Elektronski fakultet u Nišu
Katedra za Elektroniku
Predmet: OEU3O02, OET3O01

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Ispit iz predmeta
OSNOVI ELEKTRONIKE
Modul US i TEL

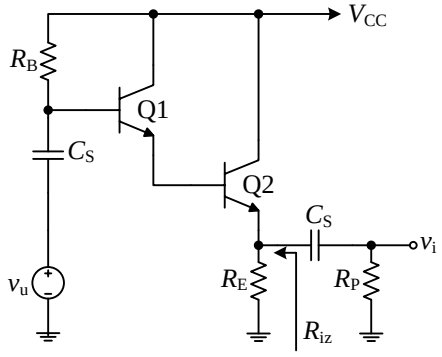
ZADACI

1. Zadatak

Za pojačavač sa Sl. 1 odrediti:

a) parametre modela za male signale (r_π, g_m),
b) naponsko pojačanje i
c) izlaznu otpornost pojačavača, R_{iz}.

Poznato je: R_B=100kΩ, R_E=1kΩ, R_p=1kΩ, V_{CC}=5V.
Tranzistori imaju sledeće parametre:
[β_1 =60, V_{BE1}=0.7V] i [β_2 =80, V_{BE2}=0.6V].
Smatrati da važi $V_A \to \infty$V i $C_S \to \infty$F.



Sl. 1

a) $I_{B1} = 0.734\,\mu A, I_{C1} = 44.039\mu A, I_{B2} = 44.773\mu A, I_{C2} = 3.581mA,$

$r_{\pi 1} = \frac{V_T}{I_{B1}} = 35.422k\Omega, g_{m1} = \frac{I_{C1}}{V_T} = 1.694mS, r_{\pi 2} = \frac{V_T}{I_{B2}} = 580.709\Omega, g_{m2} = \frac{I_{C2}}{V_T} = 137.762mS$ **30%**

b) $R_L = R_E||R_P = 500\Omega, A_n = \frac{(1+\beta_1)(1+\beta_2)R_L}{r_{\pi 1}+(1+\beta_1)(r_{\pi 2}+(1+\beta_2)R_L)} = 0.714$ **40%**

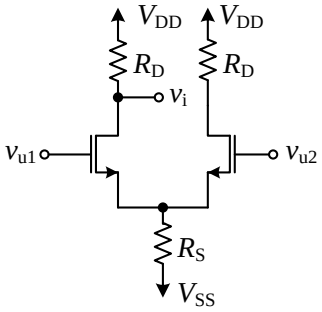
c) $R_{Q1} = \frac{r_{\pi 1}}{1+\beta_1} = 15.634k\Omega, R_{iz} = R_E||\frac{r_{\pi 2}+R_{Q1}}{1+\beta_2} = 166.796\Omega$ **30%**

2. Zadatak

Za diferencijalni pojačavač sa Sl. 2 odrediti:

a) parametre modela za male signale (r_o, g_m),
b) diferencijalno pojačanje, $A_d = v_i/(v_{u1} - v_{u2})$,
c) pojačanje srednje vrednosti, $A_{cm} = v_i/[(v_{u1} + v_{u2})/2]$ i
d) faktor potiskivanja srednje vrednosti u decibelima $CMRR_{dB}$.

Jednosmerna kompnenta ulaznih napona je $V_{U1} = V_{U2}$=0V.
Poznato je: R_D= 4kΩ, R_S= 1kΩ i $V_{DD} = -V_{SS}$ = 5V.
Tranzistori imaju sledeće parametre:
$A_1 = A_2$=500μA/V^2, $V_{TH1} = V_{TH2}$=1.5V i $V_{A1} = V_{A2}$=70V.



Sl. 2

a) $V_{ov} = V_{GS} - V_{TH} = 1.436V, I_D = 1.032mA, r_{o1,2} = \frac{V_A}{I_D} = 67.846k\Omega, g_{m1,2} = 1.436mS$ **30%**

b) $A_d = \frac{v_i}{v_{u1}-v_{u2}} = \frac{-g_m(r_o||R_D)}{2} = -2.713$ **30%**

c) $A_{cm} = \frac{v_i}{\frac{v_{u1}+v_{u2}}{2}} = -\frac{\mu R_D}{R_D+r_o+(1+\mu)2R_S} = -1.450$ **30%**

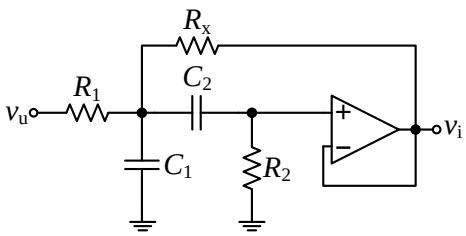
d) $CMMR_{dB} = 20\log_{10}\left(\left|\frac{A_d}{A_{cm}}\right|\right) = 5.438\,[dB]$ **10%**

3. Zadatak

Za aktivni, RC, filtar sa Sl. 3 odrediti:

a) izraz za prenosnu karakteristiku filtra, $T(s) = v_i/v_u$,
b) polove prenosne funkcije [ω_{p1}, ω_{p2}].
c) Koji tip filtra je u pitanju?

Operacioni pojačavač je idealan.



Poznato je:
$\boldsymbol{R_1}$= $\boldsymbol{R_2}$= $\boldsymbol{R_X}$= $\boldsymbol{R}$ =10kΩ, $\boldsymbol{C_1}$ = $\boldsymbol{C_2}$ = 10nF. Sl. 3

a) $T(s) = \frac{v_i}{v_u} = \frac{G\left(\frac{s}{\omega_n}\right)}{\frac{s^2}{\omega_n^2}+\frac{s}{\omega_n Q}+1}, G = \frac{1}{\sqrt{2}} = 0.707, \omega_n = \frac{\sqrt{2}}{RC} = 1.414 \times 10^4 rad/s, Q = \frac{\sqrt{2}}{3} = 0.471$ **50%**

b) $F = \frac{1}{2} + \frac{1}{2}\sqrt{1-4Q^2} = 0.667, \omega_{p1} = \frac{\omega_n Q}{F} = 10^4 \frac{rad}{sec}, \omega_{p2} = \frac{\omega_n F}{Q} = 2 \times 10^4 \frac{rad}{sec}$. **30%**

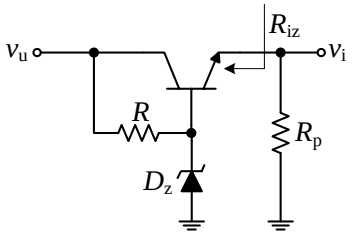
c) Propusnik opsega frekvencija (band-pass). **20%**

4. Zadatak

Za linearni regulator napona sa Sl. 4 odrediti:

a) izlazni, jednosmerni, napon, V_I,
b) faktor linijske regulacije (osetljivost, $\boldsymbol{S_V}$) i
c) izlaznu otpornost regulatora, $\boldsymbol{R_{iz}}$.

Poznato je: $\boldsymbol{R}$= 2kΩ, $\boldsymbol{R_p}$=100Ω, $\boldsymbol{V_U} \gg 3\boldsymbol{V_{Z0}}$.
Zener dioda ima sledeće parametre: $\boldsymbol{r_z}$=10Ω, $\boldsymbol{V_{Z0}}$=6.8V
Tranzistor ima sledeće parametre: $\boldsymbol{V_{BE}}$ = 0.7V, $\boldsymbol{\beta}$ =100.



Sl. 4

a) $V_I \approx V_{Z0} - V_{BE} = 6.1V,$ **20%**

$I_E = \frac{V_I}{R_p} = 0.61A, I_B = \frac{I_E}{1+\beta} = 603.96\mu A, I_C = \beta I_B = 0.604A, r_\pi = \frac{V_T}{I_B} = 43.05\Omega, g_m = \frac{I_C}{V_T} = 2.323S.$

b) $S_V = \frac{v_i}{v_u} = \frac{1}{1+\frac{R}{r_z}+\left(1+\frac{R}{r_z||r_\pi}\right)\cdot\frac{r_\pi}{(1+\beta)R}} = 4.95 \times 10^{-3}$ **50%**

c) $R_{iz} = \frac{r_\pi + R||r_z}{1+\beta} = 0.516\Omega$ **30%**

Predmetni nastavnik
dr Miljana Milić, docent
dr Marko Dimitrijević, docent
dipl. inž. Dejan Mirković, asistent