Ahsanullah University of Science & Technology

Department of Computer Science & Engineering

LAB REPORT

Course No : EEE-2142

Course Title : Electronics Device & Circuits Lab

Experiment No : 08

Experiment Name : The I-V Characteristics of an N-Channel Enhancement type MOSFET

Submitted By-

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Group no. : 06

Date of Performance : 15/09/2020

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Experiment No : 08

Name of the Experiment :

The I-V characteristics of an N-channel Enhancement type MOSFET.

Objective :

Study of the I-V characteristics of an N-channel MOSFET.

Equipments And Components :

Serial No.	Component Details	Specification	Quantity
1.	MOSFET	IRF540N	1 piece
2.	Resistor	1KΩ	1 piece
3.	Trainer Board		1 unit
4.	DC Power Supply		2 unit
5.	Digital Multimeter		1 unit
6.	Chords and wire		as required

Experimental Setup :

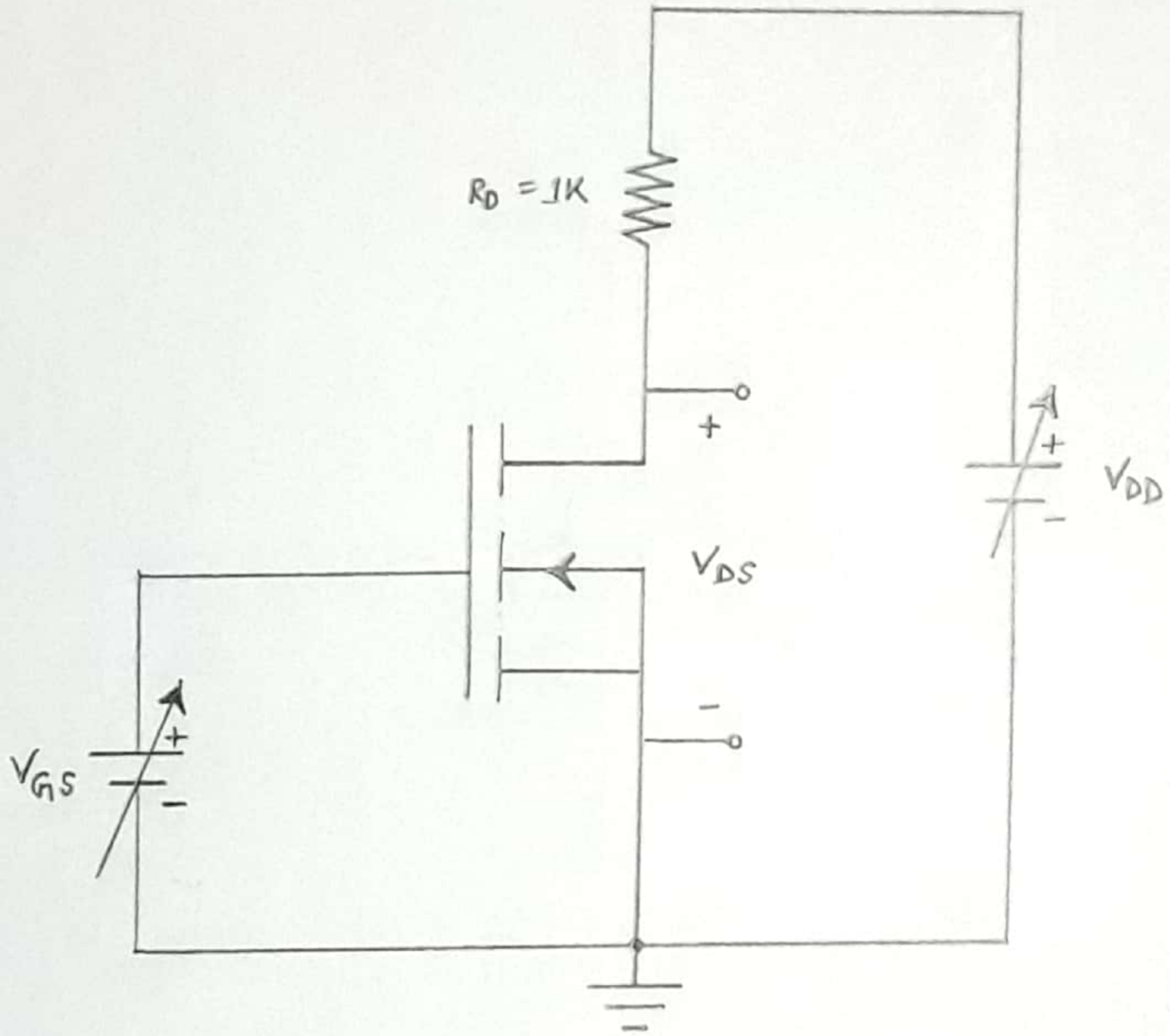


Figure : Experimental Circuit

Data sheet :

$R = 0.99K$

V_{GS} (volt)	V_{DD} (volt)	V_{DS} (volt)	V_R (volt)	$I_D = \frac{V_R}{R}$ (mA)
1.946	0.251	0.0009	0.249	0.251
	0.484	0.0021	0.480	0.484
	0.645	0.0029	0.641	0.647
	0.829	0.0035	0.826	0.834
	1.019	0.0041	0.990	1.0
	2.02	0.0094	2.019	2.039
	4.15	0.0265	4.11	4.15
	6.35	0.12	6.20	6.262
	8.146	0.746	7.40	7.47
	10.14	1.56	8.54	8.626
	12.27	2.69	9.56	9.656
	15.18	4.75	10.42	10.52
	20.42	9.38	11.04	11.15
	22.35	10.80	11.55	11.66
2.042	0.251	0.0006	0.250	0.252
	0.476	0.0008	0.475	0.48
	0.659	0.0014	0.658	0.665
	0.841	0.0019	0.839	0.847
	1.288	0.0022	1.284	1.297
	2.580	0.0046	2.574	2.60
	3.30	0.0058	3.294	3.327
	4.27	0.021	4.25	4.29
	6.39	0.092	6.30	6.36
	10.03	1.43	8.60	8.687
	12.66	2.68	9.97	10.07
	15.38	4.53	10.84	10.95
	20.33	8.46	11.86	11.97
	22.17	10.03	12.12	12.24

Report :

① Plot the I-V Characteristics of MOSFET for 2 values of V_{GS} on the graph paper.

Ans: The graph of I-V Characteristics of MOSFET for 2 values of V_{GS} has been attached with the report.

② Is the slope of both the curves are same in the linear region ? If not why ?

Ans: The slopes of both curves aren't same in the linear region that we can observe from the graph because when width of N-channel increases, resistance decreases, eventually current, I increases. For this reason, the slopes of both the curves are not same in the linear region.

Roll No: .....

Name: .....

Xaxis 5sq. unit = 1 unit
Yaxis 5sq. unit = 1 unit

Y

13

I_{DSS_2}

12

I_{DSS_1}

11

10

9

8

7

6

5

4

3

2

1

0

Saturation Region

$V_{GS} = 2.092V$

$V_{GS} = 1.946V$

Linear or Ohmic Region

I_D (mA)

$V_{GS} = 0V$

X'

1 2 3 4 5 6 7 8 9 10 11 12

X

V_p (pinch voltage)

Cut-off Region

V_{DS} (V) →

Y'

8 Inch x 10 Inch

③ Identify the Q.- points on the graph paper and mention its value.

We have identified the Q-points for $V_{DS} = 1.946\,V$

If we do a KVL in loop 1, we get

$$-V_{DD} + I_D R_D + V_{GS} = 0$$

$$\Rightarrow V_{DD} = I_D R_D + V_{GS}$$

When, $I_D = 0$

$$V_{GSmax} = V_{DD} \quad [\text{Here, } V_{DD} = 22.35V]$$

$$= 22.35V$$

when $V_{GS} = 0$, we get

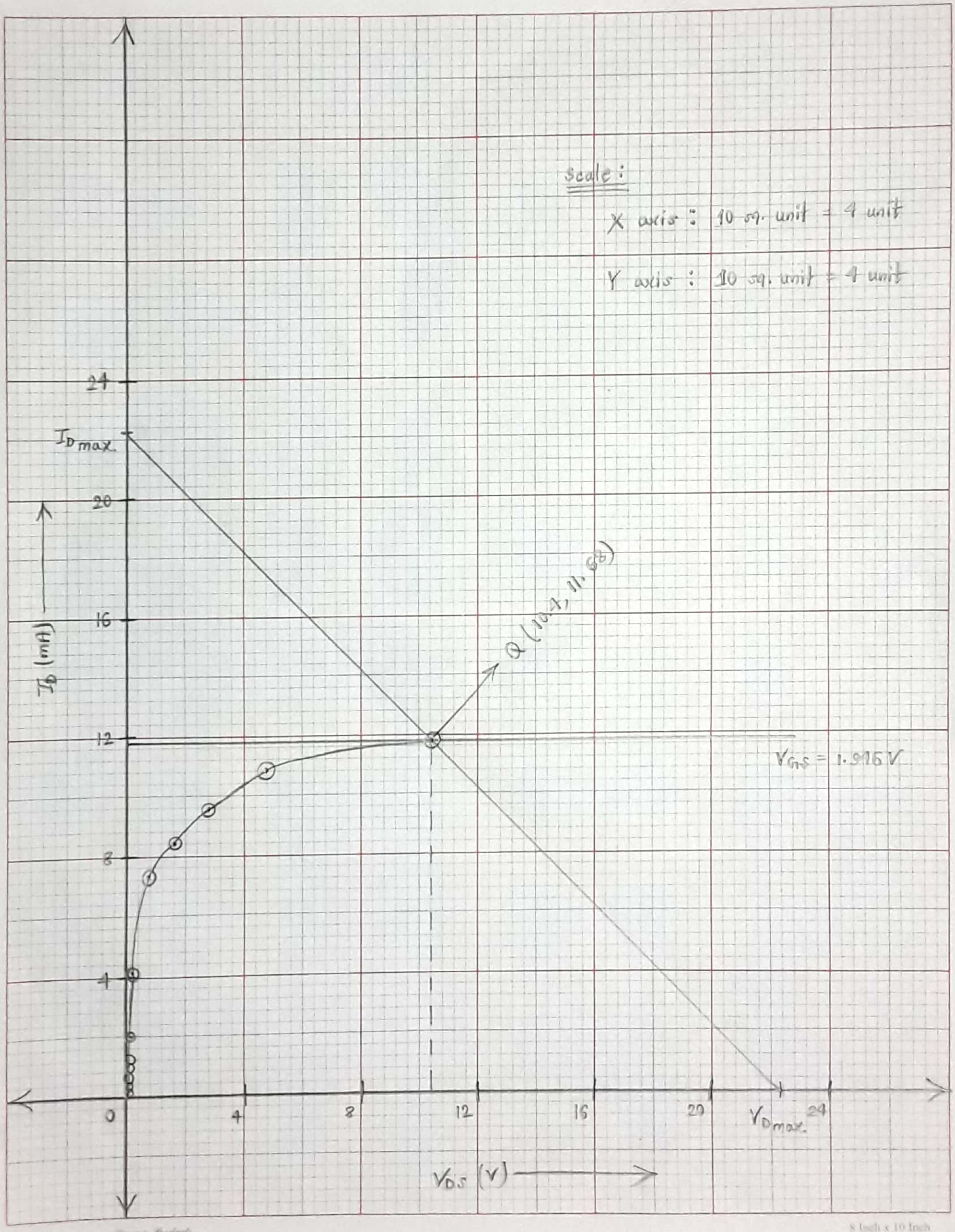
$$I_{Dmax} = \frac{V_{DD}}{R_D}$$

$$= \frac{22.35}{0.99}$$

$$= 22.57\,mA$$

So here $I_{Dmax} = 22.57\,mA$ and $V_{GSmax} = 22.35V$. Now if we draw a load line for the curve we get a point (10.9, 11.68). The graph is attached below.

Roll No. .....



8 Inch x 10 Inch

④ What is the value of I_{DSS}.

Ans: From the graph we get,

$$I_{DSS1} = 11.78$$

$$I_{DSS2} = 12.24.$$

Discussion:

In this experiment, we have studied the I-V characteristics of an N-channel Enhancement type MOSFET. We have connected the circuit properly and observed output very carefully. Thus, we have completed the experiment successfully.