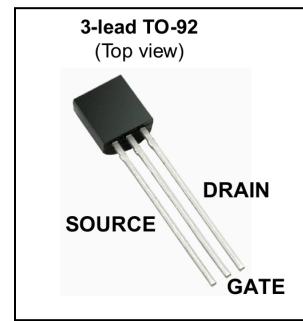


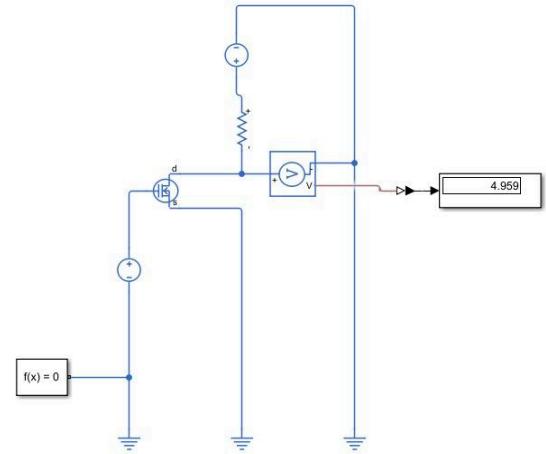
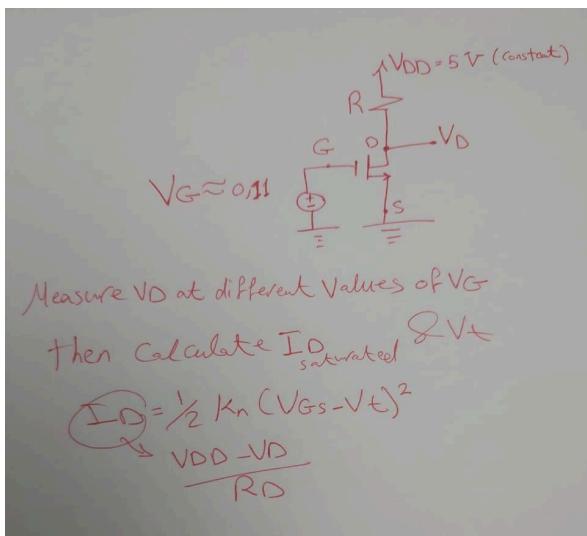
# MOSFET

In this Lab, we were required to apply what we studied about MOSFETs, where we had a peek into its various types in the market, we ended up using the 2N7000 (N-Channel Enhancement-Mode Vertical DMOS FET) Model, where it had many advantages and was a decent choice for this Lab.



We then constructed the circuit as required, connected the Gate voltage  $V_G$  to A Tunable DC supply voltage  $[-15 \rightarrow 15]V$  and connected the Source terminal to the ground, finally connected the drain in series with a 1K resistor and both to a constant DC supply (5V)

After connecting the circuit as shown in the simple diagram and in the schematic below



We then faced a problem with the readings, we started with couple readings but the  $V_D$  was too small (almost reached 0), so we changed the resistor to be 100 ohm instead, and rewrote the table as below, we increased the  $V_g$  slightly as shown in readings 1, 2, note that the  $V_t$  denoted for the 2N7000 was in the range between (0.8, 3) V, so we then set the  $V_g$  to 1.34, we were sure we the Channel was ON and the operating region was in saturation

And here we show the used Laws in this Lab

$$I_D = \frac{1}{2} k_n (V_{GS} - V_T)^2 \quad - \quad g_m = \sqrt{2knI_D} \text{ @ saturation region , } k_n = \frac{(g_m)^2}{2I_D}$$

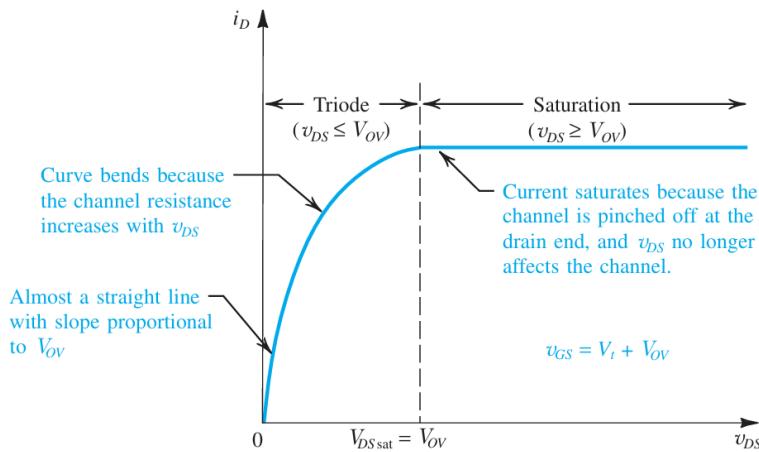
$g_m$  was given in the datasheet to be  $100 \Omega^{-1}$  or equivalently  $0.1 S$ ,  $k_n$  was calculated to be  $25mA/V^2$

As we can see here, the transition occurred when changing  $V_G$  to be more than  $V_T$  denoted in the datasheet (0.8) and only then, a drop between  $V_D$  and  $V_{DD}$  occurred starting from idx#3

| Reading idx | VGS (V) | VT (V)  | ID (mA) | VD (V) | VDD (V) |
|-------------|---------|---------|---------|--------|---------|
| 1           | 0.15    | —       | 0       | 5.02   | 5.02    |
| 2           | 0.38    | —       | 0       | 5.02   | 5.02    |
| 3           | 1.34    | 1.185   | 0.3     | 4.99   | 5.02    |
| 4           | 1.44    | 1.2034  | 0.7     | 4.95   | 5.02    |
| 5           | 1.54    | 1.1712  | 1.7     | 4.85   | 5.02    |
| 6           | 1.94    | 0.91634 | 27.7    | 1.94   | 4.91    |

## Output Plots:

id -vds characteristic normal plot from reference



Region we were operating in → **Saturation**

## Collective Summary:

- MOSFETs can be very useful in a variety of applications, different configurations and modes can be utilized for multiple situations. Lab experiments occasionally produce errors due to equipment and physical noise, We are truly grateful for Eng. Alaa our TA in all Lab sessions, and all thanks to our Instructor Prof. Mohammad Isalm