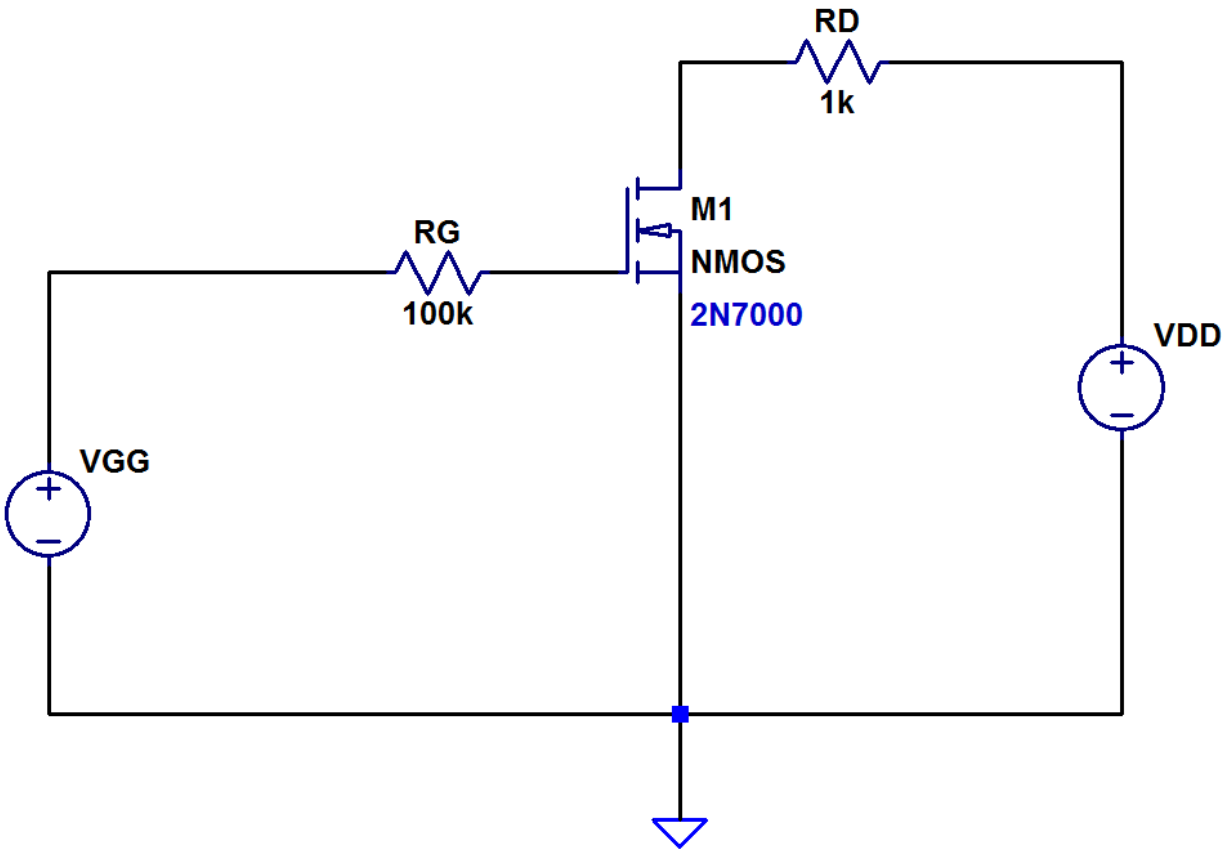
EXPERIMENT 09: N-CHANNEL MOSFET OUTPUT AND TRANSFER CHARACTERISTICS

AIM: To study transfer and output characteristics of an n-channel Metal Oxide Semiconductor field effect Transistor (MOSFET) in Common-source configuration.

APPARATUS: MOSFET (2N7000), Bread board, resistor (1KΩ, 100KΩ), connecting wires, Ammeters (0-10mA/ 0-25mA), DC power supply (0-30V) and multimeter.

CIRCUIT DIAGRAM:



THEORY:

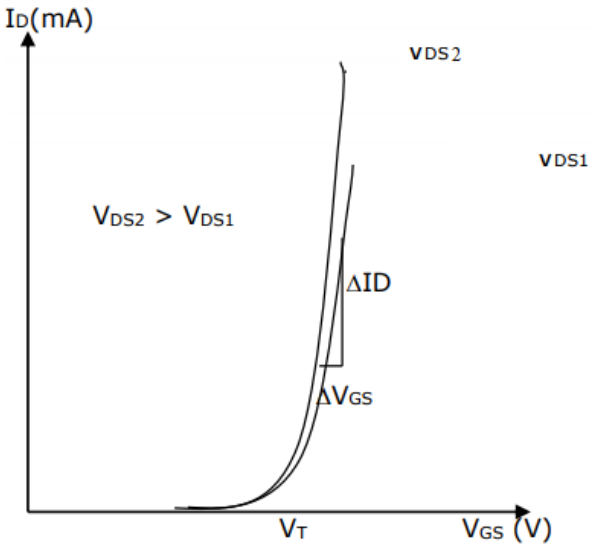
The MOSFET is actually a four-terminal device, whose substrate, or body terminal must be always held at one of the extreme voltage in the circuit, either the most positive for the PMOS or the most negative for the NMOS. One unique property of the MOSFET is that the gate draws no measurable current.

1) Explain the constructional details of n –channel E-MOSFET
2) Explain the working of n –channel E-MOSFET.
3) Mention various types of MOSFET and applications of MOSFET

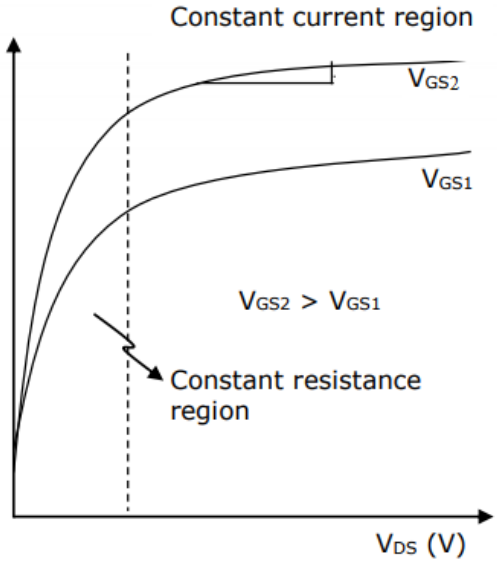
NOTE: Answer the above questions and write it as theory of this experiment.

Ideal Graph:

Transfer Characteristics:



Drain Characteristics



PROCEDURE:

OUTPUT/DRAIN CHARACTERISTICS:

1. Connect the circuit as per given diagram properly.
2. Keep V_{GS} constant at some value say 1.1 V by varying V_{GG}
3. Vary V_{DS} in step of 1V up to 10 volts and measure the drain current I_D. Tabulate all the readings.
4. Repeat the above procedure for V_{GS} as 1.2V, 1.3V, 1.4V, 1.5V etc

TRANSFER CHARACTERISTICS:

1. Connect the circuit as per given diagram properly.
2. Set the voltage V_{DS} constant at 10 V.
3. Vary V_{GS} by varying V_{GG} in the step of 0.1 up to 1.55V and note down value of drain current I_D. Tabulate all the readings.
4. Plot the output characteristics V_{DS} vs I_D and transfer characteristics V_{GS} vs I_D.
5. Calculate V_T, gm, rd or ro from the graphs and verify it from the data sheet

OBSERVATION TABLE:

OUTPUT / DRAIN CHARACTERISTICS

V_{GS} = 1.1 V		**V_{GS} = 1.2 V**		**V_{GS} = 1.3 V**		**V_{GS} = 1.4 V**		**V_{GS} = 1.5 V**	
V_{DS} (V)	**I_D (mA)**	**V_{DS} (V)**	**I_D (mA)**	**V_{DS} (V)**	**I_D (mA)**	**V_{DS} (V)**	**I_D (mA)**	**V_{DS} (V)**	**I_D (mA)**
0		0		0		0		0	
1		1		1		1		1	
2		2		2		2		2	
.		.		.		.		.	
.		.		.		.		.	
.		.		.		.		.	
Upto 10		Upto 10		Upto 10		Upto 10		Upto 10	

TRANSFER CHARACTERISTICS

V_{DS} = 10 V	
V_{GS} (V)	**I_D (mA)**
0	
0.1	
.	
.	
1	
1.1	
1.2	
1.3	
1.4	
1.5	
1.55	

CALCULATION:

1. **Threshold voltage V_T :** Gate to source voltage at which, drain current starts flowing.

2. **Transconductance gm :** Ratio of small change in drain current (ΔI_D) to the corresponding change in gate to source voltage (ΔV_{GS}) for a constant V_{DS}.

   gm = $\Delta I_D / \Delta V_{GS}$ at constant V_{DS}

3. **Output drain resistance :** It is given by the relation of small change in drain to source voltage (ΔV_{DS}) to the corresponding change in Drain Current (ΔI_D) for a constant V_{GS}.

   rd or ro = $\Delta V_{DS} / \Delta I_D$ at a constant V_{GS}

RESULTS:

1. **V_T : _____**
2. **gm : _____**
3. **ro : _____**

CONCLUSION:

POST LAB QUESTIONS:

1. What are the advantages of MOSFET over JFET?
2. To turn NMOS –E, how much voltage is required?
3. Why an input characteristic of MOSFET is not drawn?