BME 212 Electronics Laboratory

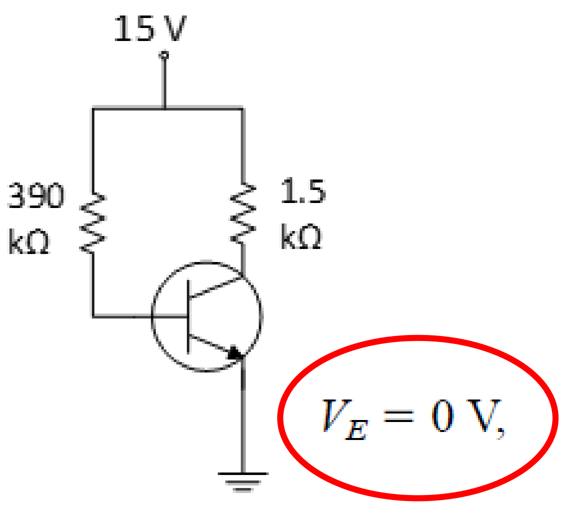
Experiment #4 DC Biasing of BJT

Objective

The objective of this experiment is to study the DC levels for the variety of important BJT biasing configurations and understanding the effect of transistor parameters on DC biasing.

Preliminary Work

1- For given circuits below, calculate and tabulate the V_{CEQ}, I_{CQ}, I_B values (β = 150 and V_{BE} = 0.7 V)



Fixed Bias

Hints:

$$I_B = \frac{V_{CC} - V_{BE}}{R_B}$$

$$I_C = \beta I_B$$

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

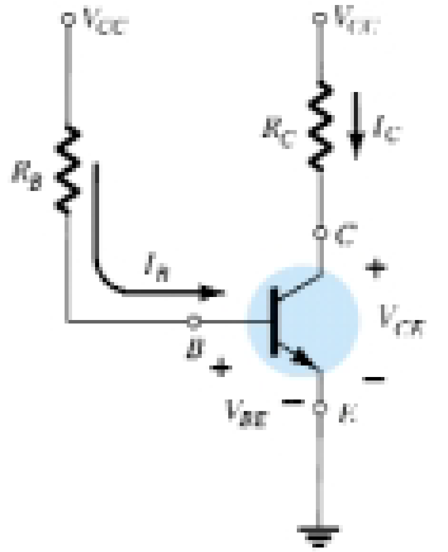
$$V_{CE} = V_{CC} - I_C R_C$$

$$V_{CE} = V_C - V_E$$

$$V_{CE} = V_C$$

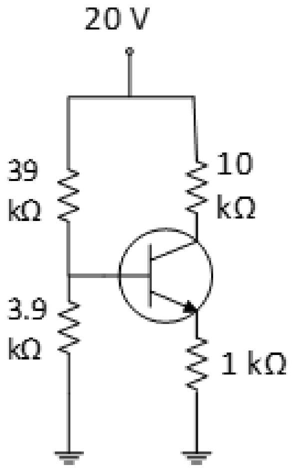
$$V_{BE} = V_B - V_E$$

$$V_{BE} = V_B$$



Preliminary Work (Cont.)

2- For given circuits below, calculate and tabulate the V_{CEQ}, I_{CQ}, I_B values (β = 150 and V_{BE} = 0.7 V)



Voltage Divider

Hints:

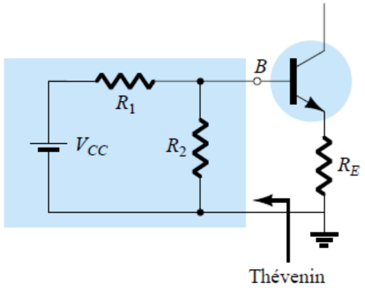


Figure 4.27 Redrawing the input side of the network of Fig. 4.25.

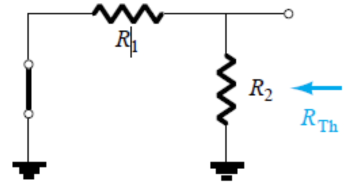


Figure 4.28 Determining R_{Th}.

$$R_{Th} = R_1 \| R_2$$

$$E_{Th} = V_{R_2} = \frac{R_2 V_{CC}}{R_1 + R_2}$$

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

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

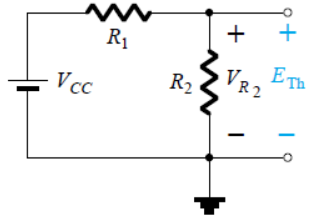


Figure 4.29 Determining E_{Th}.

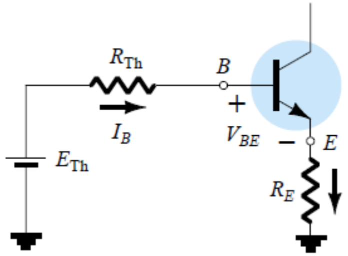


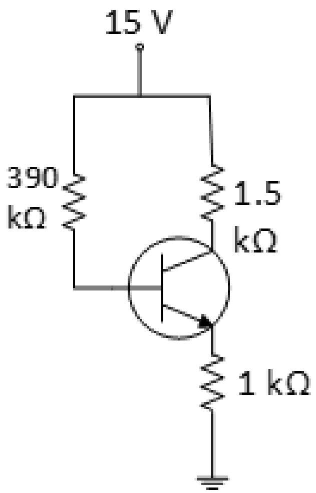
Figure 4.30 Inserting the Thévenin equivalent circuit.

Preliminary Work (Cont.)

3- For given circuits below, calculate and tabulate the V_{CEQ}, I_{CQ}, I_B values ($\beta = 150$ and $V_{BE} = 0.7$ V)

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

$$I_E = (\beta + 1) I_B$$



Emitter Bias

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

$$I_C = \beta I_B$$

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

$$V_E = I_E R_E$$

$$V_C = V_{CE} + V_E$$

$$V_B = V_{CC} - I_B R_B$$

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

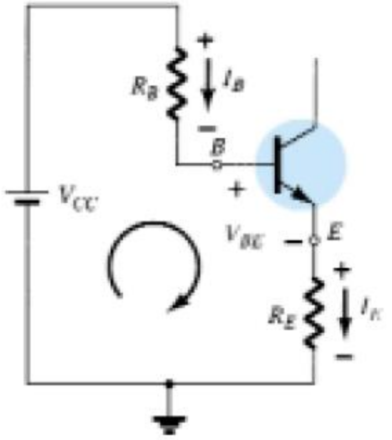


Figure 4.18 Base–emitter loop.

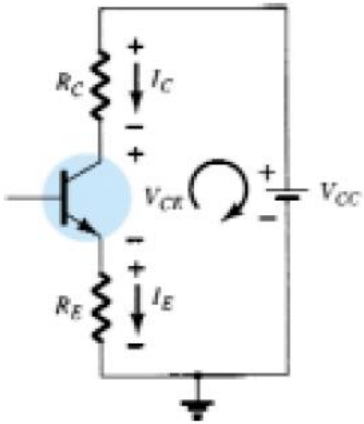
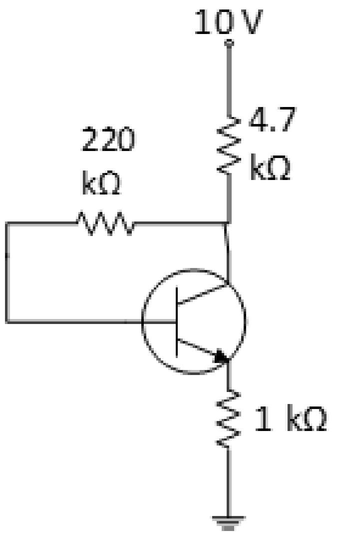


Figure 4.21 Collector–emitter loop.

Preliminary Work (Cont.)

4- For given circuits below, calculate and tabulate the V_{CEQ}, I_{CQ}, I_B values (β = 150 and V_{BE} = 0.7 V)



Collector Feedback

Hints:

$$V_{CC} - \beta I_B R_C - I_B R_B - V_{BE} - \beta I_B R_E = 0$$

$$V_{CC} - V_{BE} - \beta I_B (R_C + R_E) - I_B R_B = 0$$

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

$$I_B = \frac{V'}{R_B + \beta R'} \quad I_C = \beta I_B \quad I_{C_Q} = \frac{\beta V'}{R_B + \beta R'}$$

$$I_{C_Q} = \frac{\beta V'}{R_B + \beta R'} \cong \frac{\beta V'}{\beta R'} = \frac{V'}{R'}$$

$$I_E R_E + V_{CE} + I'_C R_C - V_{CC} = 0$$

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

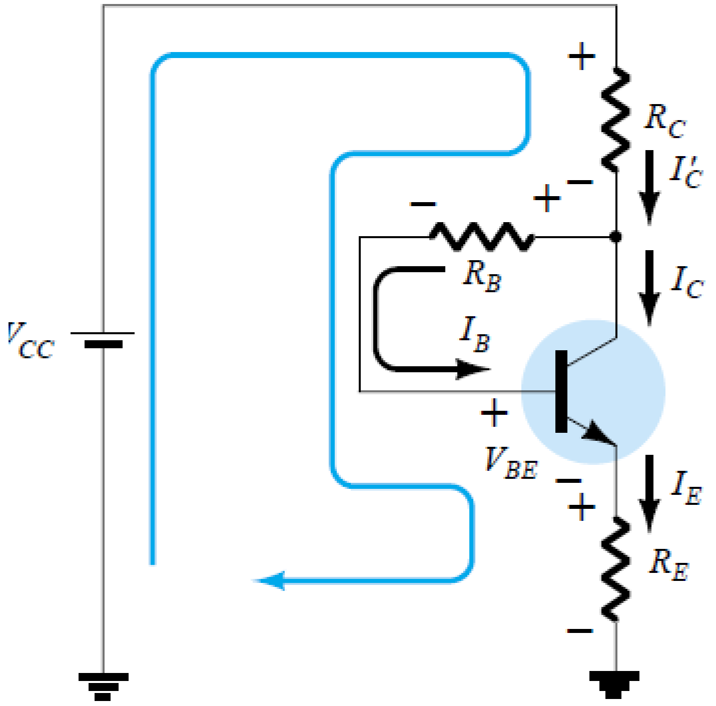
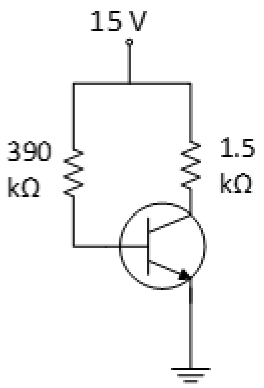


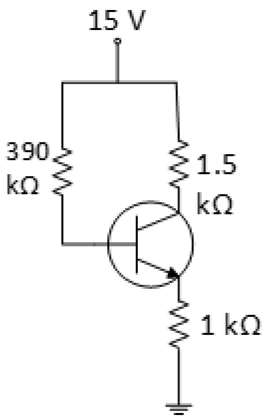
Figure 4.35 Base–emitter loop for the network of Fig. 4.34.

Procedure

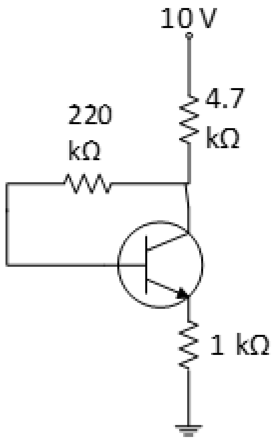
1- For given circuits below, measure and tabulate the V_{CEQ}, I_{CQ}, I_B values and compare your results with Preliminary Work 1,3 and 4.



Fixed Bias



Emitter Bias



Collector Feedback

BME212 Report#4 Results

1) Obtaining V_{CEQ}, $I_{CQ,}$ I_B and β values ofr each circuits.

	V_{CEQ}			I_{CQ}			I_B		
	Pre - β = 150	Pre-β_2 = 200	Measured	Pre - β = 150	Pre - β_2 = 200	Measured	Pre - β = 150	Pre - β_2 = 200	Measured
Fixed Bias									
Emitter Bias									
Voltage Divider									
Collector Feedback									

Comment: