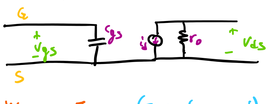
24.03.22

Thursday, 24 March 2022 1:46 PM

Credits: Μάριος Ρόζος



$L = 100\,nm$ $\mu_n = 450\,cm^2/Vs$

$C_{gs} = 1pF$ $i_d = 5mA$

$t_{ox} = 8nm$ $\varepsilon_0 = 8.85\,pF/m$

$v_{gs} = 10mV$ $r_o = 1\,k\Omega$

$\varepsilon_{ox} = 4\varepsilon_0$

$W = ;$ $I_D = ;$ (περιοχή κορεσμού)

$V_{ov} = ;$ $V_A = ;$

α) Στην περιοχή κορεσμού ισχύει: $C_{gs} = \frac{2}{3} WL\,C_{ox} \Rightarrow$

$\Rightarrow W = \frac{3}{2} \frac{C_{gs}}{L \cdot C_{ox}}$

$C_{ox} = \frac{\varepsilon_{ox}}{t_{ox}} = \frac{4\varepsilon_0}{t_{ox}} = \dots$

$\Rightarrow W = 3.389\,\mu m \approx 3.390\,\mu m$

β) Είναι $g_m = \frac{\mu_n C_{ox} W}{L} V_{ov} \Rightarrow V_{ov} = \frac{g_m L}{\mu_n C_{ox} W}$

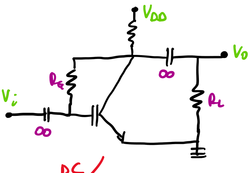
$g_m = \frac{i_d}{v_{gs}} = 0,5\,mho$

$\Rightarrow \boxed{V_{ov} = 74mV}$

γ) $I_D = \frac{1}{2} \mu_n C_{ox} \frac{W}{L} V_{ov}^2 \Rightarrow \boxed{I_D = 18.16mA}$

δ) $r_o = \frac{V_A}{I_D} \Rightarrow \boxed{V_A = 18,6V}$

Άσκηση

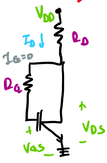


Δίνονται: V_{DD}, R_D, R_L, R_G πολύ μεγάλη

$V_t, K_n, \frac{W}{L}, V_A$

$I_D = ;$ $V_{ov} = ;$ (DC) $A_v = ;$ (AC)

DC



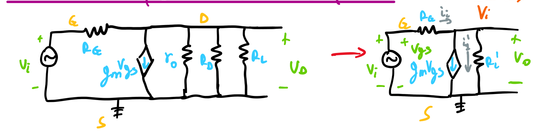
$V_{DS} = V_{GS}$ (γιατί $I_G = 0$)

κορεσμός

$I_D = \frac{1}{2} K_n (V_{GS} - V_t)^2$

$V_{DS} = V_{DD} - I_D R_D$

AC ισοδύναμο ασθενούς σήματος $A_V = \frac{V_2}{V_i} = ;$



$R_L' = R_L // R_D // r_o$

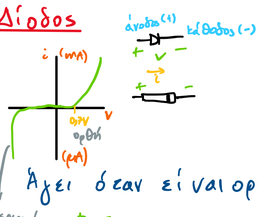
$v_o = i_i' R_L'$ (1)

$i_i' = i_i - g_m v_{gs}$ (2)

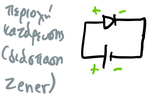
$i_i = \frac{v_i - v_o}{R_G}$ (3)

(1) (2) (3) $\Rightarrow A_v = -g_m R_L' \frac{1 - (1/g_m R_G)}{1 - R_L'/R_G} \approx -g_m R_L'$

Δίοδος

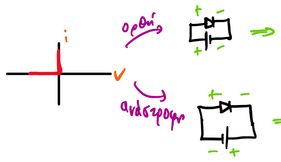


Άγει όταν είναι ορθά πολωμένη



Μονές διόδου

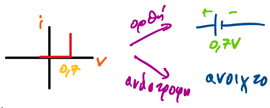
Ιδανική



ορθή ⇒ βραχυκύκλωμα

ανάστροφη ⇒ ανοιχτοκύκλωμα

Σταθερής πτώσης τάσης

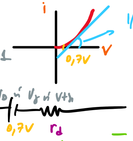


Εκθετικό μοντέλο

$i = I_S (e^{\frac{v}{nV_T}} - 1)$ n=1

$i = I_S (e^{v/V_T} - 1)$ I_S εκατ.

$i = I_S e^{v/V_T}$



$(i_D = i \;\; v_D = v)$

όπου $r_d = \frac{1}{\left[\frac{\partial i_D}{\partial v_D}\right]_{i_D = I_D}}$

Zener (περιοχή καταρρεύσης ή διάσπασης)