Fundumantal of Electronic II

Second Class

Chapter05: BJT AC Analysis

Lec05_p5

Munther N. Thiyab

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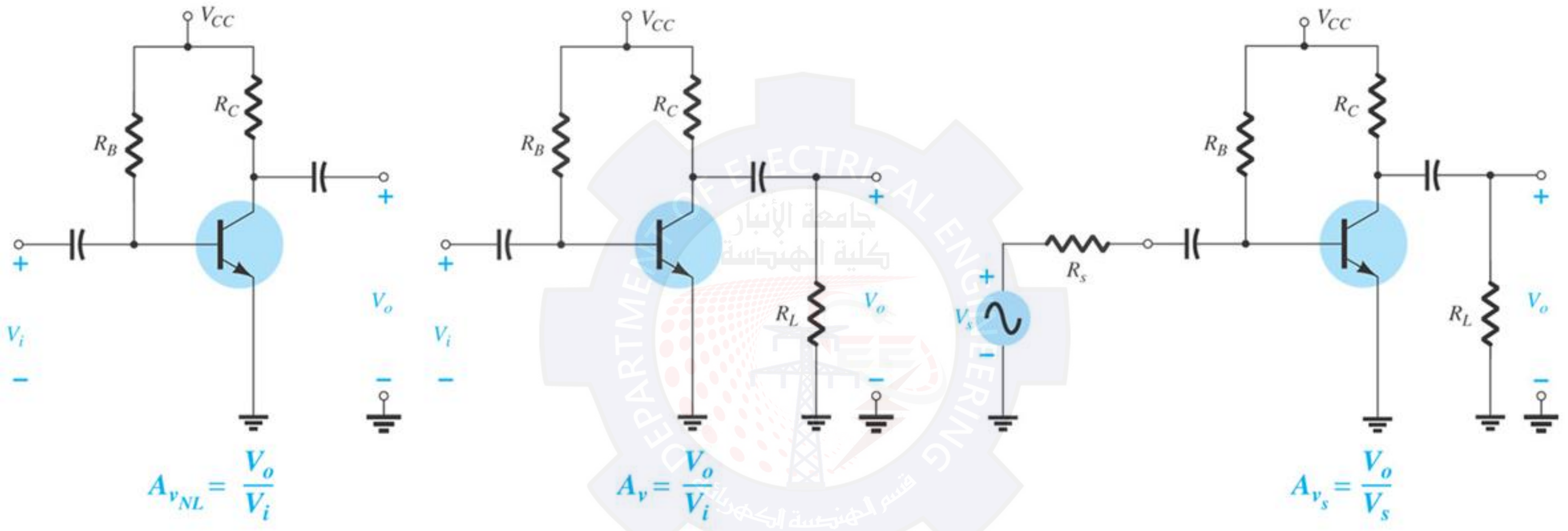
Effect of R_L and R_S

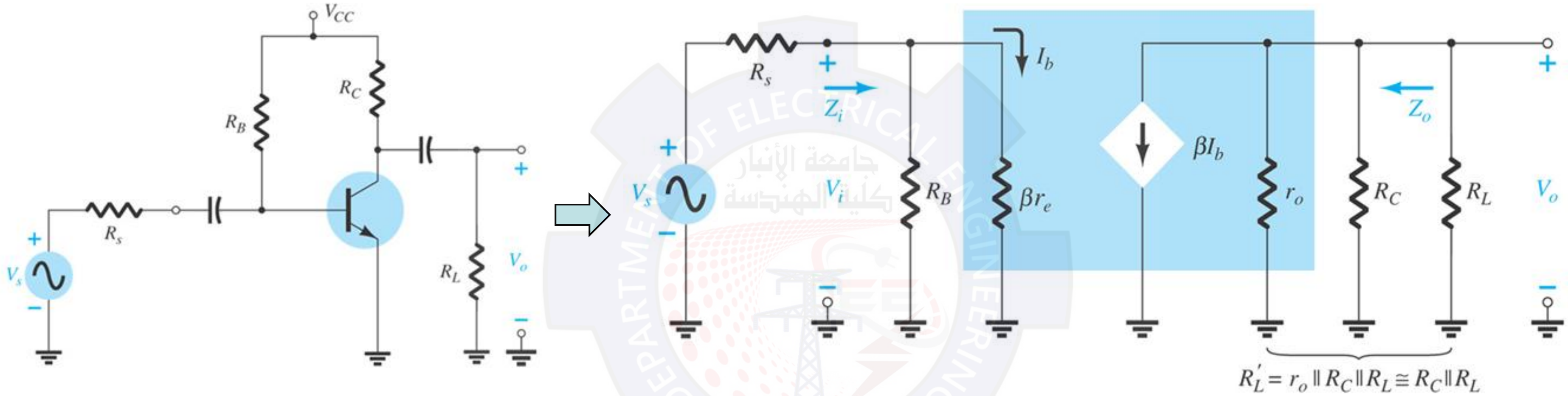


(a) (b) (c)

$$A_{vNL} \quad \frac{V}{V_i} \qquad , \qquad A_{vL} = \frac{V_o}{V_i} \;, \text{ with } R_L$$

$$A_{vS} = \frac{V_o}{V_s} \;, \text{ with } R_L \text{ and } R_S$$

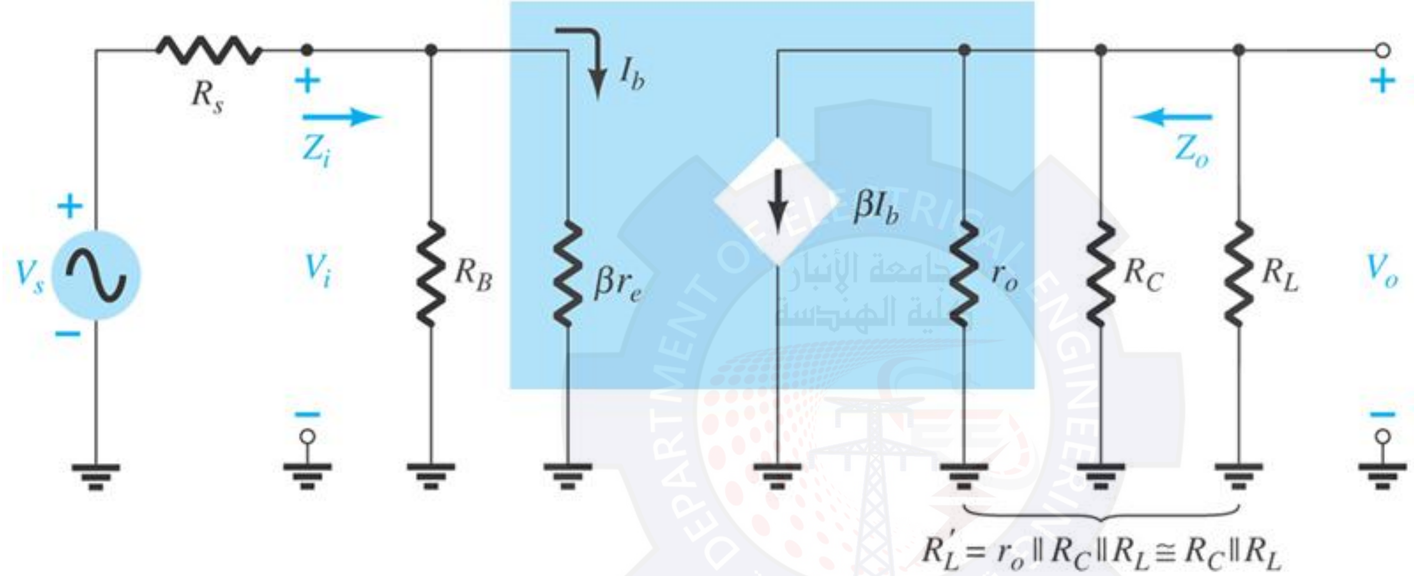
Effect of R_L and R_S



$$V_o = -\beta I_b (R_C \| r_o \| R_L) = -\beta I_b (R_C \| R_L), \quad I_b = \frac{V_i}{\beta r_e},$$

$$V_o = -\beta \left(\frac{V_i}{\beta r_e} \right) (R_C \| R_L) \;\Rightarrow\; A_{vL} = \frac{V}{V_i} = -\frac{(R_C \| R_L)}{r_e}$$

Effect of R_L and R_S



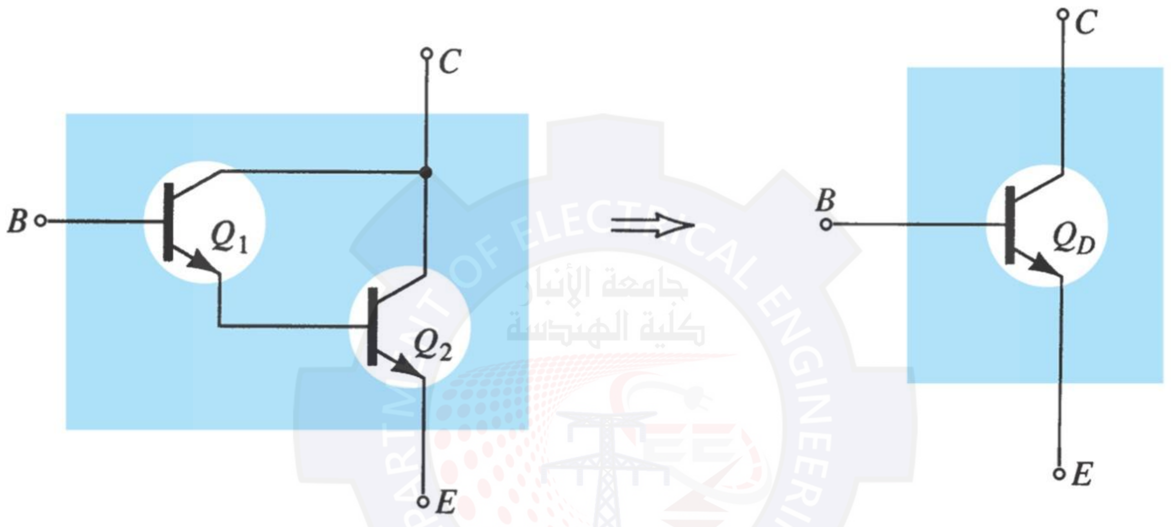
Input impedance: $Z_i = R_B \| \beta r_e$

Output Impedance: $Z_o = R_C \| r_o$

To find overall gain: $V_i = \dfrac{Z_i V_s}{Z_i + R_s}$, $\dfrac{V_i}{V_S} = \dfrac{Z_i}{Z_i + R_s}$

$$A_{vS} = \frac{}{V_S} = \frac{V_o}{V_i} \cdot \frac{V_i}{V_S} = A_{vL} \frac{Z_i}{Z_i + R_s} \Rightarrow A_{vS} = \frac{Z_i}{Z_i + R_s} A_{vL}$$

Darlington Connection



- The Darlington circuit provides a very high current gain—the product of the individual current gains: $\beta_D = \beta_1\beta_2$
- A Darlington transistor connection provides a transistor having a very large current gain, typically a few thousand.
- Darlington pairs are available as complete packages.
- A Darlington pair is sufficiently sensitive to respond to the small current.

DC Bias of Darlington Circuits

Base current:

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

Emitter current:

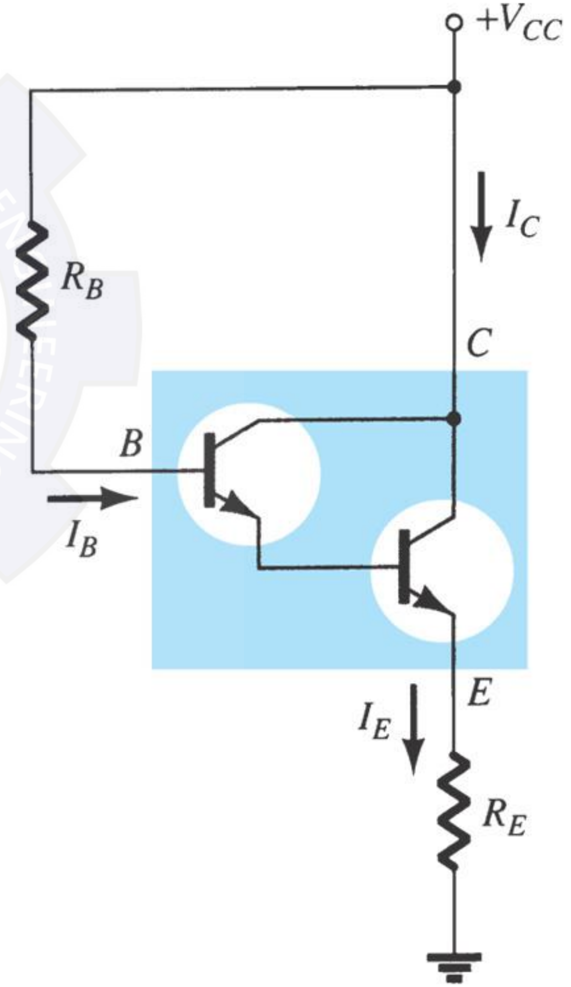
$$I_E = (\beta_D + 1)I_B \cong \beta_D I_B$$

Emitter voltage:

$$V_E = I_E R_E$$

Base voltage:

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



Darlington Circuits

- ➢When light falls on the LDR, its resistance reduces.
- ➢The bias voltage is supplied to the transistor and this voltage is enough to make the transistor and relay work.
- ➢A variable resistor is also connected on the base of transistor to adjust the sensitivity.