AEC Assignment 1

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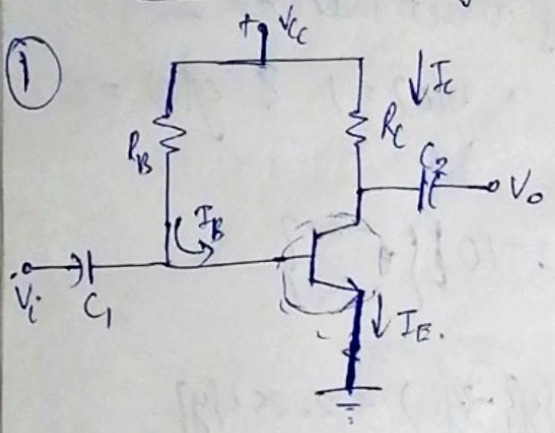
① Fixed Bias.



$V_{CC} = 16\ V.$ $\quad V_{BE} = 0.7\ V.$

$R_B = 540k\Omega$

$R_C = 3.3k\Omega.$ $\quad \beta = 100.$

$V_{CC} - I_B R_B - V_{BE} = 0.$

$\Rightarrow I_B = \dfrac{16 - 0.7}{540k\Omega} = 28.333\mu A.$

$I_C = \beta I_B = 2.83\ mA$

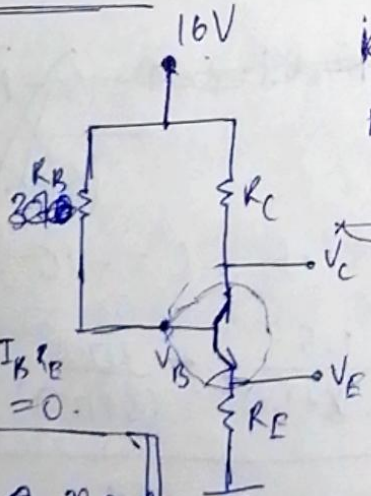
$V_{CC} - I_C R_C - V_{CE} = 0.$

$\Rightarrow \boxed{V_{CE} = 6.661\ V.}$

$\boxed{I_E = I_C + I_B = 2.858\ mA.}$

$V_C = 6.661\ V \quad | \quad V_E = 0\ V \quad | \quad V_B = V_{BE} = 0.7\ V$

② Emitter Biased.



$R_B = 480k\Omega.$

$R_C = 8k\Omega.$

$\beta = 50$

$R_E = 5k\Omega.$

$V_{BE} = 0.7\ V$

$16 - I_B R_B - V_{BE} - I_E R_E = 0.$

$\Rightarrow 16 - I_B R_B - 0.7 - (\beta+1) I_B R_E = 0.$

$\Rightarrow \boxed{I_B = \dfrac{15.3}{480 + 255} = 20.8\mu A}$

$I_C = 1.04\ mA,$

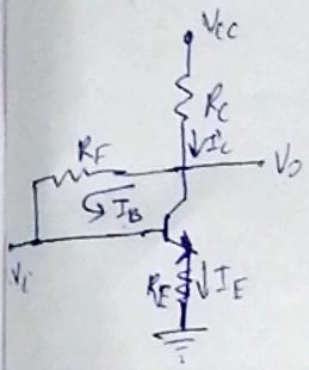
$V_C = 16 - I_C R_C = 7.68\ V.$

$I_E = 1.0608\ mA.$

$V_E = I_E R_E = 5.304\ V.$

$V_B = V_{BE} + V_E = 6.004\ V$

(3) Collector Feedback / Voltage Feedback :-



$R_F = 470\,k\Omega$ | $R_C = 9.1\,k\Omega$

$V_{CC} = 22V$ | $R_E = 9.1\,k\Omega$. $\quad \beta = 90$.

$I_C' = I_E$. | $V_{CC} - I_E R_C - I_F I_B - R_E I_E + V_{BE} = 0$

$\Rightarrow 22 - (\beta+1) I_B R_C - R_F I_B - 0.7 = 0$.

$\Rightarrow I_B = \frac{21.3}{470 + 828.1} = 16.4\,\mu A$

$V_{CC} - I_E R_C - I_E R_E - I_B R_F - V_{BE} = 0$. $\quad I_C = I_E$

$\Rightarrow I_B = \frac{22 - 0.7}{(91 \times 9.1 \times 2) + 470} = 10.02\,\mu A$.

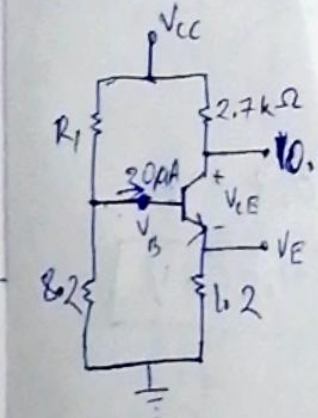
$\therefore I_C = I_E = 0.911\,mA$

$V_E = 8.2901\,V$

$V_C = 12 - R_C \times 9.1 = 3.7099$

$V_B = 8.9901V$.

Voltage-Divider biased :- (4)



$I_B = 20\mu A$, $\beta = 100$.

$I_C = 2\,mA$.

$I_E = 101 \times I_B$

$= 2.02\,mA$.

$V_E = 2.424\,V$ | $V_B = V_{BE} + V_E$

$= 3.124\,V$.

$V_{CC} = V_C + I_C R_C$

$= 16.054\,V$.

$V_{TH} = I_B R_{TH} + V_B$

$\Rightarrow \frac{V_{CC} \times 8.2}{R_1 + 8.2} = \frac{0.02 \times 8.2 \times R_1}{8.2 + R_1} + 3.124$

$$\Rightarrow \frac{16.054 \times 8.2}{8.2 + R_1} = 0.164 R_1 + 25.617 + 3.124 R_1$$

$$\Rightarrow 3.288 R_1 = 106.0258$$

$$\Rightarrow \boxed{R_1 = 32.246\ k\Omega}$$

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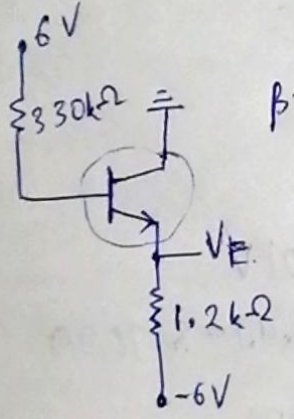
(5) Emitter follower:-



$\beta = 120$.

$V_C = 0$.

$-6V - 330 I_B - V_{BE} - 1.2 I_E + 6 = 0$

$\Rightarrow 11.3 - 330 I_B - 1452 I_B = 0$.

$\Rightarrow I_B = 0.0237\ mA = 23.7\ \mu A$

$I_E = 2.867\ mA$.

~~$V_E = -3.4404\ V$~~

$V_E = I_E R_E - 6V$

$\Rightarrow \boxed{V_E = -2.5596\ V}$

$V_B = 0.7 + V_E$

$\Rightarrow \boxed{V_B = -1.859\ V}$

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