

Punctul stabil de funcționare

Condiții: $\beta = 300$

$$-V_{BE} = |V_{BE}| = 0,6V = V_{BE}$$

- toate tranzistoarele din RA4

θ_1, θ_2 m.p.m. naturale $\Rightarrow I_{C1} = I_{C2}$

$$I_{C3} = I_{C1} + I_{C2}$$

$$V_{D3} + V_{D4} = V_{CE3} + I_{C3} R_8 \Rightarrow I_{C3} = \frac{0,6}{0,33} = 1,8 \text{ mA}$$

$$I_{C1} = I_{C2} = \frac{I_{C3}}{2} = 0,9 \text{ mA}$$

$$V_{EE} = I_B R_9 + 2V_{BE} \Rightarrow I_B = \frac{10 - 1,2}{6,8} - \frac{2,2}{6,8} = 1,294 \text{ mA}$$

$$\left. \begin{array}{l} \theta_1, \theta_2, \theta_3 \text{ sunt identice} \\ I_{C1} = I_{C2} \end{array} \right\} \Rightarrow V_{CE1} = V_{CE2} = V_{CE3}$$

$$V_{CC} - V_{EE} = I_{C1} R_4 + V_{CE1} + V_{CE3} + I_{C3} R_8$$

$$\Rightarrow V_{CE1} = V_{CE2} = V_{CE3} = \frac{V_{CC} - V_{EE} - I_{C1} R_4 - I_{C3} R_8}{2} = \frac{20 - 0,612 - 0,594}{2} = 9,397 \text{ V} \approx 9,4 \text{ V}$$

$$\theta_3 \text{ și } \theta_4 \text{ formează oglindă de curent} \Rightarrow \left\{ \begin{array}{l} I_{C3} = I_{C4} = 1,8 \text{ mA} \\ V_{CE3} = V_{CE4} = 9,4 \text{ V} \end{array} \right.$$

$$V_{CE7} = V_{CE4} + I_{C4} \cdot R_7 = 9,4 + 1,8 \cdot 0,33 = 9,994 \approx 10 \text{ V}$$

$$\Rightarrow V_{CE7} = 10,6 \text{ V}$$

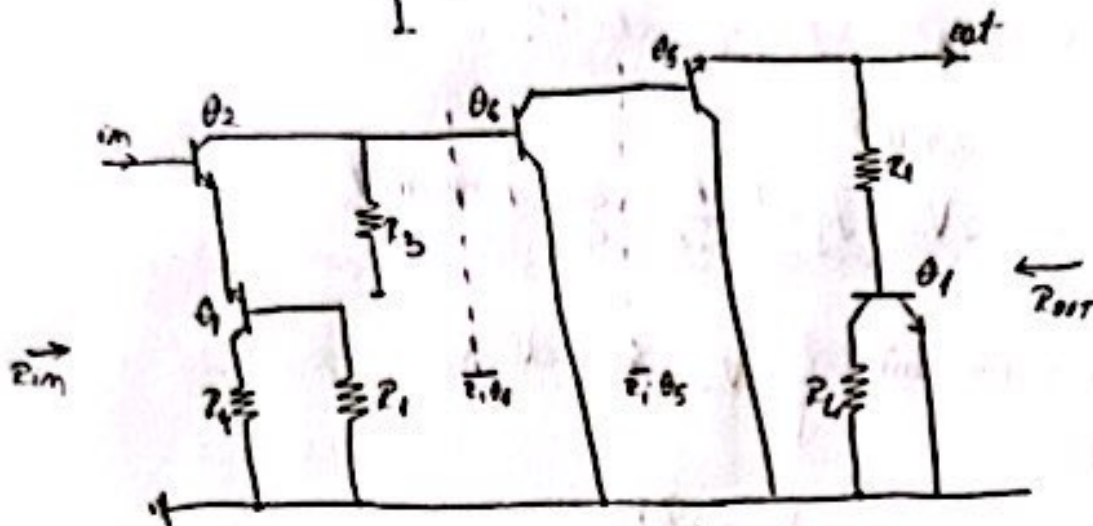
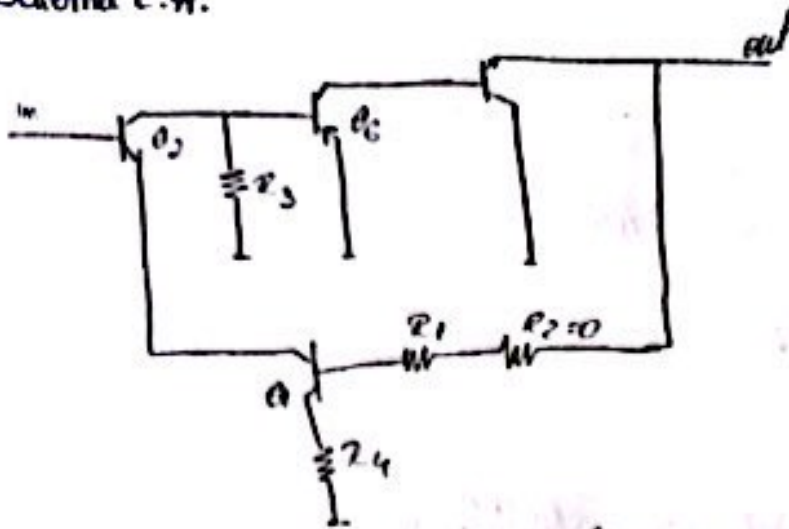
$$V_{CE5} = V_{CC} - V_{EE} - V_{CE7} = 20 - 10,6 = 9,4 \text{ V}$$

$$V_{CE6} = V_{CE5} = V_{CE5} - 0,6 \text{ V} = 9,4 - 0,6 \text{ V} = 8,8 \text{ V}$$

$$I_{mm} = \frac{2 \cdot A_{mm}}{R_L} = \frac{2 \cdot A_{mm}}{N} \cdot \frac{1}{f} = \frac{2 \cdot 0 \cdot \frac{1}{7}}{7} = 0$$

$$I_{max} = \frac{2 \cdot I_{max}}{R_{load}} = \frac{2 \cdot 1,4}{7} = 0,4 \text{ A}$$

Schema c.a.



$$g_{m1} = 40 I_1 = 40 \cdot 0,9 = 36 \frac{\text{mA}}{\text{V}} \Rightarrow h_{\pi 1} = \frac{\beta}{g_{m1}} = \frac{100}{36} = 2,77 \text{ k}\Omega$$

$$g_{m2} = 40 I_2 = 36 \frac{\text{mA}}{\text{V}} \Rightarrow h_{\pi 2} = 2,77 \text{ k}\Omega$$

$$g_{m5} = 40 I_5 = 40 \cdot 1,5 = 60 \frac{\text{mA}}{\text{V}} \Rightarrow h_{\pi 5} = \frac{100}{60} = 1,66 \text{ k}\Omega$$

$$g_{m6} = 40 I_6 = 40 \cdot 1,8 = 72 \frac{\text{mA}}{\text{V}} \Rightarrow h_{\pi 6} = \frac{100}{72} = 1,38 \text{ k}\Omega$$

$$A_{V2} = \frac{-\beta \cdot R_c}{h_{\pi 2} + (\beta + 1) R_E}$$

$$R_{E2} = \frac{(R_{\pi 1} + R_1) \cdot R_4}{R_1 + R_{\pi 1} + R_4} = \frac{(0,333 + 0,51) \cdot 0,68}{0,33 + 0,51 + 0,68} = \frac{0,971}{1,52} = 0,376$$

$$A_{V2} = \frac{-100 \cdot 0,68}{2,77 + 100 \cdot 0,376} = -1,67$$

$$A_{V6} = \frac{-\beta R_c}{R_{\pi 6} + (\beta + 1) R_E} ; R_E = 0 ; R_c = R_{\pi 6} + (\beta + 1) R_{E5}$$

$$R_{E5} = R_1 + R_{E1} = R_1 + R_{\pi 1} = 0,33 + 2,77 = 3,1 \Rightarrow R_c = 1,38 + 100 \cdot 3,1$$

$$R_c = 314,4 \text{ k}\Omega$$

$$a_{v6} = \frac{-100 \cdot 314,47}{1,38} = -22782,4$$

$$a_{v5} = \frac{(\beta_{H1}) R_{E5}}{R_{H5} + (\beta_{H1}) R_{E5}} \approx 1$$

$$R_{B01} = R_{B1} + (\beta_{H1}) R_{E1}; R_{E1} = 0 \Rightarrow R_{B01} = 2,77 \text{ k}\Omega$$

$$f_g = \frac{1}{V} = \frac{1}{R_{B1} + R_{B01}} \cdot \frac{1}{V_{B1}} = \frac{-1}{0,33 \cdot 2,77} = -0,32$$

$$R_{in1} = R_{B1} + R_{B01} = 0,33 + 2,77 = 3,1 \text{ k}\Omega$$

$$a_v = a_{v2} \cdot a_{v5} \cdot a_{v6} = -1,61 \cdot 1 \cdot (-22782,4) = 38056,6$$

$$a_v = \frac{V_{out}}{V_{in}} \cdot \frac{V_{in}}{I_{in}} = a_v \cdot R_{in}$$

$$R_{in} = R_{i02} = R_{H2} + (\beta_{H2}) R_{E2} = 2,77 + 100 \cdot 0,378 = 40,37 \text{ k}\Omega$$

$$a_v = 38056,6 \cdot 40,37 = 1,53 \cdot 10^3 \text{ k}\Omega \Rightarrow T = f_g \cdot a_v = 491,6 \text{ K}$$

$T < 0 \Rightarrow$ reacție pozitivă.