REŠENJA

1. a) $R_X = R \Rightarrow a_r = 3 + 2\frac{R}{R_X} = 5$

b)

$\frac{v_X - v_U}{R} = \frac{v_U}{R} \Rightarrow v_X = 2v_U$

$\frac{v_X}{R_X} + \frac{v_X - v_I}{R} + \frac{v_U}{R} = 0 \Rightarrow v_I = (3 + 2\frac{R}{R_X})v_U$

$a_r = \frac{v_I}{v_U} = 3 + 2\frac{R}{R_X}$

c) Kada pojačanje $a \to \infty$ tada je $a_r = 5 = 1/\beta \Rightarrow \beta = 1/5$

Kada je pojačanje $a = 3$ tada je $a_r = \frac{a}{1+\beta a} = \frac{3}{1+3/5} = 15/8$

d) $v_{\mathrm{I\,max}} = V_{CC} = \left(3 + 2\frac{R}{R_{X\,\min}}\right)V_m \Rightarrow R_{X\,\min} = \frac{2R}{\frac{V_{CC}}{V_m} - 3} = 2\mathrm{k}\Omega$

2. $v_I[\mathrm{V}] = \frac{1}{3}v_G[\mathrm{V}] + 2{,}27$, za $-1{,}5\mathrm{V} \le v_G \le 1{,}36\mathrm{V}$ (D - ON)

$v_I[\mathrm{V}] = 2v_G[\mathrm{V}]$, za $1{,}36\mathrm{V} \le v_G \le 1{,}5\mathrm{V}$ (D - OFF)

3. a) $R_2 = 4{,}4\mathrm{k}\Omega$; $R_3 = 1\mathrm{k}\Omega$; $R_4 = 5\mathrm{k}\Omega$.

b) $a_v = 8533{,}3$

c) $R_{ul} \to \infty$, $R_{izl} = 5\mathrm{k}\Omega$.

4. a) Pošto su kolektorske struje u odnosu 1:10:100, bazne struje u DC analizi utiču sa 10% i mogu da se zanemare. R_1=7k, R_3=1.2k, R_2=12.7k

b)

$g_{m1} = g_{m2} = I_{C1}/V_T = 100\mu\mathrm{A}/25\mathrm{mV} = 4\mathrm{ms}$

$r_{\pi 1} = r_{\pi 2} = 25\mathrm{k}\Omega$

$g_{m3} = I_{C3}/V_T = 1m\mathrm{A}/25\mathrm{mV} = 40\mathrm{ms}$

$r_{\pi 3} = 2.5\mathrm{k}\Omega$

$g_{m4} = I_{C4}/V_T = 10m\mathrm{A}/25\mathrm{mV} = 400\mathrm{ms}$

$r_{\pi 4} = 250\Omega$

$$a = \left(-\frac{g_{m1}}{2}(R_1 \parallel r_{\pi 3})\right)\left(-g_{m3}\left(\underbrace{R_2 \parallel (r_{\pi 4} + (1+\beta_0)R_3)}_{\approx R_2}\right)\right)\underbrace{\left(\frac{g_{m4}R_3}{1+g_{m4}R_3}\right)}_{\approx 1} \approx 1700$$

c) $2r_{\pi 1}$

d) $R_3 \parallel \frac{r_{\pi 4} + R_2}{1+\beta_0} \approx 130\Omega$

5. M_1-triodna oblast; M_2-zasićenje; $V_I = 1{,}025\mathrm{V}$.