



**Ispit iz predmeta
OSNOVI ELEKTRONIKE
Modul US**

ZADACI

1. Zadatak 100%

Za izvor konstantnog napona sa Sl. 1 odrediti:

- jednosmerni napon na bazi tranzistora Q_1 ,
- jednosmernu struju kolektora tranzistora Q_3 i
- jednosmerni, izlazni napon, V_I .

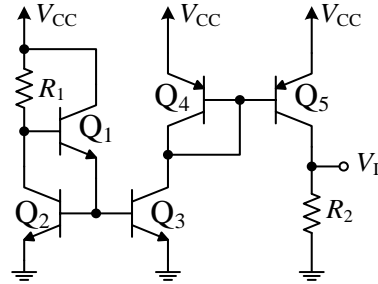
Poznato je:

$$R_1 = R_2 = 1k\Omega \text{ i } V_{CC} = 5V.$$

Tranzistori imaju sledeće parametre:

$$\beta_1 = 60, \beta_2 = \beta_3 = 100 \text{ i } \beta_4 = \beta_5 = 40.$$

Usvojiti da svi tranzistori imaju $|V_{BE}| = 0.7V$.



Sl. 1

$$a) V_{B1} = V_{BE1} + V_{BE3} = 1.4V \quad 20\%$$

$$b) I_{B1} = \frac{V_{CC} - V_{BE1} - V_{BE2}}{\left(1 + \frac{\beta_2}{2}(1 + \beta_1)\right)R} = 1.179\mu A; I_{B2,3} = \frac{(1 + \beta_1)I_{B1}}{2} = 35.988\mu A;$$

$$I_{C2,3} = \beta_{2,3}I_{B2,3} = 3.598mA \quad 40\%$$

$$c) I_{B4,5} = \frac{I_{C3}}{2 + \beta_{4,5}} = 85.686\mu A; I_{C4,5} = 3.427mA; V_I = I_{C5}R_2 = 3.427V \quad 40\%$$

2. Zadatak 100%

Za pojačavač sa Sl. 2 odrediti:

- parametre modela za male signale (r_o , g_m),
- naponsko pojačanje i
- ulaznu otpornost.

Poznato je:

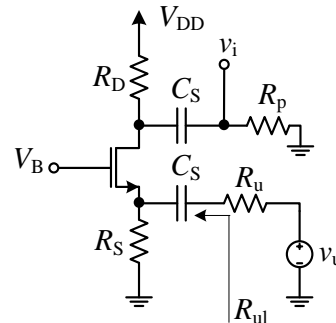
$$R_D = R_S = 10k\Omega, R_p = 10k\Omega, R_u = 50\Omega, V_{DD} = 3.3V \text{ i}$$

$$V_B = V_{DD}/2.$$

Tranzistor ima sledeće parametre:

$$A = 500\mu A/V^2, V_{TH} = 0.5V, V_A = 80V.$$

Usvojiti $C_S \rightarrow \infty F$.



Sl. 2

$$a) V_B = V_{GS} + I_D R_S \Rightarrow V_{ov} = V_{GS} - V_{TH} = 389.897mV; I_D = 760.102\mu A;$$

$$g_m = \frac{2I_D}{V_{ov}} = 389.897\mu S; r_o = \frac{V_A}{I_D} = 1.052M\Omega \quad 20\%$$

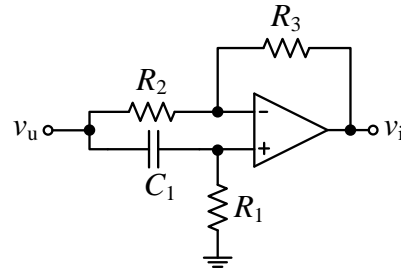
$$b) R_L = R_D \parallel \left[R_p = 5k\Omega; R_{TEV} = R_S \parallel R_u = 49.751\Omega; A_n = \frac{R_S}{R_S + R_u} \cdot \frac{(1 + \mu)R_L}{R_L + r_o + (1 + \mu)R_{TEV}} = 1.898 \quad 50\%$$

$$c) R_{ul} = \frac{r_o + R_L}{1 + \mu} \parallel R_S = 2.045k\Omega \quad 30\%$$

3. Zadatak 100%

Za filter sa Sl. 3 odrediti:

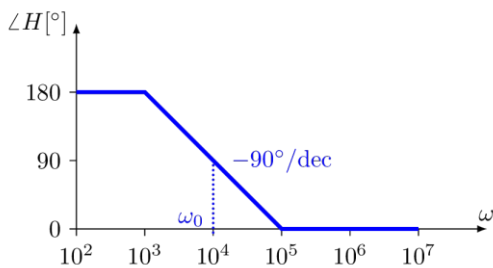
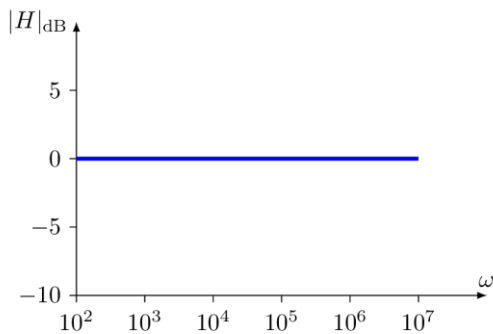
- prenosnu funkciju kola,
- skicirati amplitudsku karakteristiku,
- skicirati faznu karakteristiku i
- asimptotski nagib fazne karakteristike po dekadi.



Sl. 3

a) $H(s) = -\frac{R_3}{R_2} \cdot \frac{1 - sR_1C_1R_2}{1 + sR_1C_1} = -\frac{1 - sCR}{1 + sCR}$; $\omega_0 = \frac{1}{RC} = 10^4 \frac{rad}{sec}$; $H(s) = -\frac{1 - \frac{s}{\omega_0}}{1 + \frac{s}{\omega_0}}$ 50%

b) 20%, c) 20%



d) $-90^\circ/dec$ 10%

4. Zadatak 100%

Za regulator sa Sl. 4 odrediti:

- izlaznu otpornost i
- osetljivost.

Poznato je:

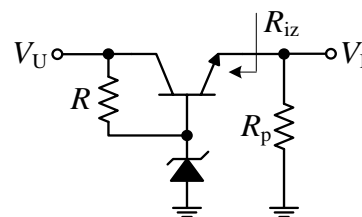
$R = 1.2k\Omega$, $V_U = 20V$ i $R_p = 200\Omega$.

Tranzistor ima sledeće karakteristike:

$\beta = 100$ i $V_{BE} = 0.7V$.

Karakteristike Zener diode su:

$V_{Z0} = 6.8V$ i $r_z = 5\Omega$.



Sl. 4

$V_I \approx V_{Z0} - V_{BE} = 6.1V$; $I_E = \frac{V_I}{R_p} = 30.5mA$; $I_B = \frac{I_E}{1 + \beta} = 301.98\mu A \Rightarrow r_\pi = \frac{V_t}{I_B} = 86.098\Omega$ 20%

a) $S_V = \frac{\Delta V_I}{\Delta V_U} = \left(1 + \frac{R}{r_z} + \left(1 + \frac{R}{r_\pi || r_z}\right) \cdot \frac{r_\pi}{(1 + \beta)R_p}\right)^{-1} = 4.13 \times 10^{-3}$ 60%

b) $R_{iz} = \frac{r_\pi + R || r_z}{1 + \beta} = 0.901\Omega$. 20%

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