

REŠENJA:

1. Beleške za predavanja, 2_Dioda.pdf, slajdovi 34 do 39.

2. a)

$$I_3 = I = 2\text{mA} = I_4; \quad I_1 = I_2 = 1\text{mA};$$

$$V_I = V_{SS} + R_2 I_2 = -2,5\text{V} \Rightarrow R_2 = (-V_{SS} - 2,5\text{V})/I_2 = 2,5\text{k}\Omega$$

$$\text{b) } g_{m1} = g_{m2} = \sqrt{2I_1 B} = 2\text{mS}; \quad a_d = \frac{v_i}{v_{u1} - v_{u2}} = \frac{g_{m2} R_2}{2} = 2,5.$$

$$\text{c) } a_s \cong -\frac{R_2}{2r_{ds4}} = -0,025; \quad \rho = \left| \frac{a_d}{a_s} \right| \cong g_{m2} r_{ds4} = 100$$

3. Beleške za predavanja, 13_Regulator_(stabilizator)_napona.pdf, slajdovi 2, 3 i 5.

$$V_+ = V_Z = 5\text{V}; \quad V_- = (V_I)_{\text{nom}} R_1 / (R_1 + R_2)$$

$$V_- = V_+ \Rightarrow (V_I)_{\text{nom}} = 6\text{V}$$

$$(I_I)_{\text{max}} = V_{BE} / R_{SZ} = 300\text{mA}$$

$$R_p = 100\Omega: (V_I)_{\text{nom}} / R_p = 6\text{V} / 100\Omega = 60\text{mA} < (I_I)_{\text{max}} \Rightarrow I_I = 60\text{mA}, \quad V_I = (V_I)_{\text{nom}} = 6\text{V}$$

$$R_p = 10\Omega: (V_I)_{\text{nom}} / R_p = 6\text{V} / 10\Omega = 600\text{mA} > (I_I)_{\text{max}} \Rightarrow I_I = (I_I)_{\text{max}} = 300\text{mA}, \quad V_I = R_p I_I = 3\text{V}$$

4. a)

$$\left. \begin{array}{l} V_{CC} - (I_B + I_C)R_C - I_B R_1 - V_{BE} - I_E R_E = 0 \\ I_C = \beta_F I_B \end{array} \right\} \Rightarrow I_C = \beta_F \frac{V_{CC} - V_{BE}}{R_1 + (1 + \beta_F)(R_C + R_E)} = 1\text{mA}$$

$$V_C = V_{CC} - \frac{\beta_F + 1}{\beta_F} I_C R_C = 6,95\text{V}$$

$$V_E = I_E R_E = \frac{\beta_F + 1}{\beta_F} I_C R_E = 5,05\text{V}$$

$$V_B = V_E + V_{BE} = 5,65\text{V}$$

b)

$$g_m = \frac{I_C}{V_T} = 40\text{mS}, \quad r_\pi = \frac{\beta_0}{g_m} = 2,5\text{k}\Omega$$

$$\left. \begin{array}{l} v_{be} = -v_g \\ v_p = -g_m (R_1 \parallel R_C \parallel R_P) v_{be} \end{array} \right\} \Rightarrow a_v = \frac{v_p}{v_g} = g_m (R_1 \parallel R_C \parallel R_P) = 98,11$$

c)

$$R_u = r_\pi \parallel R_E \parallel \frac{1}{g_m} = 24,6\Omega$$

$$R_i = R_C \parallel R_1 = 4,81\text{k}\Omega$$

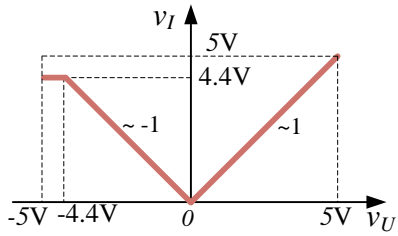
5. a)

$$v_U > 0 \Rightarrow \text{D OFF } v_I = v_U$$

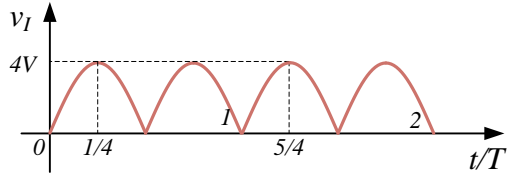
$$v_U \leq 0 \Rightarrow \text{D ON} - \text{postoji negativna povratna sprega } v_I = -v_U \text{ za } v_U \geq -v_{I_{\text{MAX}}}$$

$$v_{IOP} = v_I + V_D \Rightarrow v_{I_{\text{MAX}}} = V_{CC} - V_D = 4,4\text{V}$$

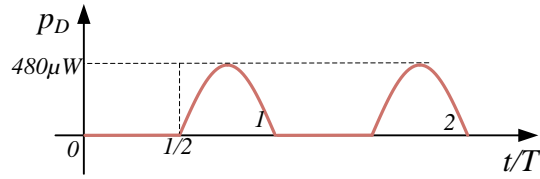
$$v_U \leq v_{I_{\text{MAX}}} \Rightarrow \text{operacioni pojačavač je u zasićenju} \Rightarrow v_I = v_{I_{\text{MAX}}} = V_{CC} - V_D = 4,4\text{V}$$



b)



$$c) \quad p_D(t) = \begin{cases} 0, kT \leq t \leq kT + \frac{T}{2} \\ -\frac{V_D V_m}{R} \sin(2\pi ft), kT + \frac{T}{2} \leq t \leq kT \end{cases}$$



$$P_D = \frac{1}{T} \int_{T/2}^T -\frac{V_D V_m}{R} \sin(2\pi ft) dt = \frac{V_D V_m}{RT} \frac{1}{2\pi f} \cos(2\pi ft) \Big|_{T/2}^T = \frac{V_D V_m}{R\pi} = 152.8 \mu\text{W}$$