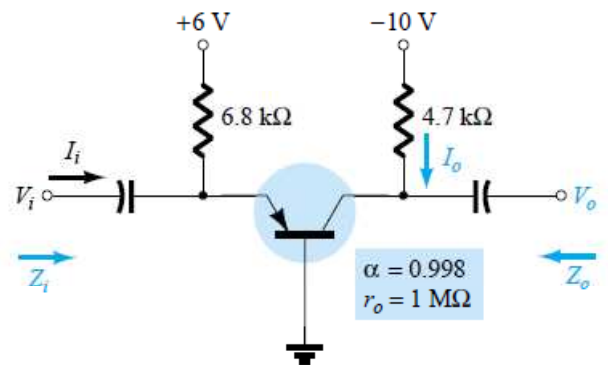


Soru 1.

For the common-base configuration of Fig.

- Determine  $r_e$ .
- Find  $Z_i$  and  $Z_o$ .
- Calculate  $A_v$  and  $A_i$ .



Çözüm 1.

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

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

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

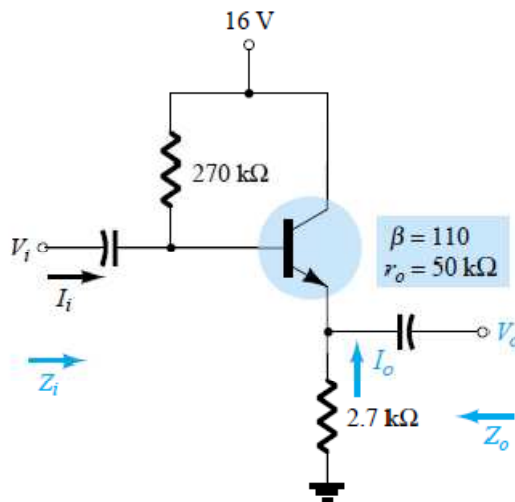
$$Z_o = R_C = 4.7 \text{ k}\Omega$$

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

Soru 2.

For the network of Fig. 8.73:

- Determine  $r_e$  and  $\beta r_e$ .
- Find  $Z_i$  and  $Z_o$ .
- Calculate  $A_v$  and  $A_i$ .



Cevap 2.

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

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

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

$$= 2.98 \text{ mA}$$

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

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

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

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

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

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

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

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

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

Soru 3.

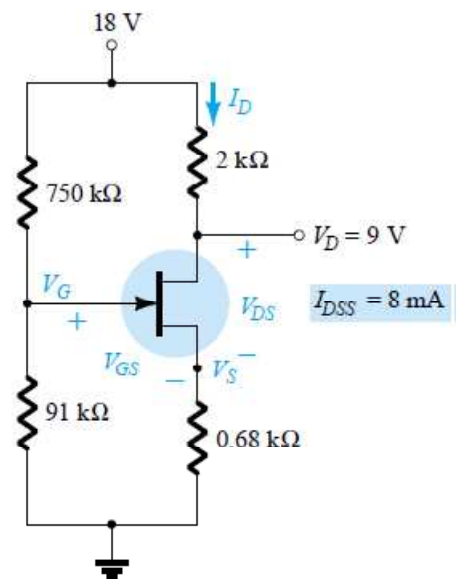
For the network of Fig. 6.78,  $V_D = 9 \text{ V}$ . Determine:

(a)  $I_D$ .

(b)  $V_S$  and  $V_{DS}$ .

(c)  $V_G$  and  $V_{GS}$ .

(d)  $V_P$ .



Cevap 3.

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

$$(b) \quad V_S = I_S R_S = I_D R_S = (4.5 \text{ mA})(0.68 \text{ k}\Omega) = \mathbf{3.06 \text{ V}}$$

$$\begin{aligned} V_{DS} &= V_{DD} - I_D(R_D + R_S) \\ &= 18 \text{ V} - (4.5 \text{ mA})(2 \text{ k}\Omega + 0.68 \text{ k}\Omega) \\ &= 18 \text{ V} - 12.06 \text{ V} \\ &= \mathbf{5.94 \text{ V}} \end{aligned}$$

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

$$V_{GS} = V_G - V_S = 1.95 \text{ V} - 3.06 \text{ V} = \mathbf{-1.11 \text{ V}}$$

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

$$= \mathbf{-1.48 \text{ V}}$$

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)  $V_{DS}$ .

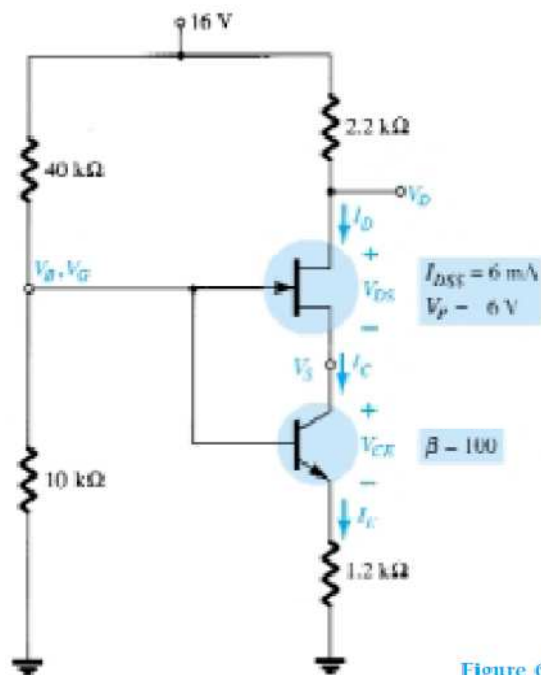


Figure 6.86

Çözüm 4.

Testing:

$$\beta R_E \geq 10 R_2$$

$$(100)(1.2 \text{ k}\Omega) \geq 10(10 \text{ k}\Omega)$$

$$120 \text{ k}\Omega > 100 \text{ k}\Omega \text{ (satisfied)}$$

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

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

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

$$I_C \cong I_E = \mathbf{2.08 \text{ mA}}$$

$$I_D = I_C = \mathbf{2.08 \text{ mA}}$$

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

$$(e) \quad V_C = V_G - V_{GS}$$

$$V_{GS} = V_P \left( 1 - \sqrt{\frac{I_D}{I_{DSS}}} \right)$$

$$= (-6 \text{ V}) \left( 1 - \sqrt{\frac{2.08 \text{ mA}}{6 \text{ mA}}} \right)$$

$$= -2.47 \text{ V}$$

$$V_C = 3.2 - (-2.47 \text{ V})$$

$$= \mathbf{5.67 \text{ V}}$$

$$V_S = V_C = \mathbf{5.67 \text{ V}}$$

$$V_D = V_{DD} - I_D R_D$$

$$= 16 \text{ V} - (2.08 \text{ mA})(2.2 \text{ k}\Omega)$$

$$= \mathbf{11.42 \text{ V}}$$

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

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