Fundumantal of Electronic I

Second Class

Chapter 4 : DC Biasing – BJTs
Lec04_p4

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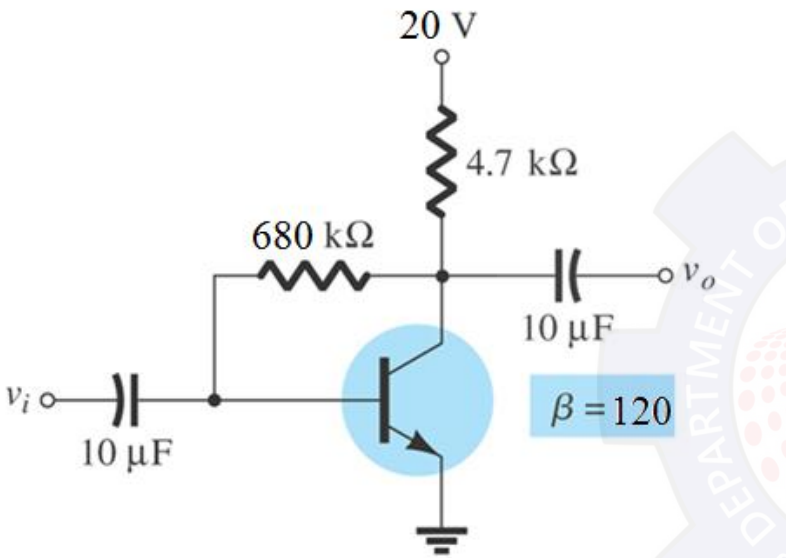
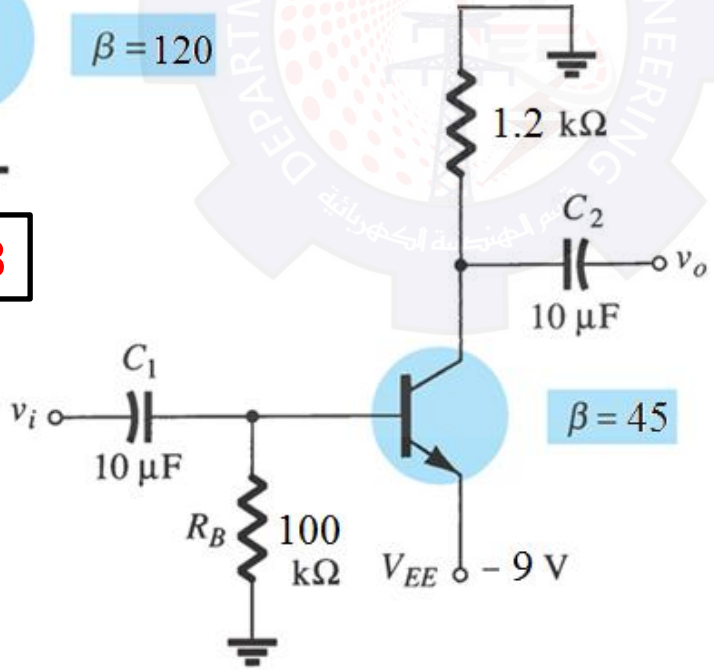
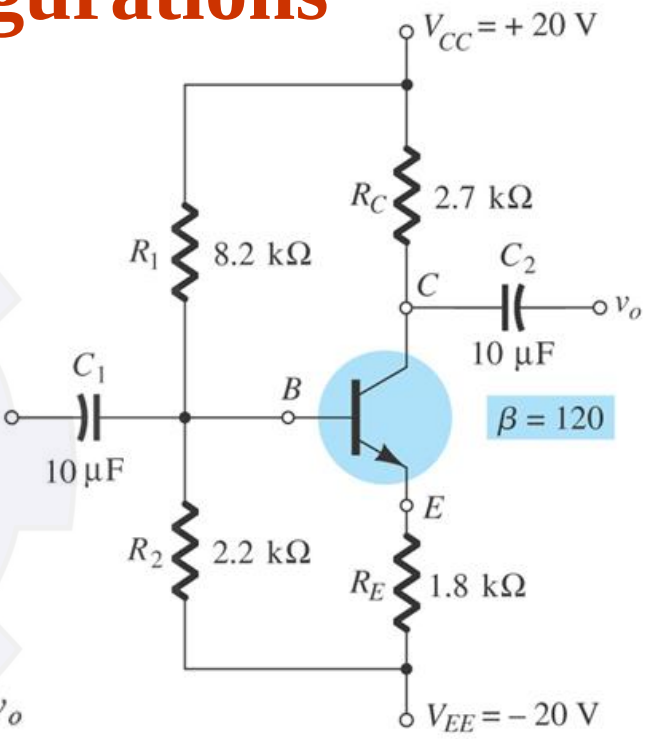
Miscellaneous Bias Configurations



Example 4.18

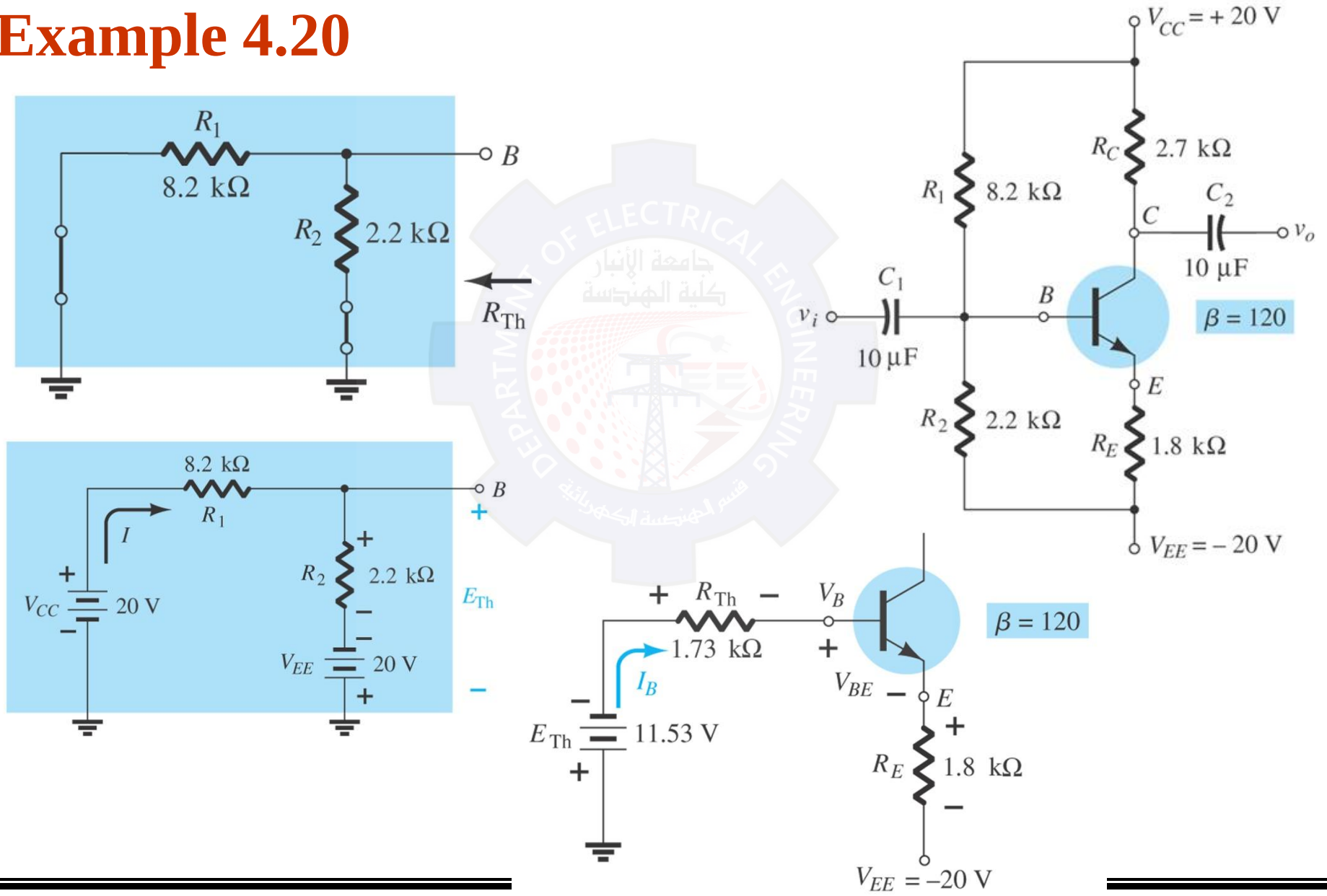


Example 4.19



Example 4.20

Example 4.20

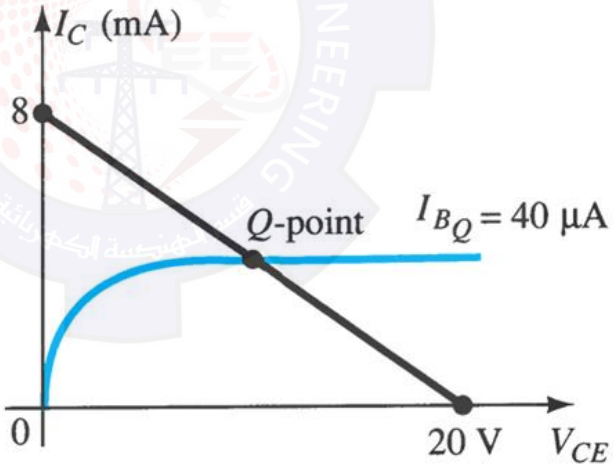

R_1
8.2 kΩ
R_2
2.2 kΩ
B
R_{Th}
8.2 kΩ
R_1
I
V_{CC}
20 V
R_2
2.2 kΩ
V_{EE}
20 V
B
+
E_{Th}
−
V_{CC} = + 20 V
R_C
2.7 kΩ
R_1
8.2 kΩ
C
C_2
v_o
10 μF
C_1
v_i
10 μF
B
β = 120
E
R_2
2.2 kΩ
R_E
1.8 kΩ
V_{EE} = − 20 V
+
R_{Th}
−
V_B
1.73 kΩ
+
I_B
V_{BE}
−
E
E_{Th}
11.53 V
+
R_E
1.8 kΩ
−
β = 120
V_{EE} = −20 V

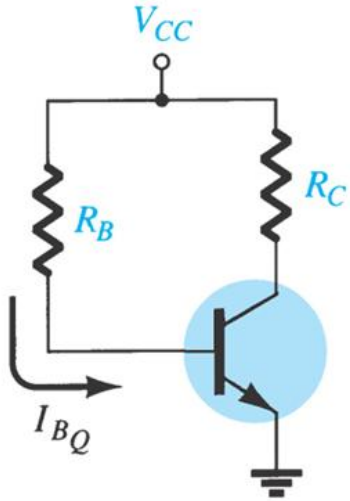
Design Operations

Current and/or Voltage may be specified, and the values of resistors are to be found.

Example 4.21

Determine V_{CC}, R_B, R_C

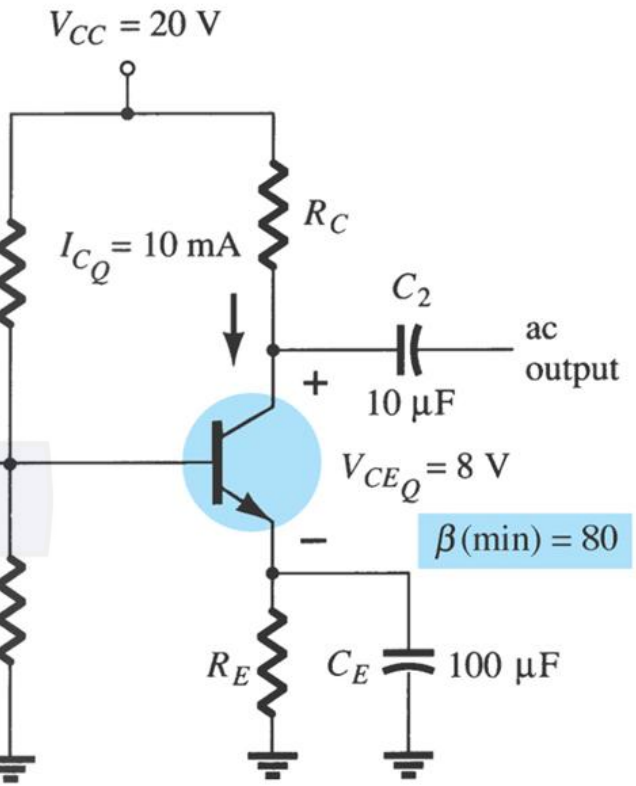


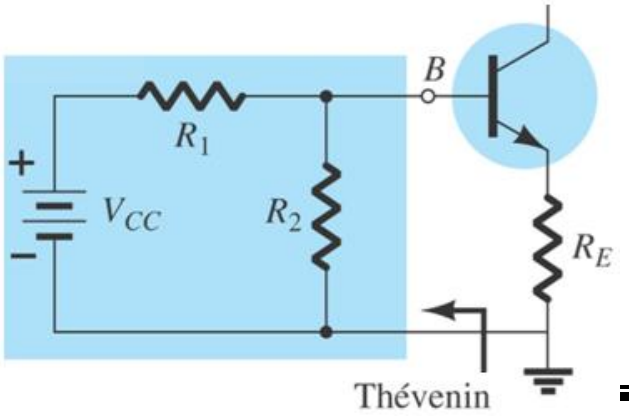


Example 4.25

Determine resistor values. Assume:

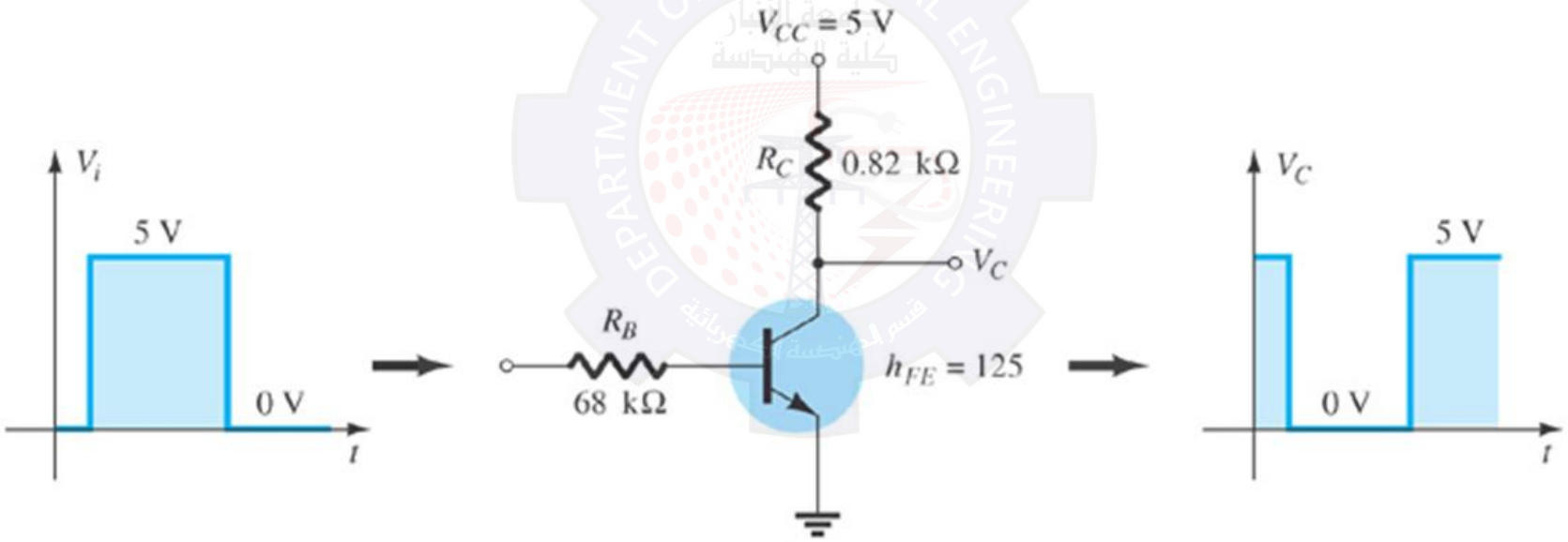
$$V_E \quad \frac{1}{10}V_{CC} \quad , \quad R_2 \le \frac{1}{10}\beta R_E$$





Transistor Switching Networks

Transistors are used for amplification and also they can be used as electronic switches.

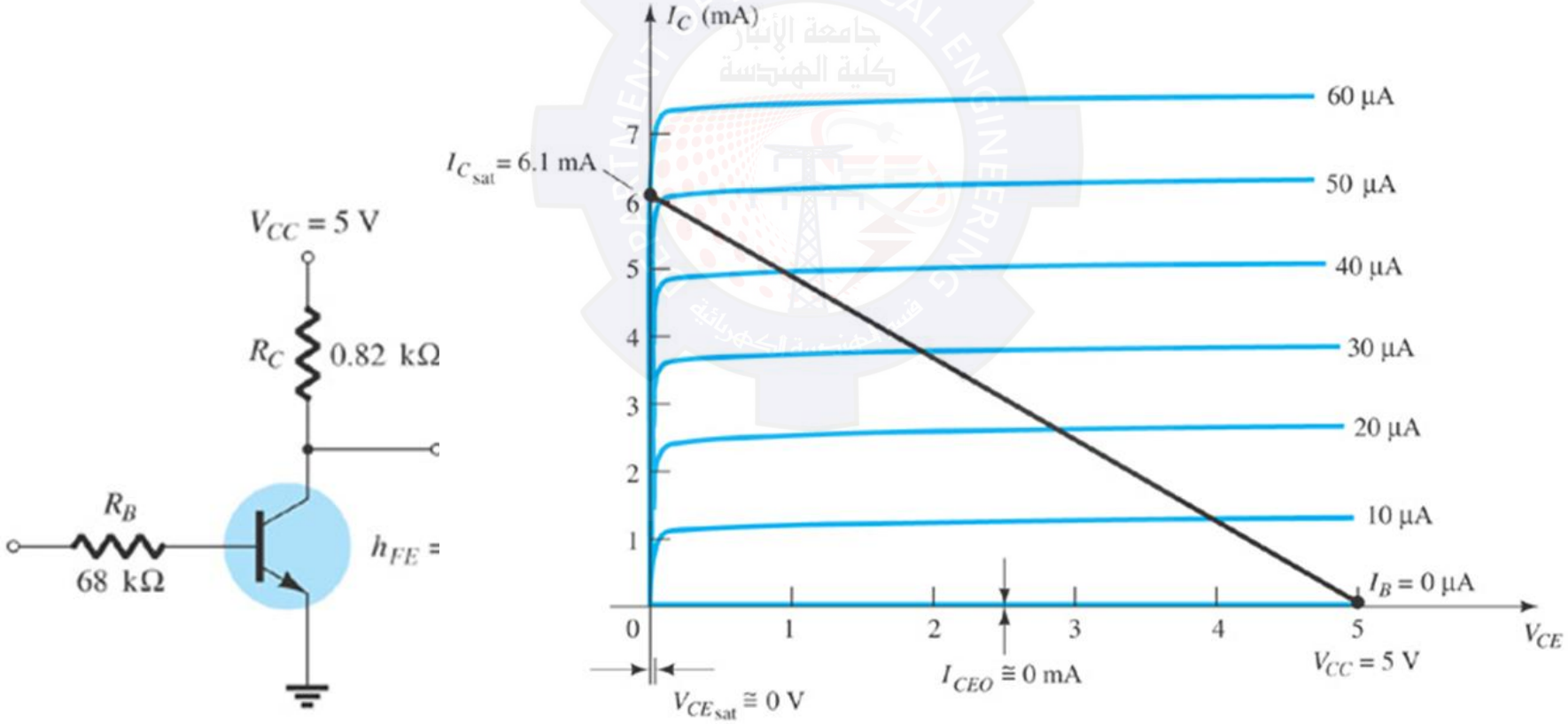


Transistor Inverter

The output voltage V_C is opposite to that applied to the base.

Switching Circuit Calculations

- **Cutoff**: When I_B=0 (V_i=0), $I_C=I_{CEO}\approx 0mA \rightarrow V_C=V_{CC}=5V$.
- **Saturation**: When V_i=5V, transistor must be operated in saturation region by having sufficient level of I_B. $\rightarrow V_C=V_{CEsat}\approx 0V$.



Operating Point switch from cutoff to saturation along load line.

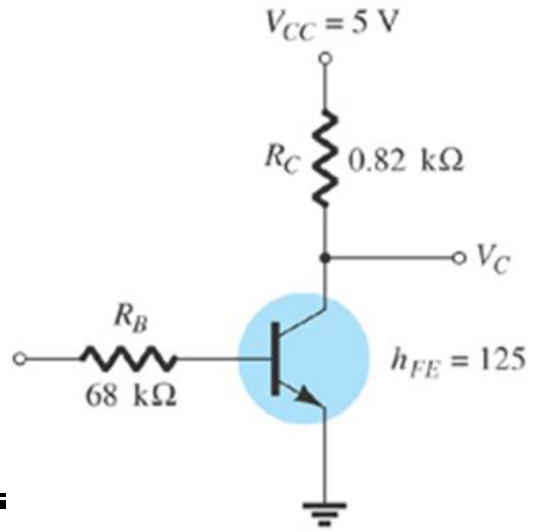
Switching Circuit Calculations

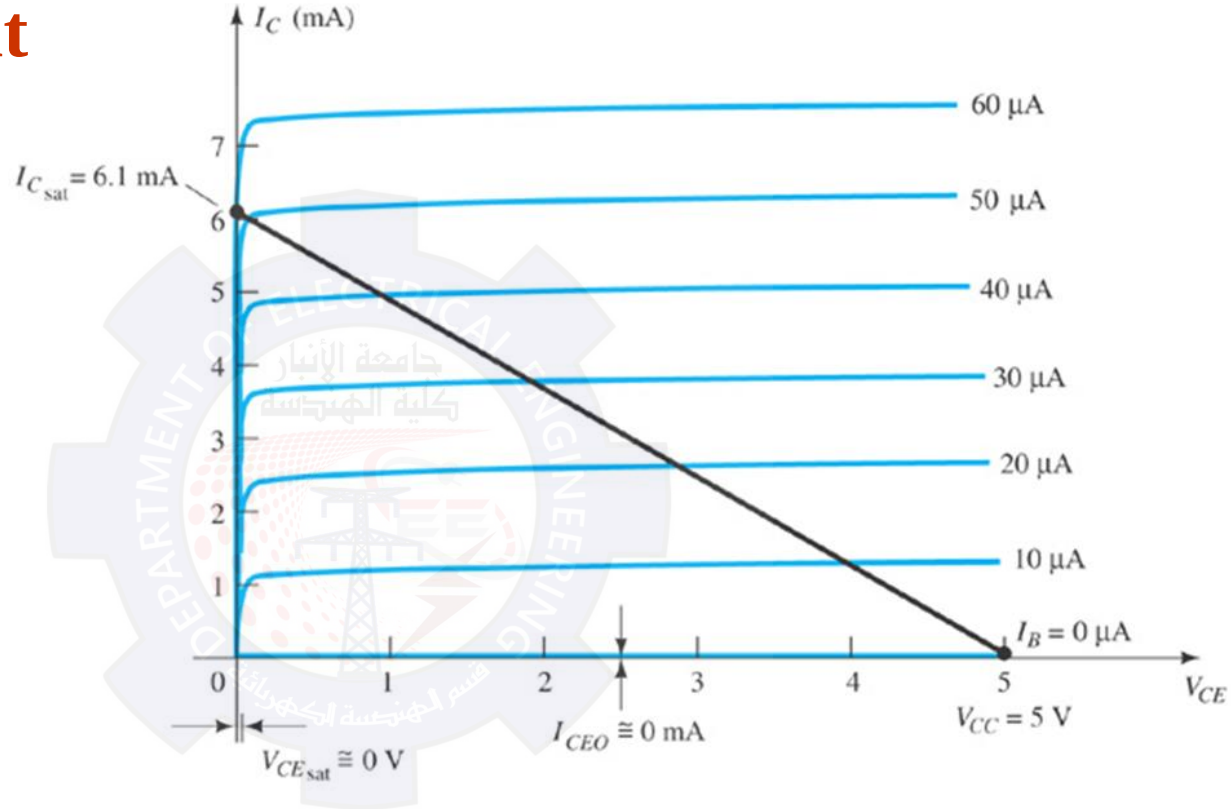
Saturation current:

$$I_{Csat} = \frac{V_{CC}}{R_C}$$

To ensure saturation:

$$I_B > \frac{I_{Csat}}{\beta_{dc}}$$



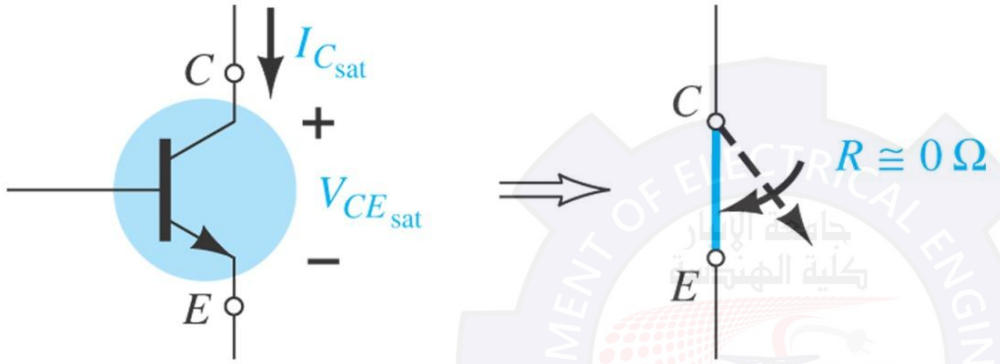


$$When\ V_i = 5,\ I_B = \frac{V_i - 0.7}{R_B} = \frac{5 - 0.7}{68k\,\Omega} = 63\mu A$$

$$I_{Csat} = \frac{V_{CC}}{R_C} = \frac{5}{0.82k} = 6.1mA$$

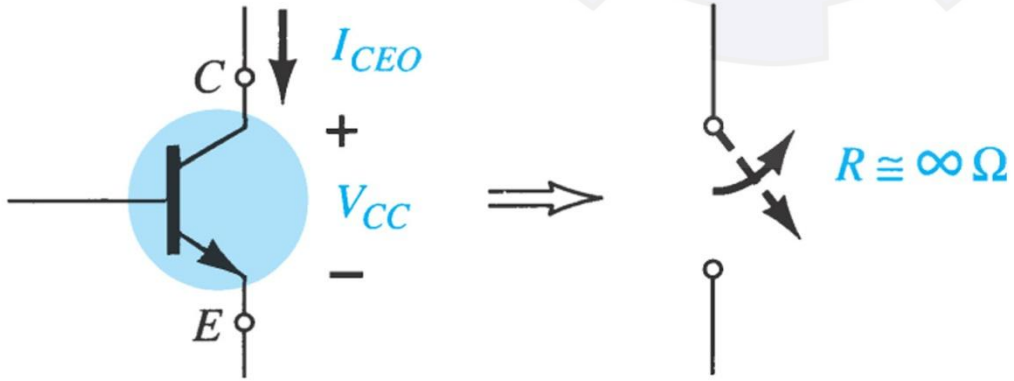
$$I_B = 63 \qquad \frac{I_{Csat}}{\beta} \qquad \frac{6.1mA}{125} \qquad 48.8$$

Transistor Switching Networks



$$R_{sat} = \frac{V_{CEsat}}{I_{Csat}}$$

Saturation conditions and the resulting terminal resistance.



$$R_{cutoff} = \frac{V_{CC}}{I_{CEO}}$$

Cutoff conditions and the resulting terminal resistance.

PNP Transistors

The analysis for *pnp* transistor biasing circuits is the same as that for *npn* transistor circuits. The only difference is that the currents are flowing in the opposite direction.