İ.T.Ü.
ELEKTRİK ELEKTRONİK FAKÜLTESİ

Soru	1	2	3	4	5	6	7	8	Topl
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Tarih : ../../..
Bölüm :
Ders :
No :
Adı,Soyadı :
İmzası :

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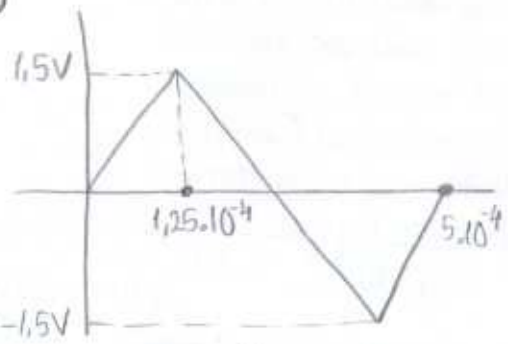
(1)



$k = \frac{\Delta V}{\Delta t} = \frac{1,5V}{1,25.10^{-4}} = 12000$

• $V_I = V_R + kt_s \Rightarrow kt_s = V_I - V_R = 5,05 - 5 = 0,05$

$kt_s = 0,05 \Rightarrow t_s = \frac{0,05}{12000} \simeq 4,17.10^{-6}$ sn

$t_s \leq 4,17$ µsn

•• $V_I = V_R + \sqrt{k^2 t_s^2 + 2k \frac{V_{omax} - V_{omin}}{K_{vo}.\omega_0}} \Rightarrow 0,15 = \sqrt{(0,05)^2 + 2.12000. \frac{12-(-10)}{K_{vo}.2\pi.f_0}}$

$0,0225 = 2,5.10^{-3} + \frac{24000.22}{K_{vo}.f_0.2\pi} \Rightarrow 0,02 = \frac{24000.22}{K_{vo}.f_0.2\pi} \Rightarrow K_{vo}.f_0 \simeq 4,2MHz \Rightarrow \boxed{K_{vo}.f_0 \geq 4,2MHz}$

•• $V_I = V_R + kt_s + k.\frac{V_{omax} - V_{omin}}{YE} \Rightarrow 0,15 = 0,05 + 12000.\frac{12-(-10)}{YE} \Rightarrow 0,1 = \frac{12000.22}{YE}$

$\Rightarrow YE = 2,64 V/\mu sn \Rightarrow \boxed{YE \geq 2,64 V/\mu sn}$

(2) a) $I_2 = \frac{V_{ref}}{R_1} \Rightarrow R_1 = \frac{V_{ref}}{I_2} = \frac{1,5V}{500mA} = 3\Omega \rightarrow \boxed{R_1 = 3\Omega}$

b) $R_{Lmax} = \frac{V_{CC} - V_{DSmin} - V_{ref}}{I_2}$, $V_{DSmin} = V_{GS} - V_T$, $I_D = \frac{k}{2}(V_{GS} - V_T)^2 (1 + \lambda V_{DS})$ (ihmal)

$\lambda V_{DS} \ll 1$ kabulü ile $\rightarrow V_{GS} - V_T = \sqrt{\frac{2I_D}{k}} = \sqrt{\frac{2.500.10^{-3}}{2}} \simeq 0,71V \rightarrow \boxed{V_{DSmin} = 0,71V}$

$R_{Lmax} = \frac{25V - 0,71V - 1,5V}{500mA} = 45,58\Omega \rightarrow \boxed{R_{Lmax} = 45,58\Omega}$

$R_0 = \mu K_{vo} R_1$, $\mu = g_m.r_{ds} \Rightarrow g_m = \sqrt{2I_D k} = \sqrt{2.5.10^{-1}.2} \simeq 1,41 A/V$, $r_{ds} = \frac{1}{\lambda I_D} = \frac{1}{0,01.5.10^{-1}} = 200\Omega$

devamı

$\mu = g_m \cdot r_{ds} = 1{,}41 \cdot 200 = 282 \Rightarrow A_{VO} = 282 \cdot K_{VO} \cdot 3 \geq 10^9 \Rightarrow K_{VO} \geq \frac{10^9}{282 \cdot 3} \cong 1{,}18 \cdot 10^6$

$$K_{VO} \geq 1{,}18 \cdot 10^6 \equiv 121{,}44\,dB$$

③ a) $I_d = I_b = \frac{V_I}{R} \Rightarrow t_d = t_b = C \cdot \frac{V_H}{I_d} = \frac{C \cdot V_H \cdot R}{V_I}$

$$t_d + t_b = \frac{2CV_HR}{V_I} \Rightarrow \boxed{f = \frac{V_I}{2CV_HR}}$$

$$V_H = 2 \cdot \frac{R_1}{R_2} \cdot V_{omax} \Rightarrow \boxed{f = \frac{V_I}{4RCV_{omax}} \cdot \frac{R_2}{R_1}}$$

b) $\frac{\partial f}{\partial V_I} = 2\,kHz/V \Rightarrow \frac{\partial f}{\partial V_I} = \frac{1}{2CV_HR} = 2\,kHz/V \Rightarrow R = \frac{1}{2 \cdot 47 \cdot 10^{-9} \cdot 2 \cdot 2 \cdot 10^3} \cong 2{,}66\,k\Omega$

$$\boxed{R = 2{,}66\,k\Omega}$$

$V_H = 2\,\frac{R_1}{R_2} \cdot (V_Z + V_D) \Rightarrow 2 = 2 \cdot \frac{R_1}{R_2} \cdot (4{,}7 + 0{,}6) \Rightarrow \frac{R_2}{R_1} = 5{,}3 \Rightarrow \boxed{\begin{matrix} R_1 = 1\,k\Omega \\ R_2 = 5{,}3\,k\Omega \end{matrix}}$

$R_6 = R_1 // R_2 = 1k // 5{,}3k \Rightarrow \boxed{R_6 = 0{,}84\,k\Omega}$

$R_5 = R \Rightarrow \boxed{R_5 = 2{,}66\,k\Omega}$

$R_8 = R_3 // R_3 = \frac{R_3}{2} \Rightarrow \boxed{R_8 = 5\,k\Omega}$

R_1	$1\,k\Omega$
R_2	$5{,}3\,k\Omega$
R_3	$10\,k\Omega$
R_5	$2{,}66\,k\Omega$
R_6	$0{,}84\,k\Omega$
R_8	$5\,k\Omega$