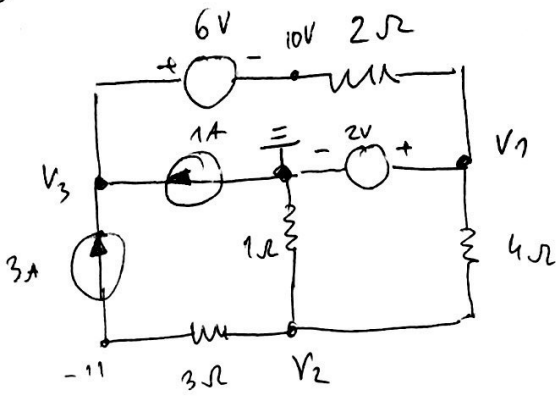


①



$$V_1 = 2V$$

$$\frac{V_3}{2} - \frac{V_1}{2} = 7$$

$$\boxed{V_3 = 16V}$$

$$V_2 \left(\frac{1}{1} + \frac{1}{4} \right) - \frac{1}{4} V_1 = -3 \quad | \cdot 4$$

$$5V_2 - V_1 = -12$$

$$5V_2 = -10 \quad \boxed{V_2 = -2V}$$

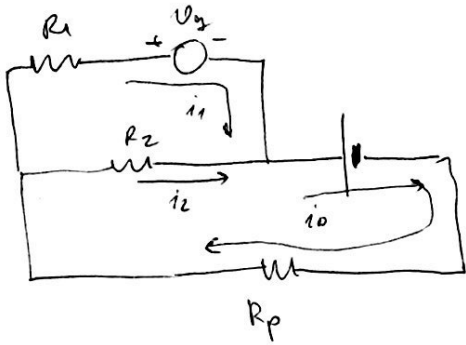
$$16 + 11 = 27$$

$I_C = 2A$	$P_{1A} = 16W$
$I_D = -3A$	$P_{6V} = -24W$
$I_B = 1A$	$P_{2V} = -6W$
$I_A = 4A$	$P_{3A} = 27 \cdot 3 = 81W$

$$V_T = 4V \quad R_T = \text{~~10~~} = 1\Omega$$

2

$U_y = -12V$ $D_2: ON$ $D_1: OFF$



$i_1 + i_2 = i_0$ $i_1 = i_0 - i_2$

$V_D + i_2 R_2 + i_0 R_p = 0$

$i_2 = - \frac{i_0 R_p + V_D}{R_2}$

$U_{D1} = V_D + U_y < V_D$

$i_1 + U_y + i_1 R_1 - i_2 R_2 = 0$

$U_y + i_0 R_1 - i_2 R_1 - i_2 R_2 = 0$

$U_y + i_0 R_1 + 2 \cdot \frac{i_0 R_p + V_D}{R_2} R_2$

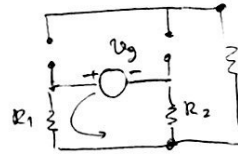
$i_0 \cdot R + 4 i_0 R + U_y + 2 V_D = 0$

$i_{D2} = - \frac{U_y + 2V_D}{5R} > 0$ $\Rightarrow U_y = -2V_D$ $D_2 \rightarrow OFF$

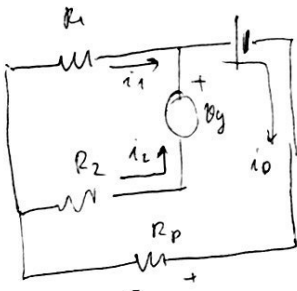
$U_p = i_0 \cdot R_p = - \frac{2}{5} U_y - 0,56$ 1°

$U_p = 0V$ 2°

$\frac{U_y}{2R} = i$ $U_y = 2iR$



$i \cdot R_1 = U_{D1} = \frac{U_y}{2}$ $\Rightarrow U_y = 2V_D$ $D_1 \rightarrow ON$



$i_0 = i_1 - i_2$ $i_1 = i_0 + i_2$

$i_0 \cdot R_p + V_D - U_y + i_2 R_2 = 0$

$i_2 = \frac{U_y - V_D - i_0 R_p}{R_2}$

$U_y + i_1 R_1 - i_2 R_2 = 0$

$U_{D2} = V_D - U_y < V_D$

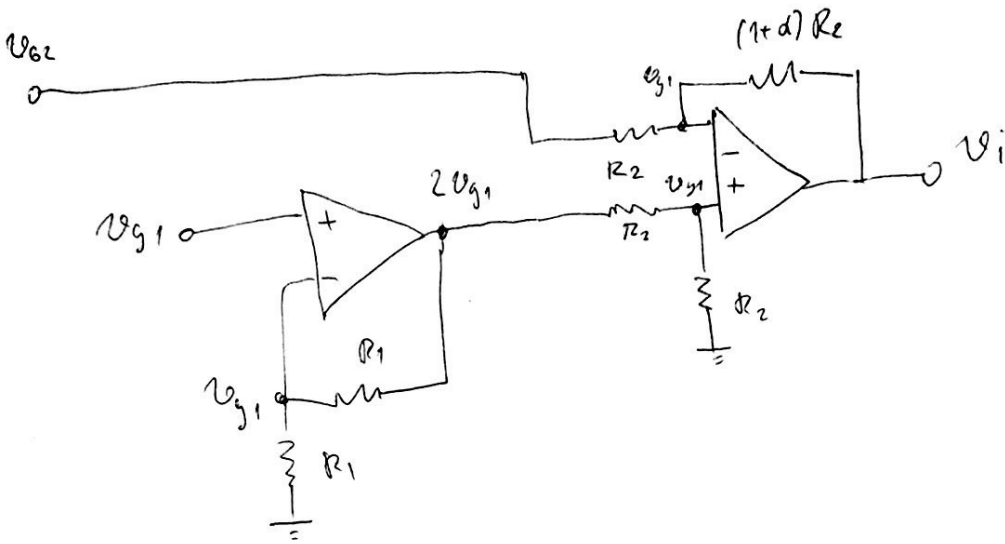
$U_y + i_0 R_1 - i_2 R_1 - i_2 R_2 = 0$

$U_y + i_0 \cdot R - 2U_y + 2V_D + 2i_0 R_p = 0$

$5i_0 R = U_y - 2V_D$

$i_0 = \frac{U_y - 2V_D}{5R}$

$U_p = \frac{2}{5} U_y - 0,56$ 3°



$$\frac{v_{G2} - v_{G1}}{R_2} = \frac{v_{G1} - v_i}{(1+d)R_e}$$

$$(1+d)v_{G2} - (1+d)v_{G1} = v_{G1} - v_i$$

$$v_i = v_{G1}(2+d) - (1+d)v_{G2}$$

$$a_d = \frac{2+d+1+d}{2} = \frac{3}{2} + d$$

$$a_s = 2+d - 1-d = 1$$

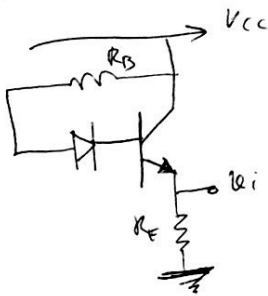
$$\boxed{\rho = \frac{3}{2} + d}$$

$$v_i = (1+d)(v_{G1} - v_{G2}) + v_{G1}$$

$$v_{G1} - v_{G2} = -3\text{mV} + 1\text{mV} \sin \omega t$$

$$v_i = (1+d)(-3\text{mV} + 1\text{mV} \sin \omega t) + 1\text{mV} + 2\text{mV} \sin \omega t$$

④



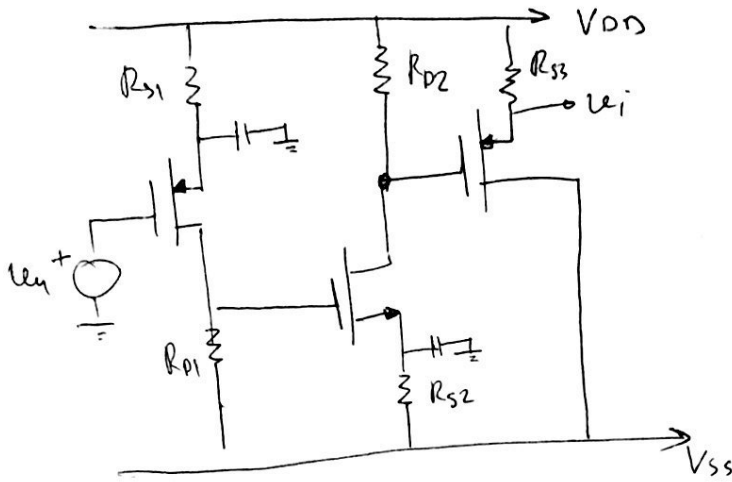
$$V_{CC} - i_B R_B - V_D - V_{BE} - i_B (1+\beta) R_E = 0$$

$$i_B = \frac{V_{CC} - V_D - V_{BE}}{R_B + (1+\beta) R_E} = 189,05 \mu\text{A}$$

$$i_C = 18,905 \text{ mA} \quad i_E = 19,09 \text{ mA}$$

$$V_E = 1,9 \text{ V} \quad V_B = 2,5 \text{ V} \quad V_C = 5 \text{ V}$$

$$V_{CC \text{ min}} = 1,2 \text{ V}$$



$R_{S3} = 5 \text{ k}\Omega$

$V_{S63} = \sqrt{\frac{2I}{B_3}} + V_t = 1,407$

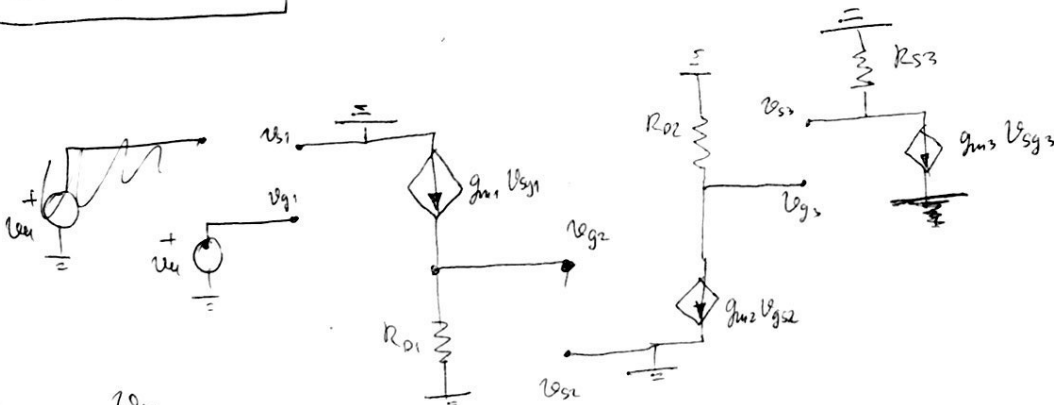
$V_{S3} = 0V \quad V_{G3} = -1,407$

$g_{m1} = g_{m2} = 2 \text{ mS}$

$R_{D2} = 6407 \Omega$
 $R_{S1} = 3,3 \text{ k}\Omega$

$V_{S61} = \sqrt{\frac{2I}{B_1}} + V_t = 1,7V$

$g_{m3} = 2,828 \text{ mS}$



$u_{sg1} = -u_i$

$u_{g2} = -g_{m1} R_{D1} \cdot u_i$

$u_{g3} = -g_{m2} \cdot u_{g2} R_{D2} = g_{m1} g_{m2} \cdot R_{D1} \cdot R_{D2} \cdot u_i$

$u_{S3} = -g_{m3} u_{sg3} \cdot R_{S3}$

$u_{sg3} u_{S3} (1 + g_{m3} R_{S3}) = g_{m3} R_{S3} u_{g3}$

$u_{S3} = \frac{g_{m3} R_{S3} u_{g3}}{1 + g_{m3} R_{S3}}$

$u_i = \frac{g_{m1} g_{m2} g_{m3} \cdot R_{D1} R_{D2} R_{S3}}{1 + g_{m3} R_{S3}} \cdot u_o$

$a = 100$

$R_{D1} = \frac{100 (1 + g_{m3} R_{S3})}{g_{m1} g_{m2} g_{m3} \cdot R_{D2} R_{S3}} = 4178 \Omega$

$V_x - V_{SS} = R_D \cdot I$

$V_x = I R_D + V_{SS} = -0,822V = V_{G2}$

$R_{S2} = 2778 \Omega$

$V_{G2} - V_{S2} = \sqrt{\frac{2I_0}{B_2}} + V_t$

$V_{S2} = V_{G2} - \sqrt{\frac{2I_0}{B_2}} - V_t = -2,522V$