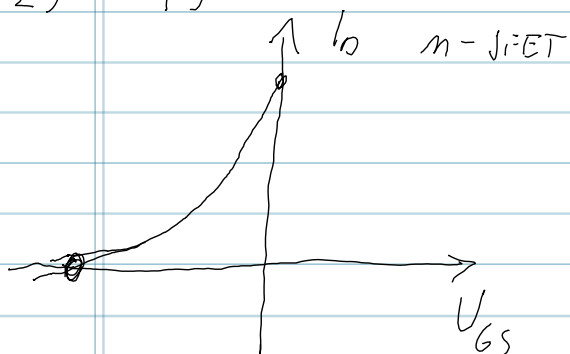
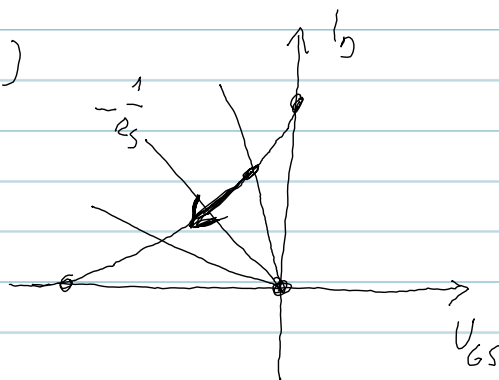


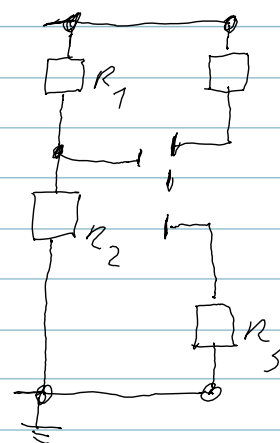
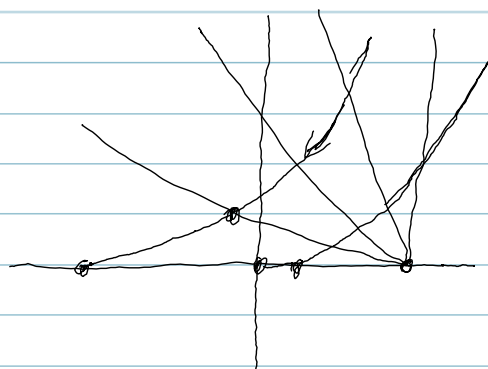
- 1) 3)  
2) 4)



5)

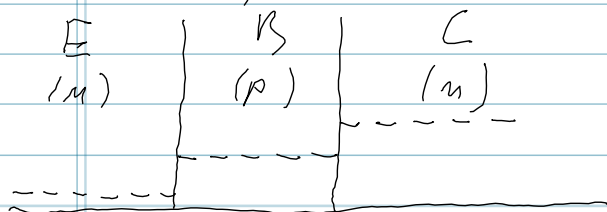


6)



7)

8) mpm, NAP

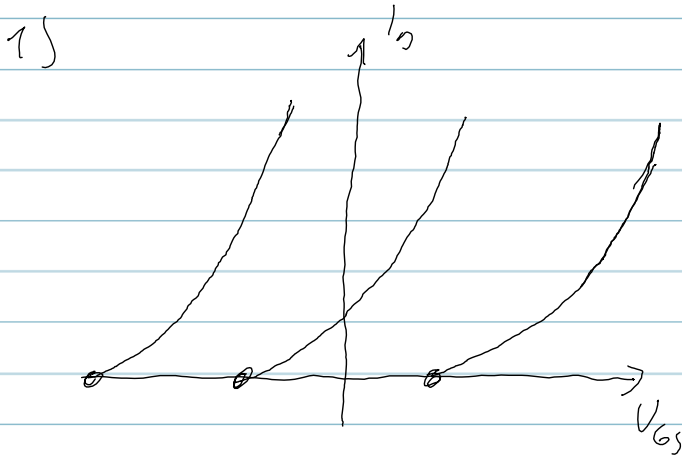


$$P_{OE} = \frac{n_i^2}{N_{DE}}$$

$$\mu = \frac{I_{ME}}{I_{ME} + I_{PE} \text{ (circled) } E}$$

$$N_{DE} \nearrow = I_{PE} \searrow$$

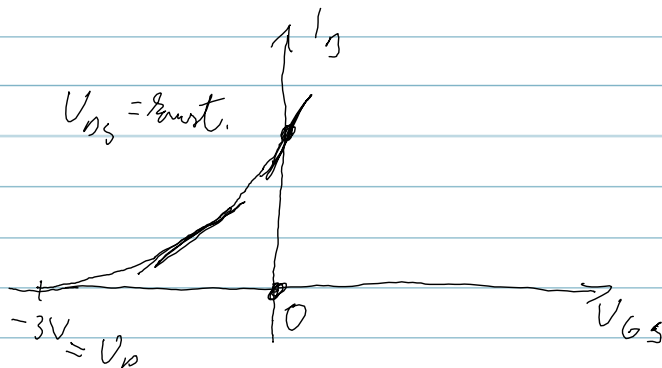
2006 - 2007



2)

МОДЕЛЬ

3)  $V_p = -3V$



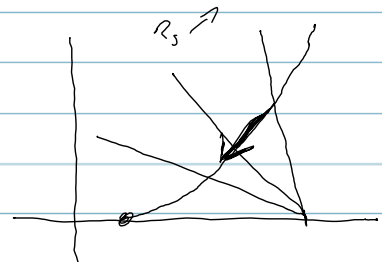
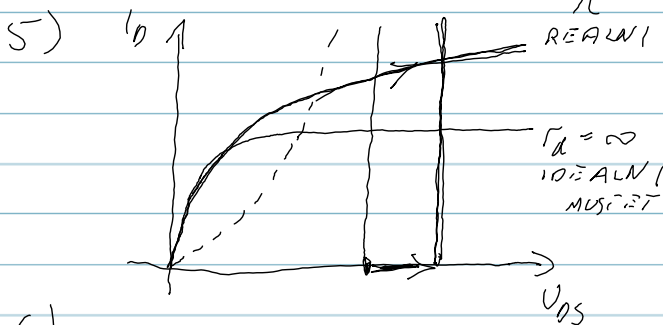
$$V_{DS} = V_{GS} - V_p \quad 2 = V_{GS} + 3$$

$$V_{GS} = -1V$$

МОДЕЛЬ

$$V_{DS} = V_{GS} - V_{GS0}$$

4)  $g_{m1} \rightarrow g_{m2} \quad r_{ds} = r_{dc}$



6)

$$V_{DS} = V_{DD} - I_D (R_{D1} + R_s)$$

7)  $y = A + (B + C)DE$       8)  $y = A(B + C + D + E)$

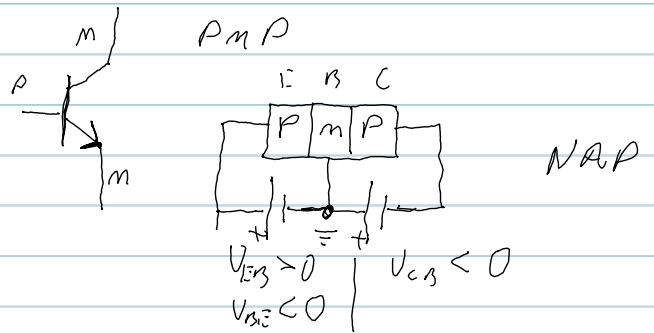
9) ЗАДАЧА

10)  $Q_N = q S \frac{(m_{B0} + m_{Bv}) W_B}{2}$

$$\frac{Q_N}{S} = \frac{1.6 \cdot 10^{-19} \cdot 12 \cdot 10^3}{2} = 0.6 \frac{mAs}{cm^2}$$

2007 - 2008

1) 2) 3) 4) 5) 6) 7) 8)



$$V_{EB} = V_E - V_B = -V_2 - (-V_1)$$

$$V_{PM}$$

$$V_{CB} = V_C - V_B = 0 - (-V_1) = V_1 > 0$$

$$= V_{PM}$$

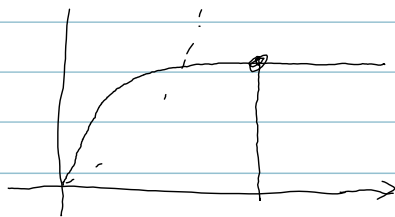
2006 - 2007

ZADACI

1) 1.1 a

$$1.2 \quad U_{DS} \rightarrow U_{GS} - U_{GS0}$$

$$= 2.25 - 0.75 = 1.5 < 2V$$



$$I_D = \frac{k}{2} (U_{GS} - U_{GS0})^2$$

$$g_m = k (U_{GS} - U_{GS0}) = 0.666 \frac{mA}{V}$$

$$k = \frac{2 I_D}{(U_{GS} - U_{GS0})^2} = \frac{2 \cdot 0.5 \cdot 10^{-3}}{(2.25)^2} = 0.44 \frac{mA}{V^2}$$

$$1.4 \quad U_{DS} = U_{GS} - U_{GS0}$$

$$2 \quad 3 - 0.75$$

$$2 < 2.25$$

IZ ODRNO PUD. RADJA

$$I_D = k \left[ (U_{GS} - U_{GS0}) \cdot U_{DS} - \frac{U_{DS}^2}{2} \right] = 1.11 mA$$

$$1.5) \quad g_m = k U_{DS} = 0.888 \frac{mA}{V}$$

$$r_d = \frac{1}{g_d} \quad g_d = k (U_{GS} - U_{GS0}) - k U_{DS}$$

2) 2.1  $I_{DQ} = 2.41 \text{ mA}$   
ZAS.

$$I_{DQ} = \frac{\mu}{2} (V_{GS} - V_{GS0})^2$$

$$V_{GS} = \pm \sqrt{\frac{2I_{DQ}}{\mu}} + V_{GS0}$$

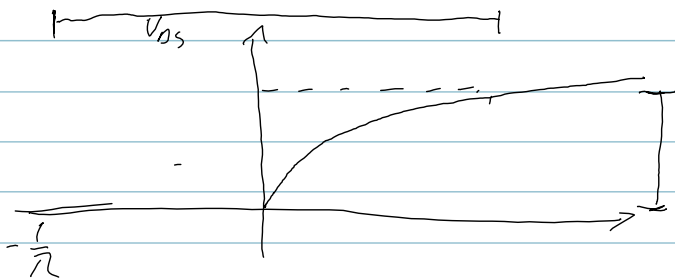
$$= \pm 1.48 + 1.05 = 2.53 \text{ V}$$

$$V_{GG} = V_{GS} + I_D \cdot R_S$$

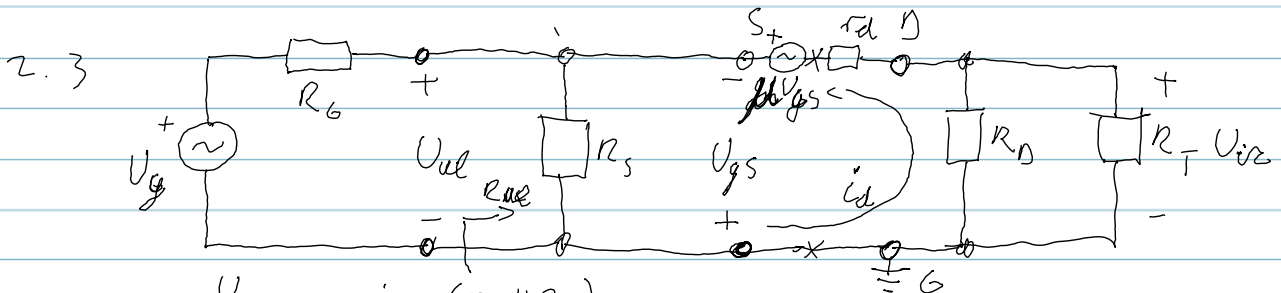
$$\frac{V_{DD}}{R_1 + R_2} \cdot R_2 = V_{GS} + I_D \cdot R_S \quad R_S = 679 \Omega$$

2.2  $g_m = \mu (V_{GS} - V_{GS0})$

$$I_D = \frac{\mu}{2} (V_{GS} - V_{GS0})^2 (1 + \mu V_{GS})$$



$$r_d = \frac{1}{\mu} = \frac{1}{\mu} + V_{GS}$$



$$A_v = \frac{U_{U2}}{U_{U1}} = \frac{-i_d \cdot (R_D \parallel R_T)}{-V_{GS}}$$

$$= \frac{(1 + \mu) \cdot (R_D \parallel R_T)}{r_d + R_D \parallel R_T}$$

$$i_d = \frac{(1 + \mu) V_{GS}}{r_d + R_D \parallel R_T}$$

$$\mu = g_m \cdot r_d$$

$$2.4 \quad R_{ul} = R_s \parallel \frac{\cancel{+U_{gs}}}{+i_d}$$

$$= R_s \parallel \frac{r_d + R_D \parallel R_T}{1 + \mu}$$

$$2.5 \quad R_{iz} = R_D \parallel \left[ r_d + (R_g \parallel R_s) (1 + \mu) \right]$$

$S \Rightarrow D$   
Mittelwert

3) 3.1 n p n N A P

$$3.2 \quad P_{EO} = P_{OE} \cdot \exp\left(\frac{U_{BE}}{U_T}\right)$$

$$U_{BE} = U_T \ln \frac{P_{EO}}{P_{OE}} \quad T = 300 K$$

$$3.3 \quad I_E = -(I_{PE} + I_{ME})$$

$$I_E < 0$$

$$I_B, I_C > 0$$

$$I_{ME} = q S D_{MB} \frac{N_{PB} - N_{BV}}{W_B}$$

$$I_{PE} = q S D_{PE} \frac{P_{EO} - P_{OE}}{W_E}$$

$$3.4 \quad I_B > 0$$

$$I_B = I_E + I_{PE} - I_{BO}$$

$$3.5 \quad I_E = -2 \text{ mA} \quad I_C = 1.99 \text{ mA}$$

$$\beta = \frac{I_C}{I_B}$$

$$I_E + I_C + I_B = 0$$

$$I_B = -I_E - I_C = 0.01 \text{ mA}$$

$$\beta = \frac{1.99 \text{ mA}}{0.01 \text{ mA}}$$

$$\beta = \frac{\alpha}{1 - \alpha}$$

$$\alpha = \beta \cdot \beta^*$$