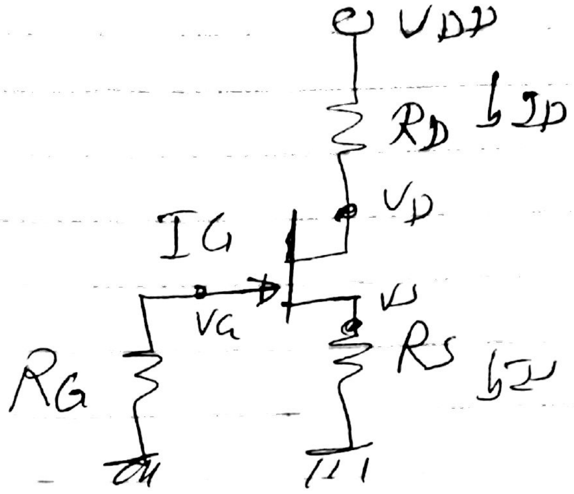
2 Self Biasing



$I_G = 0$

$\therefore 0 - V_G = I_G R_G \to 0$

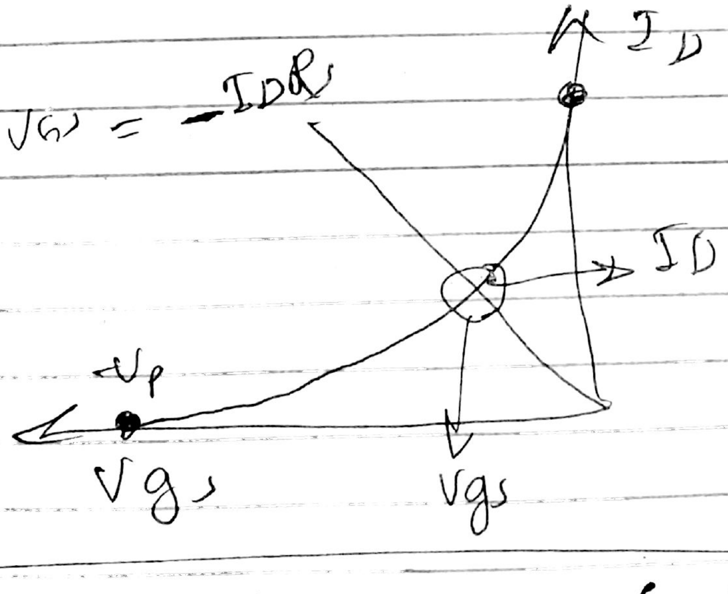
$\therefore V_G = 0$

$V_{GS} = V_G - V_S = 0 - I_S R_S = -I_S R$

& $I_D = I_S$

$\therefore V_{GS} = -I_D R_S$ → (معادلة خط مستقيم) 1

$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$ معادلة منحنى 2



تقاطع المعادلة 1 مع المعادلة 2

ينتج عنه ال ID و Vgs

$V_{DS} = V_{DD} - I_D(R_S + R_D)$

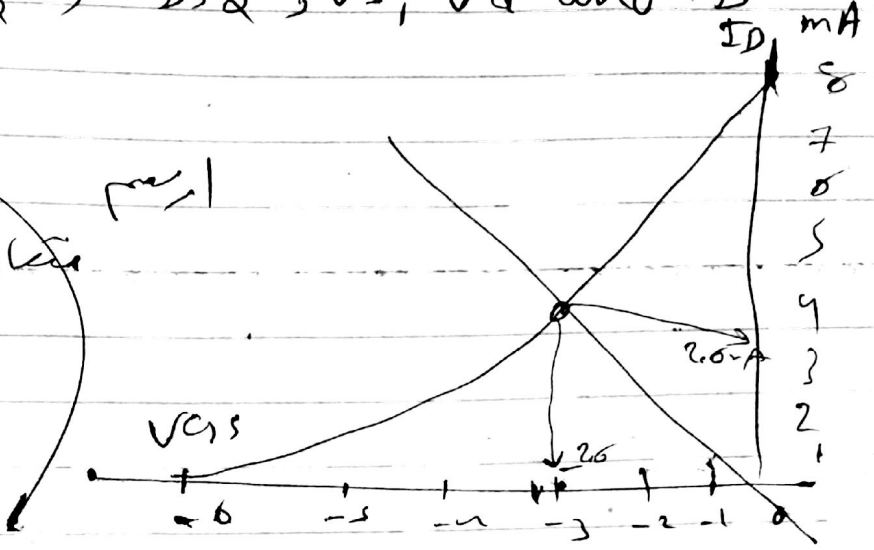
EX $R_D = 3.3k\Omega$ $R_S = 1k\Omega$ $R_G = 1M\Omega$

$V_{DD} = 20V$, $I_{DSS} = 8mA$, $V_p = 6V$,

Find V_{GSQ}, I_{DQ}, V_{DSQ}, V_S, V_G and V_D

$$V_{GS} = -I_D R_S$$

$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_p}\right)^2$$



at $I_{DS} = 0$ $V_{GS} = 0$

at $V_{GS} = -1$ $\Rightarrow$ $I_D = \frac{-1}{1K} = -1mA$ $\longrightarrow$

$\therefore$ $V_{GS} = -2.6V$

$I_D = 2.6mA$

$$V_{DS} = V_{DD} - I_D(R_D + R_S)$$

$$= 20 - 2.6\times10^{-3}(3.3\times10^{+3} + 1\times10^{+3}) = 8.82V$$

$$V_S = I_D R_S = 2.6\times10^{-3}\times1\times10^{3} = 2.6V$$

$$V_D = V_{DS} + V_S = 8.82 + 2.6 = 11.42V$$

$$V_G = 0$$

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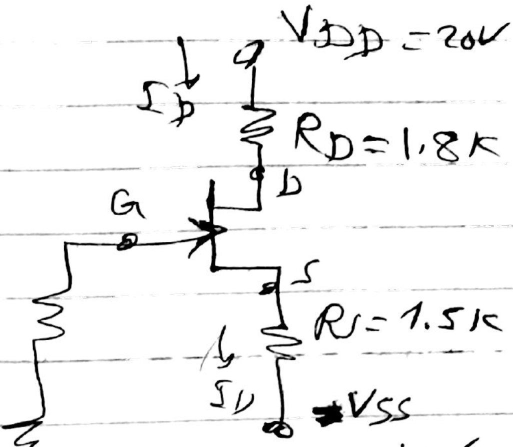
(Another type of Self biasing)

Ex $I_{DSS} = 8\,mA$

$V_p = -3\,V$

find $I_D, V_{GS}, V_{DS}, V_D, V_G, V_S$



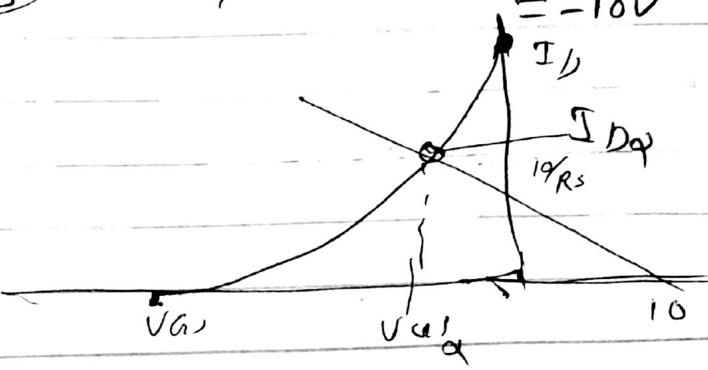
- Sol

$V_G = 0$ $\quad V_{GS} = V_G - V_S = -V_S$

$V_S - (-10) = I_D R_S$

$(-V_{GS}) + 10 = I_D R_S$

$V_{GS} = 10 - I_D R_S$



at $V_{GS} = 0$ $\quad I_D = \frac{10}{R_S} = \frac{10}{1.5k}$

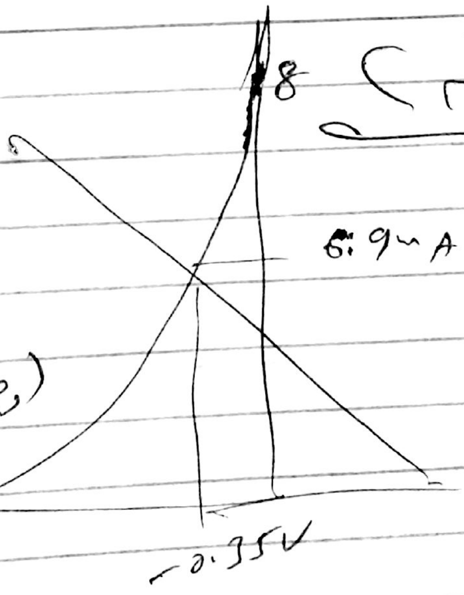
at $I_D = 0$ $\quad V_{GS} = 10$

[illegible]

[illegible]

$V_{GSQ} = -0.35\,V$

$I_D = 6.9\,mA$



$V_{DS} = (V_{DD} + V_{SS}) - I_D(R_D + R_S)$

$= (20 + 10) - 6.9 \times 10^{-3} \times (3.3k)$

$= 7.23\,V$

$V_{GS} = 0, \; V_S = -V_{GS} = +0.35\,V$ $\quad , \; V_D = V_{DS} + V_S = 7.23 + 0.35 = 7.58\,V$

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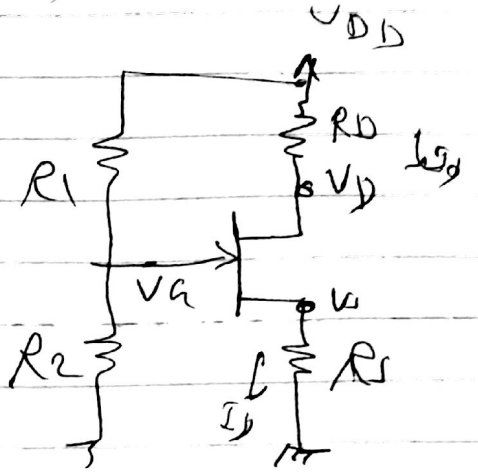
EX(3) المثال

(Voltage divider Biasing)



$$V_G = V_{DD}\frac{R_2}{R_1+R_2}$$

$$V_{GS} = V_G - I_D R_S$$

$$I_D = I_{DSS}\left(1-\frac{V_{GS}}{V_p}\right)^2$$

$$V_{DS} = V_{DD} - I_D(R_D+R_S)$$

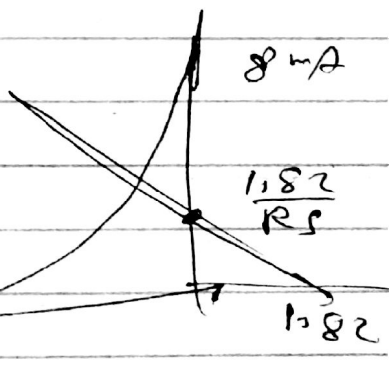
EX $R_D = 2.4k$, $R_S = 1.5k$, $R_1 = 7.1M$, $R_2 = 270k$

$V_{DD} = 16V$, $I_{DSS} = 8mA$, $V_p = -4V$

Find I_{DQ}, V_{DSQ}, V_{GSQ}, V_S, V_D, V_G

Sol/ $V_G = V_{DD}\frac{R_2}{R_1+R_2} \simeq 1.82V$

$V_{GS} = 1.82 - I_D R_S$



$I_{DQ} = 2.4mA$, $V_{GS} = -1.8V$

$V_D = V_{DD} - I_D R_D = 16 - 2.4 \times 2.4$

$= 10.24V$

$V_S = I_D R_S = 2.4 \times 1.5 = 3.6V$

$V_{DS} = V_D - V_S = 10.24 - 3.6 = 6.64V$