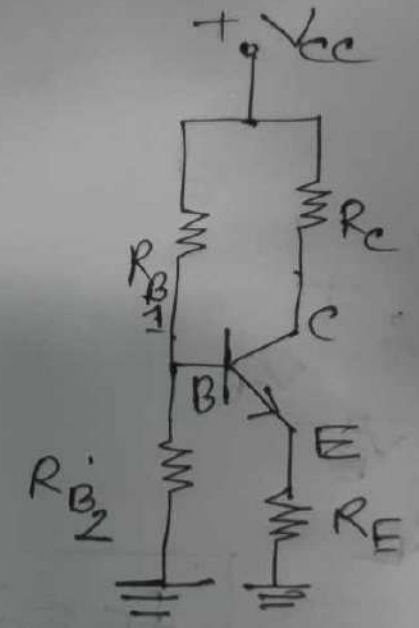
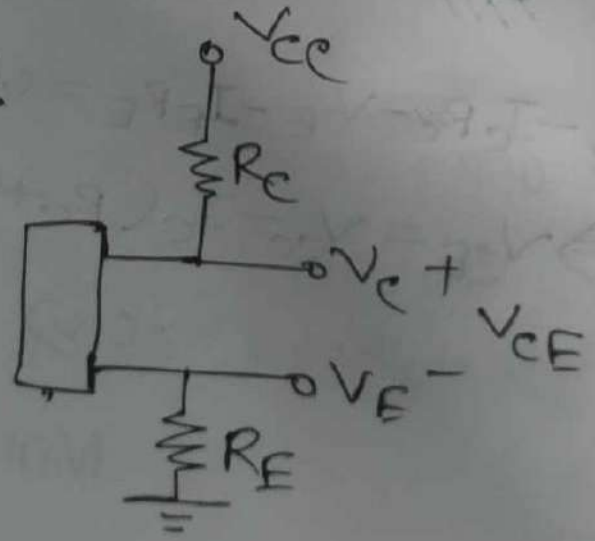
(iii) Voltage devider Bias Configuration



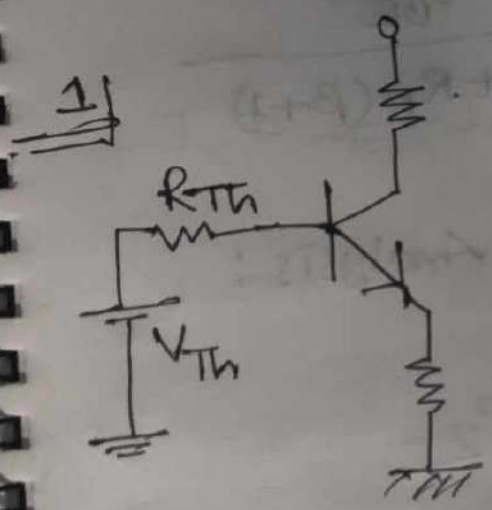
(9)



$I_E \cong I_c$

$V_{CC} - I_c R_C - V_{CE} - I_E R_E = 0$

$\Rightarrow V_{CE} = V_C - I_c(R_C + R_E)$



$$R_{Th} = \frac{R_B \times R_{B_2}}{R_B + R_{B_2}} \quad \text{--- (1)}$$

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$$V_{Th} = \frac{R_{B_2} \cdot V_{cc}}{R_{B_1} + R_{B_2}} \quad \text{--(ii)}$$

$$V_{Th} - I_B R_{Th} - V_{BE} - R_E I_B (\beta + 1) = 0$$

$$\Rightarrow I_B = \frac{V_{Th} - V_{BE}}{R_{Th} + R_E(\beta + 1)}$$

Approximate Analysis :

$$\beta R_E > 10 \cdot R_{B_2}$$

$$V_B = \frac{R_{B_2} \cdot V_{cc}}{R_{B_1} + R_{B_2}}$$

$$V_{BE} = V_B - V_E = 0.7 \text{ V}$$

$$V_E = V_B - V_{BE}$$

$$I_E = \frac{V_E}{R_E}$$

$$I_B = \frac{V_{cc} - V_B}{R_B}$$

$$\therefore I_C = I_E - I_B$$

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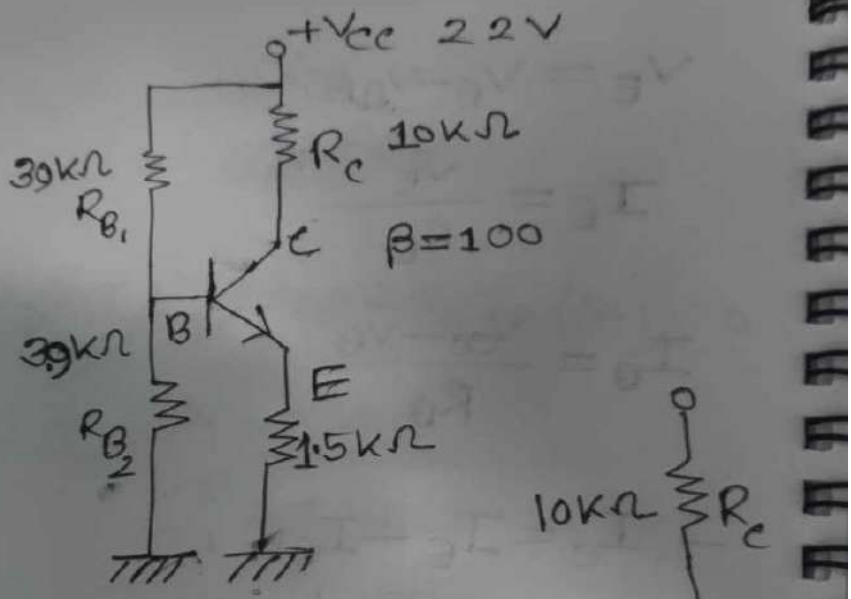

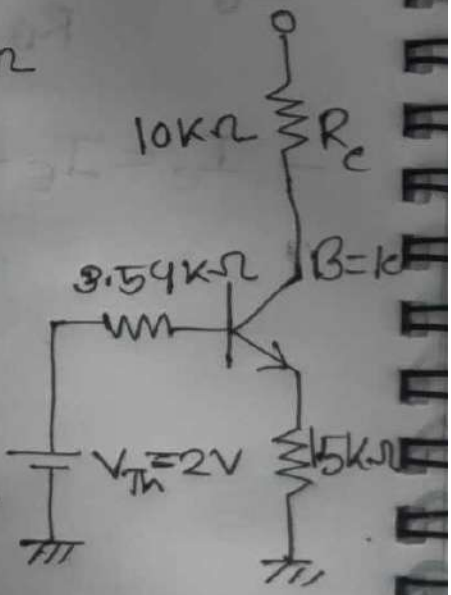

$R_{Th} = 3.54\ k\Omega$

$$V_{Th} = \frac{R_{B_2} \cdot 22}{R_{B_2} + R_{B_1}}$$

$$= \frac{3.9 \times 22}{3.9 + 39}$$

$V_{Th} = 2\ V$

$$I_B = \frac{V_{TH} - V_{BE}}{R_{TH} + R_E(\beta+1)}$$

$$= \frac{2 - 0.7}{\{3.54 + 15(100+1)\} \times 1000}$$

$$\therefore I_B = 8.34 \times 10^{-6} A \quad \text{(Ans)}$$

$$I_C = \beta I_B = 8.34 \times 100 \times 10^{-3}$$

$$= 0.834 mA \quad \text{(Ans)}$$

$$I_E = 0.834 + 8.34 \times 10^{-3} = 0.842 A$$

$$V_{CE} = V_{CB} + V_{BE}$$

$$= (V_C - V_B) + V_{BE}$$

$$= V_{CC} - I_E \cdot R_E$$

$$=$$

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$= (V_{cc} - I_c R_c - V_B) + V_{BE}$

$= 22 - 0.834 \times 10^{-3} \times 10^{3} \times 2) + 0.7$

$V_{CE} = 22 - 0.834 \times 10^{-3} (11.5 \times 10^{3})$

$= 12.909 V$ (Ans)

$V_B = V_{Th} = 2 V$

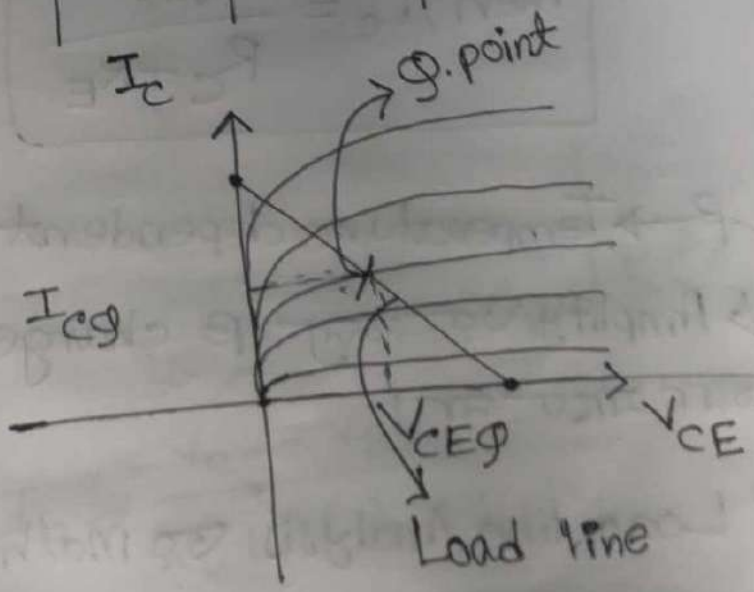
$V_{B.E} = 0.7 V$

$\therefore V_E = 1.3 V$

$V_{CE} = V_{cc} - I_c (R_c + R_E)$

when, $V_{CE} = 0$, $I_c = \frac{V_{cc}}{(R_c + R_E)}$

β	I_C	V_{CE}
100	0.84	12.3V
50	0.81	12.6



Q point stable হলে Amplify হবে ভালো MO

করার জন্য।

when, $I_C = 0$,

$$V_{CE} = V_{CC}$$

when, $V_{CE} = 0$

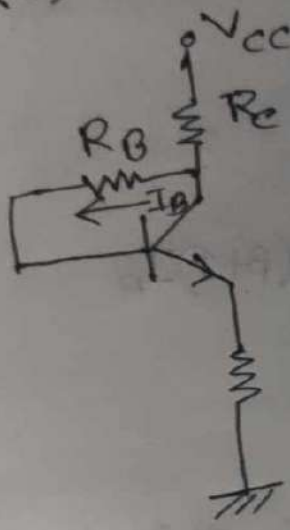
$$\text{then, } I_C = \frac{V_{CC}}{R_C + R_E}$$

$\beta \rightarrow$ Temperature dependent

Amplify এর জন্য β change করা যাবে না।

* Load line Analysis এ Math করতে হবে।

(iv) Collector Feedback Configuration



$$I_B = \frac{V_{CC} - V_{BE}}{R_B + \beta R_C + (\beta+1) R_E} \quad \Big| \; \beta >>$$

$$I_B = \frac{V_{CC} - V_{BE}}{R_B + \beta (R_C + R_E)}$$

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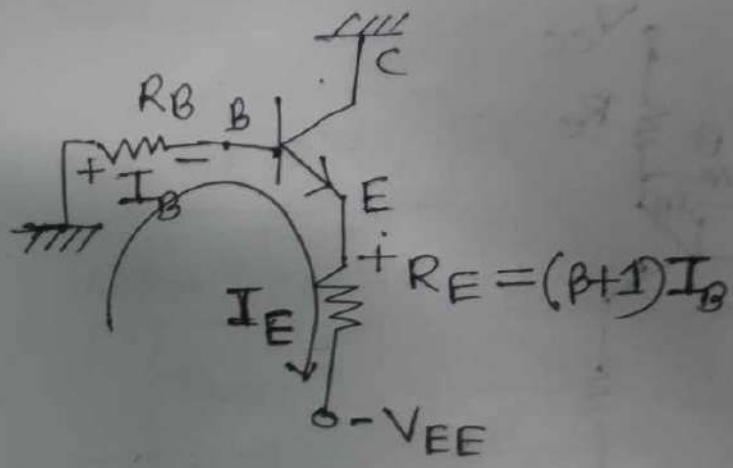
(v) Emitter Follower Configuration



$$-V_{EE} + I_B R_B + V_{BE} + I_E \cdot R_E = 0$$

$$\Rightarrow I_B = \frac{V_{EE} - V_{BE}}{R_B + R_E(\beta+1)}$$

(Ans)