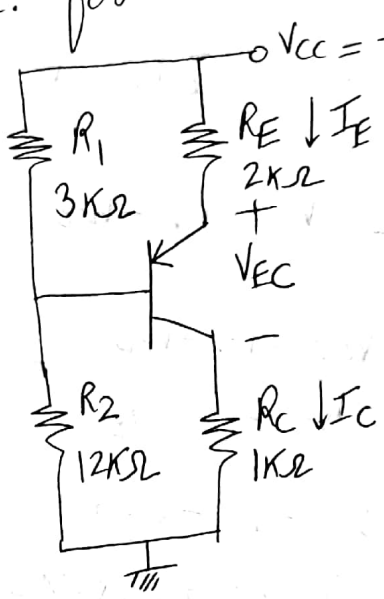
# PNP transistor

## Numerical 01:-

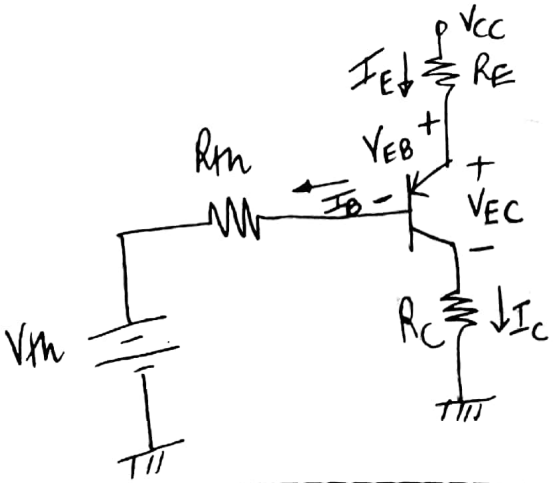
Determine quiescent collector current and emitter-collector voltage. for circuit below :-




Given
$V_{EB(ON)} = 0.7V$
$\beta = 100$

**Soln:-** For pnp transistor as compared to npn transistor have all terminal currents $(I_C, I_B, I_E)$ direction & voltage polarities are $(V_{EC}, V_{EB})$ reversed.

1] Applying thevenin's theorem & drawing equivalent ckt at base,




$$V_{th} = \frac{R_2}{R_1+R_2} V_{CC} = \frac{12K}{3K+12K} \times 20$$

$$V_{th} = 16\,V$$

$$R_{th} = R_1 \parallel R_2 = 3K \parallel 12K$$

$$R_{th} = 2.4K\Omega$$

KVL to B-E loop gives,

$$V_{th} + I_B R_{th} + V_{EB} + I_E R_E - V_{CC} = 0$$

$$V_{th} + I_B R_{th} + V_{EB} + (1+\beta) I_B R_E - V_{CC} = 0 \qquad I_E = (1+\beta) I_B$$

$$I_B \left(R_{th} + (1+\beta) R_E\right) = V_{CC} - V_{th} - V_{EB}$$

$$I_{BQ} = \frac{V_{CC} - V_{th} - V_{EB}}{R_{th} + (1+\beta) R_E}$$

$$= \frac{20 - 16 - 0.7}{2.4\,K\Omega + 101 \times 2\,K\Omega}$$

$$I_{BQ} = 16.14\,\mu A$$

$$\text{i.e } I_{CQ} = \beta I_{BQ} = 100 \times 16.14\,\mu A$$

$$\boxed{I_{CQ} = 1.61\ mA} \quad ; \quad I_E = I_C + I_B = 1.63mA$$

KVL to C-E loop gives,

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

$$V_{EC} = V_{CC} - I_E R_E - I_C R_C$$

$$= 20 - 1.63mA \times 2K\Omega - 1.61mA \times 1K\Omega$$

$$\boxed{V_{EC} = 15.1\,V}$$