Compiti d'esame svolti

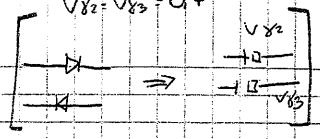
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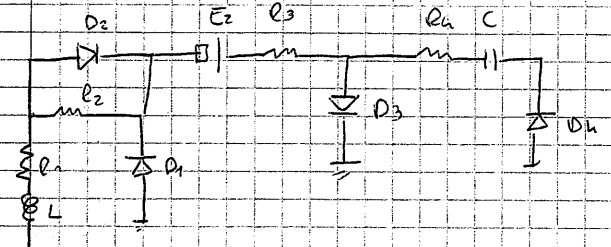
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13.1.17.

$V_{\gamma 2} = V_{\gamma 3} = 0{,}7$

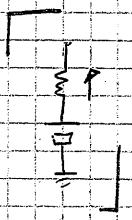


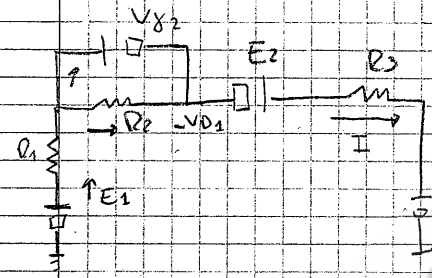
Es 1



$[L \to CC \quad C \to aperto]$ $\omega \to 0$ $j\omega L = 0$ $I_{D4} = \phi$ $\frac{1}{j\omega C} = \infty$

HP D2, D3 ON
D1 OFF





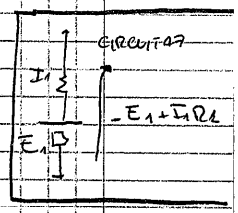
$I_{R2} = \frac{V_{\gamma 2}}{R_2} = 0{,}14\ mA$

$I_{R1} = I_{R3} = I_{D3} = \frac{E_1 + E_2 - V_{\gamma 2} - V_{\gamma 3}}{R_1 + R_3} = 0{,}40\ mA$

$E_1 + E_2 - V_{\gamma 2} - V_{\gamma 3} - I_{R1}(R_1 + R_3) = 0$

$-E_1 + R_1 I_1 + V_{\gamma 2} - E_2 + R_3 I_1 + V_{\gamma 3} = 0$

$I_1 = \frac{E_1 + E_2 - V_{\gamma 2} - V_{\gamma 3}}{R_1 + R_3}$



$+I_{R2} + I_{D2} = I_{R1}$

$I_{D2} = I_{R1} - I_{R2}$

$I_{D3} = 0{,}1\ mA$ OK D3 ON

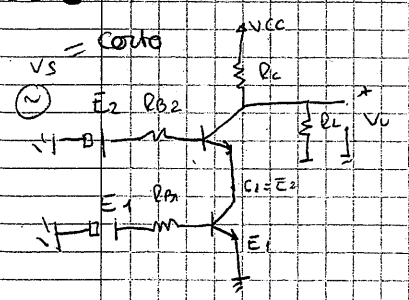
$I_{D2} = 0{,}26\ mA$ OK D2 on

$-E_1 + R_1 I_1 + V_{\gamma 2} - V_{D1} = 0 \longrightarrow -V_{D1} = E_1 - R_1 I_{R1} - V_{\gamma 2} = 3\ V$

$V_{D1} = -3\ V$ OK OFF $\Rightarrow I_{D1} = 0$

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Es 2 PUNTO RIPOSO



$[V_{TH} = V_{CC} \frac{R_2}{R_1 + R_2} \quad R_{TH} = R_1 // R_2]$

$[Vs \Rightarrow$ polo $\textcircled{2}]$

HP Q_1 Q_2 ZAD

$E_1 = R_B I_{B1} + V_{BE\,ON}$ $I_{B1} = \frac{E_1 - V_{BE\,ON}}{R_B} = \frac{4{,}7 - 0{,}7}{100} = 0{,}04\ mA$

$I_{C1} = \beta_1 I_{B1} = 4{,}8\ mA$

$I_{C1} = I_{E2}$ $I_{B2} = \frac{I_{E2}}{\beta_{E2} + 1} = 47{,}525\ \mu A$ $I_{C2} = \beta_{E2} I_{B2} = 4{,}753\ mA$

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devo mettere la water

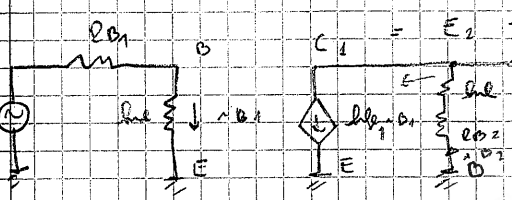
$V_{CE1} = V_{C1} - V_{E1} \quad V_{E1} = 0$

$V_{CE1} = V_{C1} = E_2 - R_{B2} I_{B2} - V_\gamma = 1,258\ V$

$V_{CE2} = V_{C2} - V_{C1} = V_{TH} - R_{TH} I_{C2} - V_{C1} = 2,581\ V$

ES)

cambio per piccoli segnali



non ho zeri ne la parte del condensatore

$i_{b1} = \frac{V_S}{R_{B1} + h_{ie}}$

$+ h_{fe1} \cdot i_{b1} - h_{fe2} \cdot i_{b2} - i_{b2} = 0$

$i_{b2}(h_{fe2} + 1) = h_{fe1} \cdot i_{b1} \qquad i_{b2} = \frac{h_{fe1}}{h_{fe2} + 1} \cdot i_{b1}$

$V_U = - h_{fe2} \cdot i_{b2} \cdot \frac{R_{TH}}{R_{TH} C s + 1}$

$V_U = - \frac{h_{fe2}\, h_{fe1}}{h_{fe2} + 1} \cdot \frac{V_S}{R_{B1} + h_{ie}} \cdot \frac{R_{TH}}{R_{TH} C s + 1}$

$A_V(s) = A_{V0} \frac{1}{1 + \frac{s}{\omega_p}}$

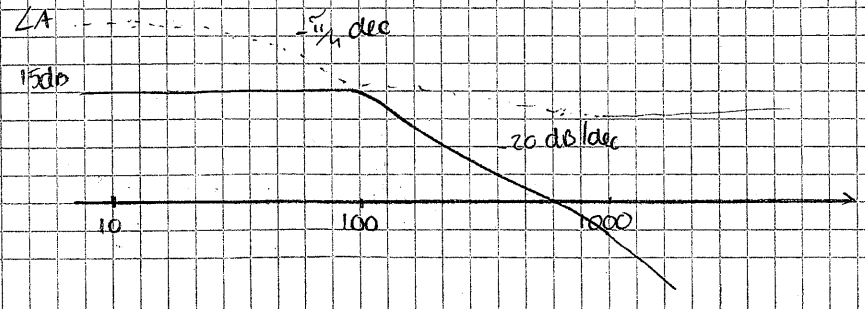
$A_V(s) = A_{V0} \frac{\omega_p}{\omega_p + s}$

$\omega_p = \frac{1}{R_{TH} C} = 100\ rad/s$

A_{V0} C → aperto

$V_U = - R_{TH}\, h_{fe2} \cdot i_{b2}$

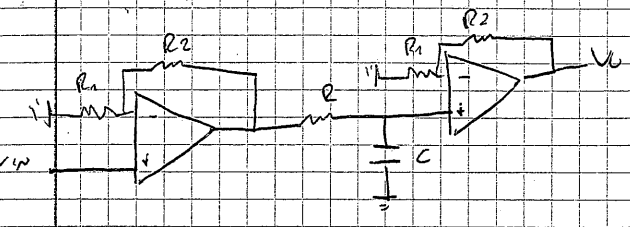
$V_U = - R_{TH} \frac{h_{fe2}\, h_{fe1}}{h_{fe2} + 1} \cdot \frac{V_S}{(R_{B1} + h_{ie})} = -5,703 \rightarrow 15,1\ dB$



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ES 4

PASSA BASSO $\omega_p = 5$ krad/s guadagno $= 40$ dB $\rightarrow A_0 = 100$ lo prendo in modulo



$\frac{1}{R_1} + \frac{R_2}{R_1} = 10$ $\quad R_2 = 9\,k\Omega$ $\quad R_1 = 1\,k\Omega$

$20 \log_{10} x = 40$

$\frac{1}{RC} = 5$ krad/s $\quad RC = 200\,\mu s$ $\quad C = 100\,nF$ $\quad R = 2\,k\Omega$

$\log_{10} x = 2 \quad 10^2 = x \quad 100 = x$

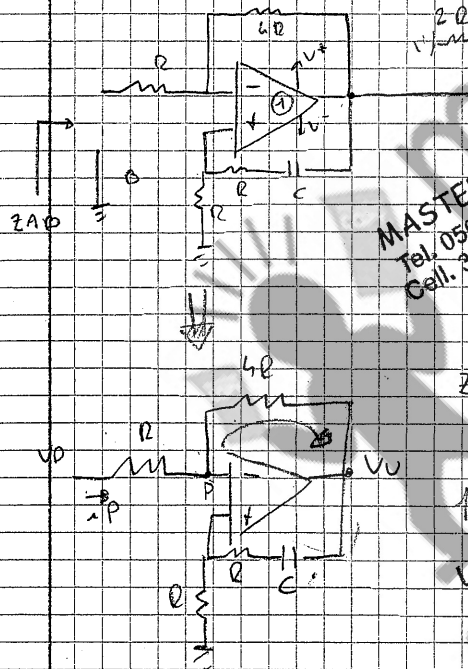
$n \cdot k = 10^{-9} \cdot 10^{3} = 10^{-6}$

$C = F$

ES 5

Ricavare Z_{AB} OP-AMP 1 ideale

OP-AMP 2 $R_{IN} = 50\,M\Omega$ $R_{out} = 20\,\Omega$ $\omega_p = 30$ rad/s $A_0 = 100$ dB



[il secondo modulo non ha alcun effetto sulla Z_{AB}]

$V_p - V_u = 4RI$

$V_p = V_u + 4RI$

$Z_{AB} = \frac{V_p}{I}$ $\quad \mu_p = \frac{V_p - V_u}{5R}$ $\quad \mu = \frac{V_u}{2R + \frac{1}{Cs}}$

Poi il CCV $V^+ = V^-$ $\quad V^- = V_u - 4R \cdot \mu_p$

$V^+ = V_u \frac{R}{2R + \frac{1}{Cs}}$ $\quad V^- = V_u + 4R \cdot \mu_p$

$V_u \frac{R}{2R + \frac{1}{Cs}} = V_u + 4R \frac{V_p - V_u}{5R}$ $\quad V^- - V_u = 4R \cdot \mu_p$

$V^- = V_u + 4R \cdot \mu_p$

$V_u \frac{R}{2R + \frac{1}{Cs}} = \frac{5V_u + 4V_p - 4V_u}{5}$ $\quad V_u \left(\frac{RCs}{2RCs + 1} - \frac{1}{5} \right) = V_p \frac{4}{5}$

$RC = \frac{1}{\omega_0}$

$V_u \frac{5RCs - 2RCs - 1}{2RCs + 1} = 4V_p$ $\quad V_u \frac{(3RCs - 1)}{(2RCs + 1)4} = V_p$ $\quad \mu_p = \frac{V_p}{5R} \frac{-5RCs - 5}{3RCs - 1}$

$\frac{-\frac{5s}{\omega_0} - 5}{\frac{3s}{\omega_0} - 1} = \frac{-5s - 5\omega_0}{3s - \omega_0} = \frac{\omega_0 + s}{\omega_0 - 3s} R$ $\quad$ [IN DC $Z_{AB} = R$]

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