Design of Astable Multivibrator:

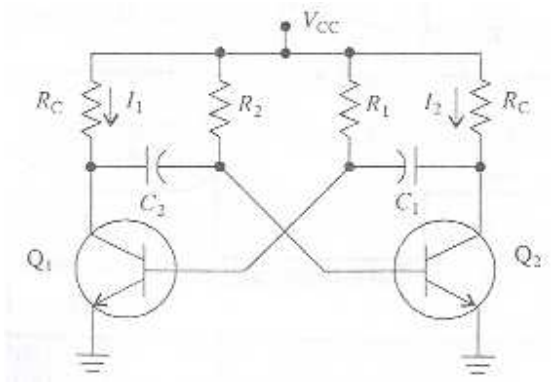
Circuit diagram is shown below.

This circuit is not symmetrical . so here

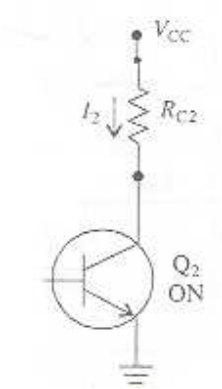
we need to consider both states of the device.

Assume that initial state of the device is

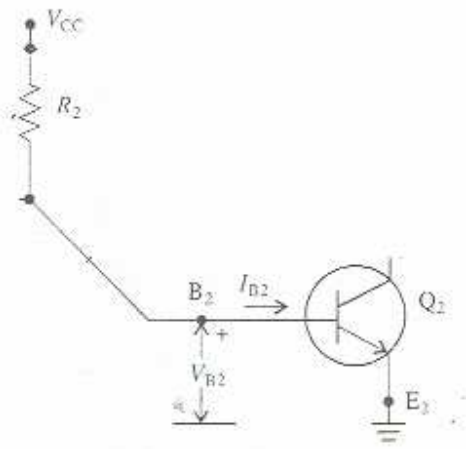
Q1 OFF & Q2 ON



Collector circuit of Q2



Base circuit of Q2



Since For DC analysis capacitors are replaced with an open circuit.

Here there is no need to check the status of Q1 since voltage at base terminal of Q1 varies

From time to time(this is not a fixed value).

To keep Q2 is in ON state, $I_{B2} \geq I_{B2(\min)}$

Where $I_{B2(\min)} = \frac{I_{C2}}{h_{FE}}$

From the collector circuit of Q2 , $I_{C2} = \left(\frac{V_{CC} - V_{CE(sat)}}{R_C} \right)$

$$I_{B2(\min)} = \frac{1}{h_{FE}}\left(\left(\frac{V_{CC} - V_{CE(sat)}}{R_C}\right)\right)\text{--------(2)}$$

From the base circuit of Q2 ,

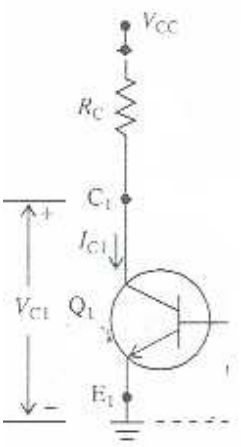
$$I_{B2} = \left(\frac{V_{CC} - V_{BE(sat)}}{R_2}\right)$$

Therefore, we know the necessary condition to keep the transistor in ON state is

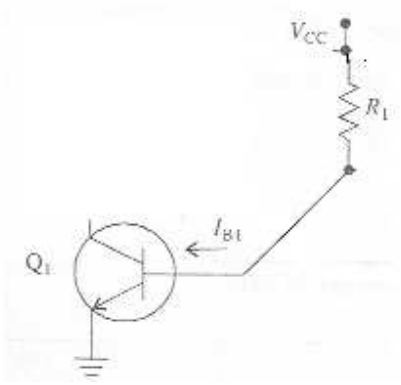
$$\left(\frac{V_{CC} - V_{BE(sat)}}{R_2}\right) \geq \frac{1}{h_{FE}}\left(\left(\frac{V_{CC} - V_{CE(sat)}}{R_C}\right)\right)\text{--(3)}$$

Other state of the astable multivibrator is Q1 ON & Q2 OFF

Collector circuit of Q1



Base circuit of Q1 is



Here there is no need to check the status of Q2 since voltage at base terminal of Q2 varies

From time to time(this is not a fixed value).

To keep Q1 is in ON state, $I_{B1} \geq I_{B1(\min)}$

Where $$I_{B1(\min)} = \frac{I_{C1}}{h_{FE}}$$

From the collector circuit of Q1 ,

$$I_{C1} = \left(\frac{V_{CC} - V_{CE(sat)}}{R_C} \right)$$

$$I_{B1(\min)} = \frac{1}{h_{FE}} \left(\frac{V_{CC} - V_{CE(sat)}}{R_C} \right)$$

From the base circuit of Q1 ,

$$I_{B1} = \left(\frac{V_{CC} - V_{BE(sat)}}{R_1} \right)$$

Therefore, we know the necessary condition to keep the transistor in ON state is

$$\left(\frac{V_{CC} - V_{BE(sat)}}{R_1} \right) \geq \frac{V_{CC} - V_{CE(sat)}}{R_C h_{FE}} \quad \text{----(4)}$$

Capacitor values should be selected from

$$T_2 = 0.693 R_2 C_2$$

And $T_1 = 0.693 R_1 C_1$----------(5)

Component values should be selected to satisfy equations (3), (4) & (5)