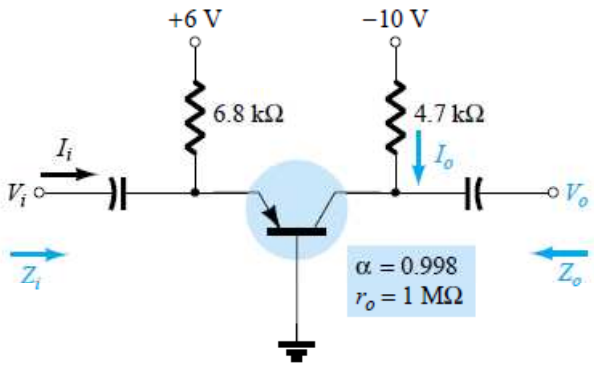
Soru 1.

For the common-base configuration of Fig.
(a) Determine r_e.
(b) Find Z_i and Z_o.
(c) Calculate A_v and A_i.



Çözüm 1.

(a) $$I_E = \frac{V_{EE} - V_{BE}}{R_E} = \frac{6\text{ V} - 0.7\text{ V}}{6.8\text{ k}\Omega} = 0.779\text{ mA}$$

$$r_e = \frac{26\text{ mV}}{I_E} = \frac{26\text{ mV}}{0.779\text{ mA}} = \mathbf{33.38\ \Omega}$$

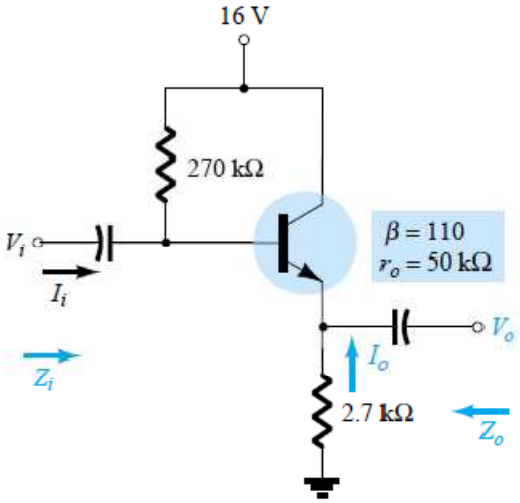
(b) $$Z_i = R_E \parallel r_e = 6.8\text{ k}\Omega \parallel 33.38\ \Omega$$
$$= \mathbf{33.22\ \Omega}$$

$$Z_o = R_C = 4.7\text{ k}\Omega$$

(c) $$A_v = \frac{\alpha R_C}{r_e} = \frac{(0.998)(4.7\text{ k}\Omega)}{33.38\ \Omega}$$
$$= \mathbf{140.52}$$

Soru 2.

For the network of Fig. 8.73:
(a) Determine r_e and βr_e.
(b) Find Z_i and Z_o.
(c) Calculate A_v and A_i.



Cevap 2.

(a) $$I_B = \frac{V_{CC} - V_{BE}}{R_B + (\beta + 1)R_E} = \frac{16\text{ V} - 0.7\text{ V}}{270\text{ k}\Omega + (111)(2.7\text{ k}\Omega)} = \frac{15.3\text{ V}}{569.7\text{ k}\Omega}$$

$$= 26.86\ \mu\text{A}$$

$$I_E = (\beta + 1)I_B = (110 + 1)(26.86\ \mu\text{A})$$

$$= 2.98\text{ mA}$$

$$r_e = \frac{26\text{ mV}}{I_E} = \frac{26\text{ mV}}{2.98\text{ mA}} = \mathbf{8.72\ \Omega}$$

$$\beta r_e = (110)(8.72\ \Omega) = \mathbf{959.2\ \Omega}$$

(b) $$Z_b = \beta r_e + (\beta + 1)R_E$$

$$= 959.2\ \Omega + (111)(2.7\text{ k}\Omega)$$

$$= 300.66\text{ k}\Omega$$

$$Z_i = R_B \parallel Z_b = 270\text{ k}\Omega \parallel 300.66\text{ k}\Omega$$

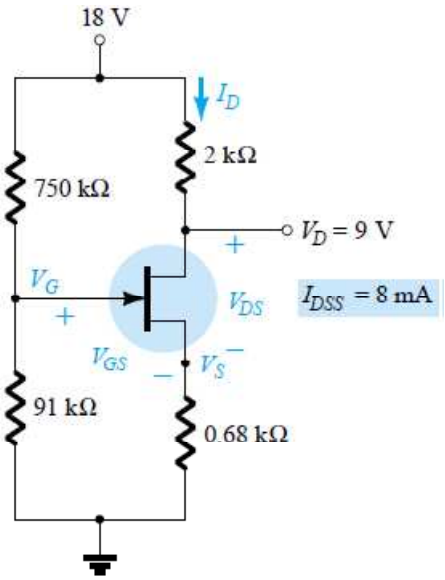
$$= 142.25\text{ k}\Omega$$

$$Z_o = R_E \parallel r_e = 2.7\text{ k}\Omega \parallel 8.72\ \Omega = \mathbf{8.69\ \Omega}$$

(c) $$A_v = \frac{R_E}{R_E + r_e} = \frac{2.7\text{ k}\Omega}{2.7\text{ k}\Omega + 8.69\ \Omega} \cong \mathbf{0.997}$$

Soru 3.

For the network of Fig. 6.78, $V_D = 9$ V. Determine:
(a) I_D.
(b) V_S and V_{DS}.
(c) V_G and V_{GS}.
(d) V_P.



Cevap 3.

(a) $$I_D = \frac{V_{R_D}}{R_D} = \frac{V_{DD} - V_D}{R_D} = \frac{18\text{ V} - 9\text{ V}}{2\text{ k}\Omega} = \frac{9\text{ V}}{2\text{ k}\Omega} = \mathbf{4.5\text{ mA}}$$

(b) $$V_S = I_S R_S = I_D R_S = (4.5\text{ mA})(0.68\text{ k}\Omega)$$
$$= \mathbf{3.06\text{ V}}$$
$$V_{DS} = V_{DD} - I_D(R_D + R_S)$$
$$= 18\text{ V} - (4.5\text{ mA})(2\text{ k}\Omega + 0.68\text{ k}\Omega)$$
$$= 18\text{ V} - 12.06\text{ V}$$
$$= \mathbf{5.94\text{ V}}$$

(c) $$V_G = \frac{R_2}{R_1 + R_2} V_{DD} = \frac{91\text{ k}\Omega(18\text{ V})}{750\text{ k}\Omega + 91\text{ k}\Omega} = \mathbf{1.95\text{ V}}$$
$$V_{GS} = V_G - V_S = 1.95\text{ V} - 3.06\text{ V} = \mathbf{-1.11\text{ V}}$$

(d) $$V_P = \frac{V_{GS}}{1 - \sqrt{\frac{I_D}{I_{DSS}}}} = \frac{-1.11\text{ V}}{1 - \sqrt{\frac{4.5\text{ mA}}{8\text{ mA}}}} = \mathbf{-4.44\text{ V}}$$
$$= \mathbf{-1.48\text{ V}}$$

Soru 4.

For the combination network of Fig. 6.86, determine:

(a) V_B and V_G.
(b) V_E.
(c) I_E, I_C, and I_D.
(d) I_B.
(e) V_C, V_S, and V_D.
(f) V_{CE}.
(g) V_{DS}.

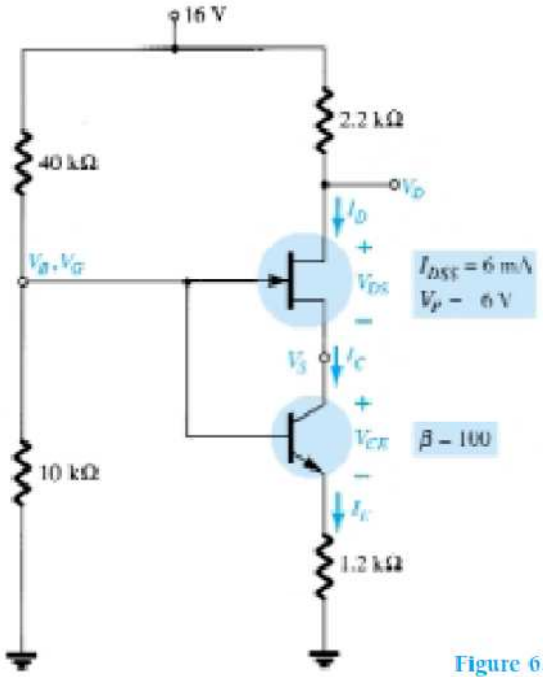


Figure 6.86

Çözüm 4.

Testing:

$$\beta R_E \geq 10R_2$$
$$(100)(1.2\ \text{k}\Omega) \geq 10(10\ \text{k}\Omega)$$
$$120\ \text{k}\Omega > 100\ \text{k}\Omega \text{ (satisfied)}$$

(a) $$V_B = V_G = \frac{R_2 V_{DD}}{R_1 + R_2} - \frac{10\ \text{k}\Omega(16\ \text{V})}{40\ \text{k}\Omega + 10\ \text{k}\Omega}$$
$$= \mathbf{3.2\ V}$$

(b) $$V_E = V_B - V_{BE} = 3.2\ \text{V} - 0.7\ \text{V} = \mathbf{2.5\ V}$$

(c) $$I_E = \frac{V_E}{R_E} = \frac{2.5\ \text{V}}{1.2\ \text{k}\Omega} = \mathbf{2.08\ mA}$$
$$I_C \cong I_E = \mathbf{2.08\ mA}$$
$$I_D = I_C = \mathbf{2.08\ mA}$$

(d) $$I_B = \frac{I_C}{\beta} = \frac{2.08\ \text{mA}}{100} = \mathbf{20.8\ \mu A}$$

(e) $$V_C = V_G - V_{GS}$$
$$V_{GS} = V_P\left(1 - \sqrt{\frac{I_D}{I_{DSS}}}\right)$$
$$= (-6\ \text{V})\left(1 - \sqrt{\frac{2.08\ \text{mA}}{6\ \text{mA}}}\right)$$
$$= -2.47\ \text{V}$$
$$V_C = 3.2 - (-2.47\ \text{V})$$
$$= \mathbf{5.67\ V}$$
$$V_S = V_C = \mathbf{5.67\ V}$$
$$V_D = V_{DD} - I_D R_D$$
$$= 16\ \text{V} - (2.08\ \text{mA})(2.2\ \text{k}\Omega)$$
$$= \mathbf{11.42\ V}$$

(f) $$V_{CE} = V_C - V_E = 5.67\ \text{V} - 2.5\ \text{V}$$
$$= \mathbf{3.17\ V}$$

(g) $$V_{DS} = V_D - V_S = 11.42\ \text{V} - 5.67\ \text{V}$$
$$= \mathbf{5.75\ V}$$