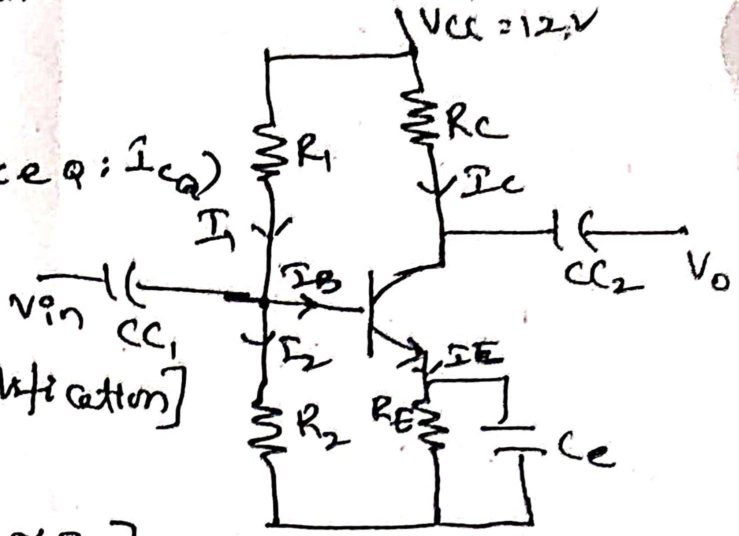
$V_{cc} = 12V$; $\beta = 100$; $I_c = 2mA$

$f_L = 100Hz$; $R_L = 10k\Omega$

mid point of Quiscent ($V_{ceQ} : I_{cQ}$)



$V_{CE} = \frac{V_{cc}}{2}$

Assume $I_c \cong I_E$ [for simplification]

$\therefore V_E = I_E R_E$

$= I_c R_E$ [$\because I_E \cong I_c$]

$\Rightarrow$ Drop across R_E must be 10% of V_{cc}.

R_E acting as feedback ; for stabilization only 10% of feed back is enough. for max o/p drop should be Less.

$V_{cc} \Rightarrow 12V$; $V_E = 10\%$ of $V_{cc} \Rightarrow 1.2V$

$$R_E = \frac{V_E}{I_c} = \frac{1.2}{2\times10^{-3}} = 600\Omega$$

$\Rightarrow$ KVL to o/p loop

$V_{cc} = I_c R_c + V_{CE} + I_E R_E$

$= I_c R_c + V_{CE} + V_E$

$$R_c = \frac{V_{cc} - V_{CE} - V_E}{I_c} = 2.4k\Omega$$

$\Rightarrow$ finding R_1 & R_2

from ckt KCL to I_n :

$I_1 = I_2 + I_B$

I_2 must be 10 times of I_B :

$I_2 = 10 I_B \Rightarrow I_1 = 10 I_B + I_B = 11 I_B$.

$I_c = \beta I_B \quad \therefore I_B = \frac{I_c}{\beta} = \frac{2mA}{100} \Rightarrow 0.02\times10^{-3}$

$\Rightarrow 0.02mA \Rightarrow 20\mu A$

$\therefore V_B = I_2 R_2 \qquad R_2 = \dfrac{V_B}{I_2}$

$V_{BE} = V_B - V_E \Rightarrow V_B = V_{BE} + V_E$

$= 0.7 + 1.2 \Rightarrow 1.9V$

$\therefore R_2 = \dfrac{1.9}{10 \times 20\mu A} \Rightarrow \dfrac{1.9}{200\mu A}$

R_1: Apply KVL to i/p loop

$V_{CC} = I_1 R_1 + I_2 R_2$

$I_1 R_1 = V_{CC} - I_2 R_2$

$R_1 = \dfrac{V_{CC} - I_2 R_2}{I_1}$

$= \dfrac{V_{CC} - V_B}{I_1}$

$= \dfrac{12 - 1.9}{11 \times 20\mu A}$

Note

$I_E = I_B + I_C$

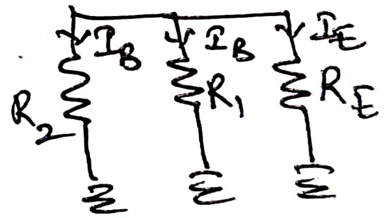
$= I_B + \beta I_B$

$= (1+\beta) I_B$

$\Rightarrow$ Design of Coupling Capacitors C_1 & C_2

$f_L = \dfrac{1}{2\pi R_{eq} C_1} \Rightarrow C_1 = \dfrac{1}{2\pi R_{eq} f_L}$

$\Rightarrow C_2 = \dfrac{1}{2\pi R_L f_L}$



$\Rightarrow$ finding bypass capacitor (C_E)

X_{ce} must be less than or equal $\dfrac{R_E}{10}$

$R_{eq} = R_1 || R_2 || R_E(1+\beta)$

$C_e = \dfrac{1}{2\pi f_L \cdot X_{ce}} \qquad \left[X_{ce} = \dfrac{R_E}{10} = \dfrac{600}{10} = 60 \right.$

$\dfrac{1}{R_{eq}} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{(1+\beta)R_E}$

$= \dfrac{R_1 R_2 R_E(1+\beta)}{R_1 R_2 + R_2 R_E(1+\beta) + R_1 R_E(1+\beta)}$

$= \dfrac{1}{2\pi f_L \cdot 60}$

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