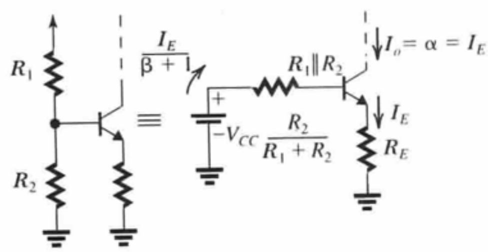
**6.138**



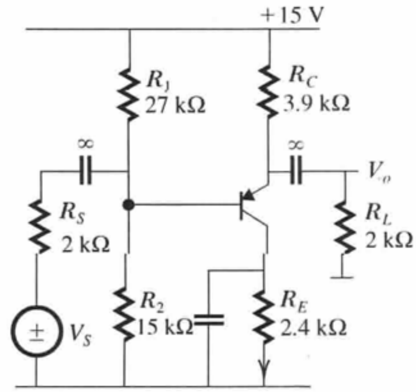

$$V_{CC} \cdot \frac{R_2}{R_1 + R_2} = \frac{I_E}{\beta + 1}(R_1 \| R_2) + V_{BE} + I_E R_E$$

$$\Rightarrow I_E = \frac{V_{CC}\frac{R_2}{R_1 + R_2} - V_{BE}}{R_E + \frac{(R_1 \| R_2)}{\beta + 1}}$$

Thus,

$$I_O = \alpha I_E = \frac{\alpha \cdot \left[\frac{V_{CC}R_2}{R_1 + R_2} - V_{BE}\right]}{R_E + \frac{(R_1 \| R_2)}{\beta + 1}}$$

**6.142**




β = 100

$$R_1 \| R_2 = 9.64 \text{ k}\Omega$$

$$V_{BB} = \frac{15 \times R_2}{R_1 + R_2} = 5.36 \text{ V}$$

$$I_E = \frac{V_{BB} - 0.7}{2.4 + \frac{9.64}{101}} = 1.87 \text{ mA}$$

$$g_m = \frac{I_C}{V_T} = \frac{0.99 I_E}{V_T} = 74 \text{ V/V}$$

$$r_O = \frac{V_A}{I_C} = 54 \text{ k}\Omega$$

$$r_\pi = \frac{\beta}{g_m} = \frac{100}{74} = 1.35 \text{ k}\Omega$$

$$R_C \| R_L = \frac{3.9 \times 2}{5.9} = 1.32 \text{ k}\Omega << r_o$$

Thus we can neglect $r_o$

$I_c = 0.99 \times I = 1.68$ mA

$$R_{in} = (R_1 \| R_2) | r_\pi = 1.18 \text{ k}\Omega$$

$$R_O = r_O \| R_C \approx 1.32 \text{ k}\Omega$$

$$\frac{v_O}{v_1} = -\frac{R_{IN}}{R_{IN} + R_s} \times g_m (r_O \| R_C \| R_L)$$

$$R_S = -\frac{1.18}{3.18} \times 74 \times 1.29$$

$$= -35.4 \text{ V/V}$$