Ex. No. 11	**CHARACTERISTICS OF METAL OXIDE SEMICONDUCTOR FIELD EFFECT TRANSISTOR (MOSFET)**
Date:	

AIM

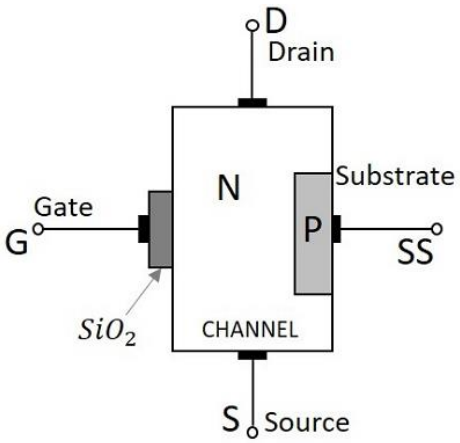
To obtain the Drain Characteristics and Transfer Characteristics of a MOSFET in Common Source Configuration and to plot the characteristics.

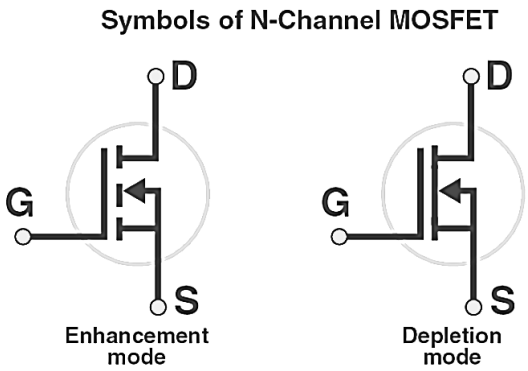
SOFTWARE REQUIRED

LT spice

THEORY

MOSFET stands for Metal Oxide Silicon Field Effect Transistor or Metal Oxide Semiconductor Field Effect Transistor. MOSFETs are used to switch or amplify voltages in circuits. It is a voltage controlled device and is constructed by three terminals. The terminals are: Source, Gate, and Drain. The following figure shows the structure and symbol of an N-Channel MOSFET.

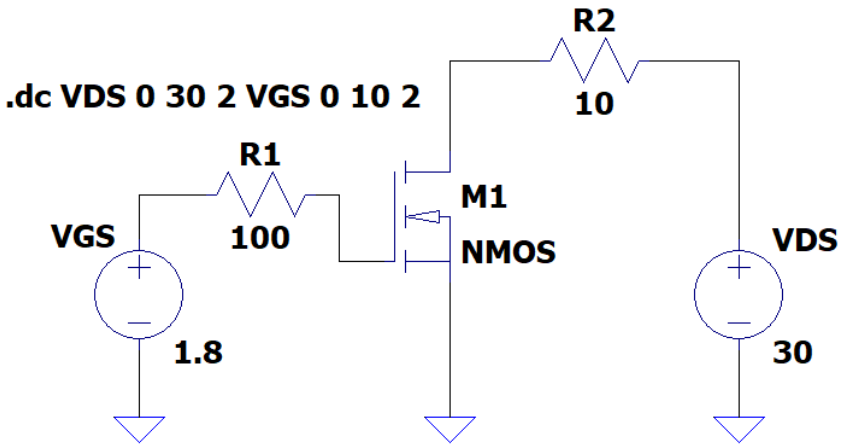




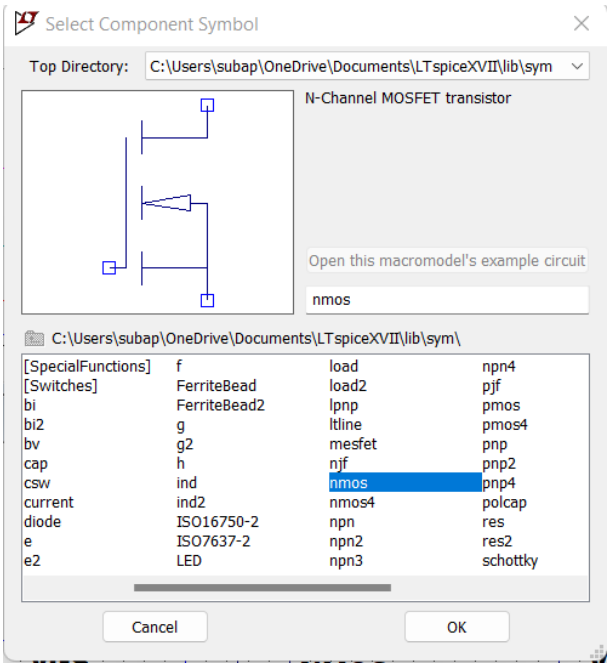
An oxide layer is deposited on the substrate to which the gate terminal is connected. This oxide layer acts as an insulator between Gate and substrate. Depending upon the substrate used, they are called as **P-type** and **N-type** MOSFETs. The voltage at gate controls the operation of the MOSFET. With negative gate bias voltage, it acts as **depletion MOSFET** while with positive gate bias voltage it acts as an **Enhancement MOSFET**.

PROCEDURE

1. Construct the given circuit in LT spice



2. Selection of NMOS (3-terminal) device



3. **Drain Characteristics**

The drain characteristics of a MOSFET are drawn between the drain current $\mathbf{I_D}$ and the drain source voltage $\mathbf{V_{DS}}$.

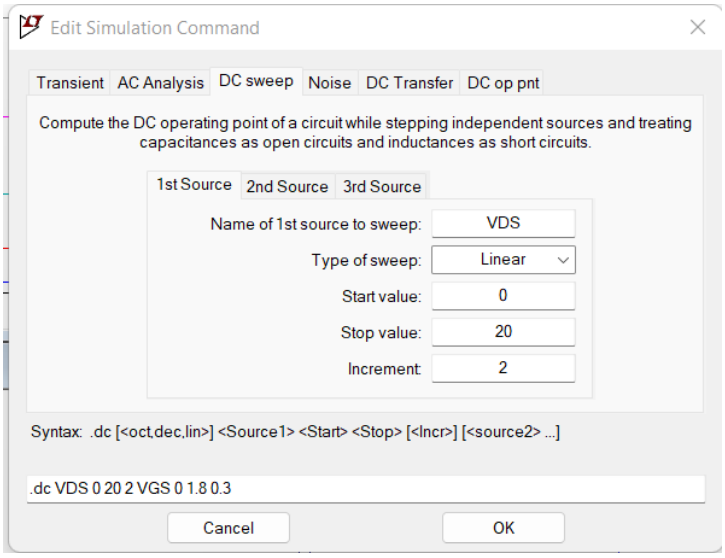
To plot the drain characteristics

i. Set VDS= 20V

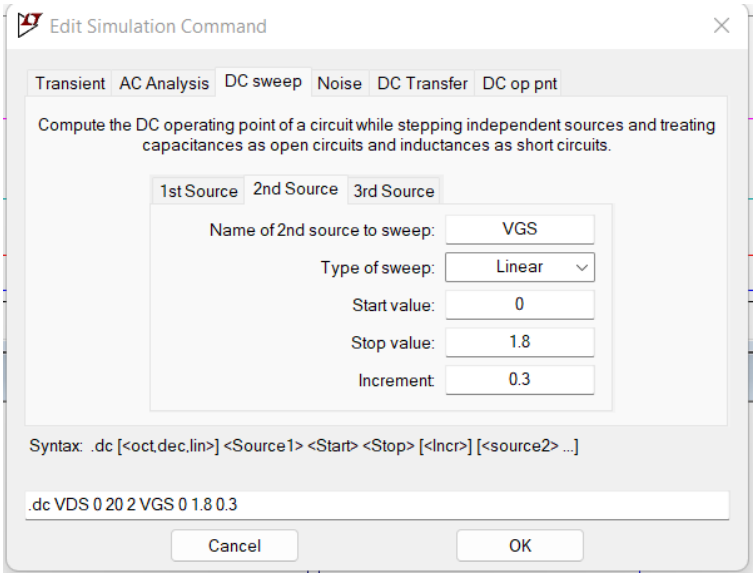
ii. Set VGS = 1.8V

iii. Go to Simulation -> Edit simulation cmd -> DC sweep

iv. Select first source (VDS) and enter the following values

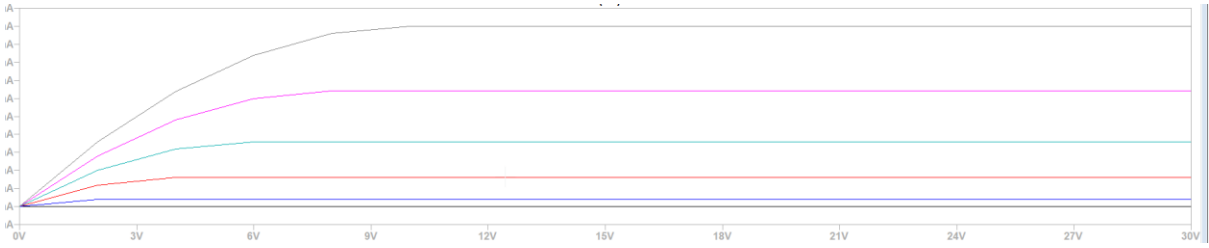


v. Select the second source and input the values as follows



vi. Click ok and Run the simulation

vii. Right click on the plot pane, select Add trace, select Id(drain current) and click ok

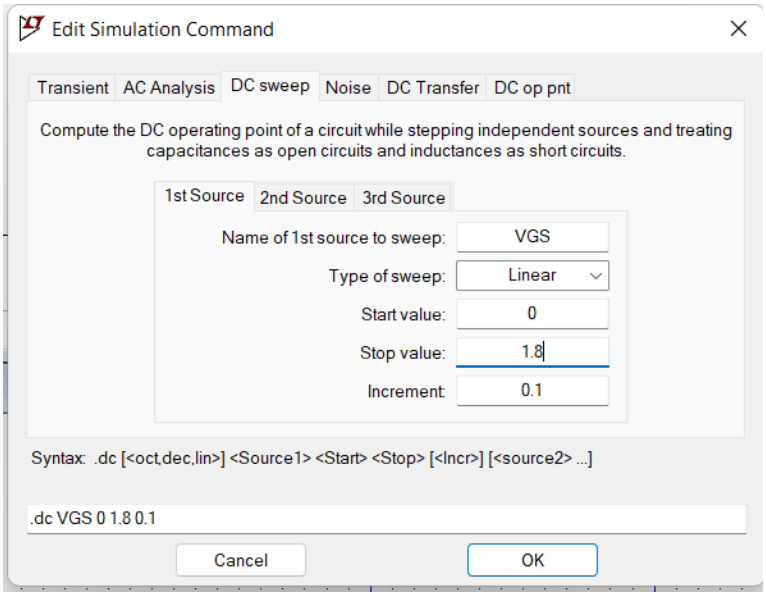


Transfer Characteristics

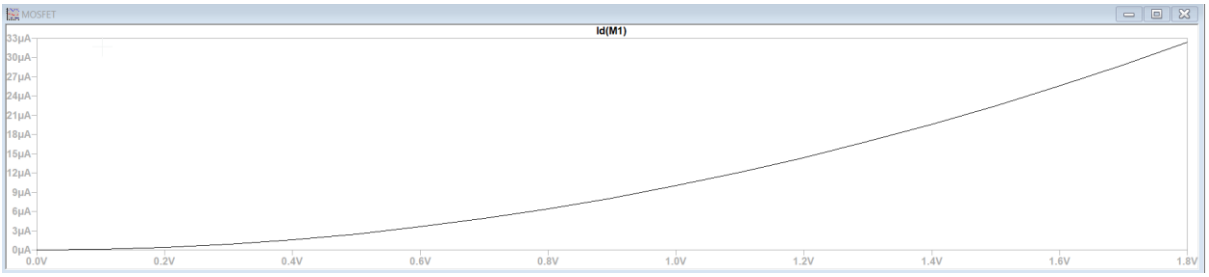
Transfer characteristics define the change in the value of $\mathbf{V_{DS}}$ with the change in $\mathbf{I_D}$ and $\mathbf{V_{GS}}$ in both depletion and enhancement modes. The below transfer characteristic curve is drawn for drain current versus gate to source voltage.

4. To plot the transfer characteristics

i. Set VGS= 1.8V
ii. Set VDS = 20V
iii. Go to Simulation -> Edit simulation cmd -> DC sweep
iv. Select first source (VGS) and enter the following values



i. Click ok and Run the simulation
ii. Right click on the plot pane, select Add trace, select Id(drain current) and click ok



Result

Thus the MOSFET characteristics are simulated using LTspice.