

## REŠENJA:

1. Beleške za predavanja, Povratna sprega, slajdovi 9, 10 i 11.

2. Beleške za predavanja, „9\_Izlazni\_pojacavacki\_stepeni.pdf“, slajdovi 10-11 (+ 6-8).

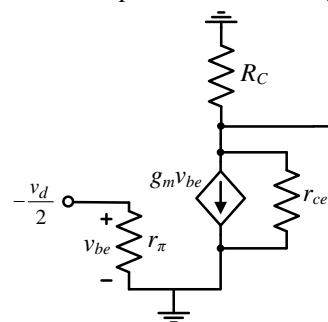
3. Beleške za predavanja, 13\_Regulator\_(stabilizator)\_napona.pdf, slajdovi 4, 5, 6.

4. a)  $v_1 = v_2 = 0$

Kako je kolo simetrično u mirnoj radnoj tački struja strujnog izvora se deli na dve jednake komponente. Tako da je struja kolektora tranzistora:

$$I_C = \frac{I_0}{2} = 1\text{mA}$$

b)  $g_m = \frac{I_C}{V_T} = 40\text{mS}$ ,  $r_\pi = \frac{\beta_0 V_T}{I_C} = 2.5\text{k}\Omega$ ,  $r_{ce} = \frac{V_A}{I_C} = 75\text{k}\Omega$



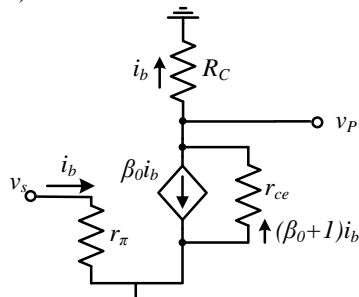
$$v_{be} = -\frac{v_d}{2}$$

$$v_p = -(R_C \parallel r_{ce})g_m v_{be} = v_d \frac{(R_C \parallel r_{ce})g_m}{2}$$

$$a_d = \frac{v_p}{v_d} = \frac{(R_C \parallel r_{ce})g_m}{2}$$

$$R_C = \frac{2a_d r_{ce}}{g_m r_{ce} - 2a_d} = 2.56\text{k}\Omega$$

c)



$$v_s = i_b r_\pi + (\beta_0 + 1)i_b r_{ce} + i_b R_C \Rightarrow i_b = \frac{v_s}{r_\pi + (\beta_0 + 1)r_{ce} + R_C}$$

$$v_p = i_b R_C \Rightarrow a_s = \frac{v_p}{v_s} = \frac{R_C}{r_\pi + (\beta_0 + 1)r_{ce} + R_C} = 3.38 \cdot 10^{-4}$$

$$\rho = \left| \frac{a_d}{a_s} \right| = 148048$$

d)

$$V_{CE} = V_{CC} - I_C R_C - (V - V_{BE}) \geq V_{CES}$$

$$V \leq V_{CC} - I_C R_C + V_{BE} - V_{CES} = 9.84\text{V}$$

5.

a)

$$v_X = v_A - R \frac{v_B - v_A}{R} = 2v_A - v_B$$

$$v_I = v_X - \left( \frac{v_B - v_A}{R} - \frac{v_X}{R_X} \right) R = \left( 3 + \frac{2R}{R_X} \right) v_A - \left( 2 + \frac{R}{R_X} \right) v_B$$

b)  $v_B = V_m \sin(2\pi ft + \pi) = -V_m \sin(2\pi ft) = -v_A$

$$v_I = \left( 5 + \frac{3R}{R_X} \right) v_A = \left( 5 + \frac{3R}{R_X} \right) V_m \sin(2\pi ft) \leq V_{CC} \Rightarrow R_X \geq \frac{3R}{\frac{V_{CC}}{V_m} - 5} = 15\text{k}\Omega$$