NORTH SOUTH UNIVERSITY

Department Of Electrical & Computer Engineering

LAB REPORT

Course Code: EEE111L

Course Title: Analog Electronics-I

Course Instructor: Dr. Shekh Md Mahmudul Islam (SMMI)

Experiment No: 01

Experiment Name: I-V Characteristics of diode.

Experiment Date: Wednesday, October 19, 2022

Submission Date: Wednesday, October 26, 2022

Section: 12

Group Number: 07

Submitted To: Naziza Mehzabin Hossain

SUBMITTED BY	STUDENT ID	SCORE
1. Md. Redone Ahammed Bappy (Cover, circuit, Discussion)	2212846043	19/20
2. Md. Mahid Alom (~~Res~~ Title/Objective/Equipment, Theory, Question answer)	2211894643	〃
3. Meher Afroz (.	2013173042	
4. Khan Mohammed Sasholo Seeam	1831759642	

Anik Rahman Badhon ~~1~~130 1713101642

Experiment - 1

Title: I-V characteristics of diode

Objective: Study the I-V characteris of diode

Equipment and components:

Serial no.	Component Details	Specification	Quantity
1	p-n junction diode	1N4007	1piece
2	Resistor	1kΩ	1 piece
3	Dc power supply		1 unit
4	Digital Multimeter		1 unit
5	Chords and wire		as required

Theory: A diode consists of two terminals, or, it is a bi-polar device that the first one terminal is the anode and the second one is the cathode. Diodes are used to protect circuits by limiting the voltage. Diode acts like a short circuit when it is in forward bias and as an open circuit when it is in reverse bias. Normally, these are the two kinds of biasing exist. Semiconductor like silicon and germanium are used to make the most of the diodes. There are different kinds of diodes and each has it's own applications.

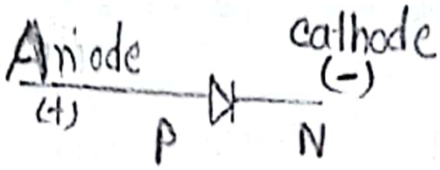


Fig-1: Schematic Diagram of Diode

Fig-2: P-N junction

Diode is connected with the source in two types.

1. When the diode is connected across a voltage source with positive polarity of source on higher potential connected to P side of diode and negative polarity on lower potential connected to N side, then the diode is in forward bias.

And the circuit will act like a short circuit

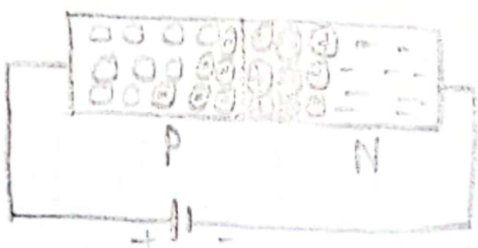


Fig-03: Forward bias

Fig-04: Forward Bias

2. When the diode is connected across a voltage source with negative polarity of source connected to p side of diode and positive polarity on higher potential of source connected to N side of diode, Then the diode is in Reverse bias condition.

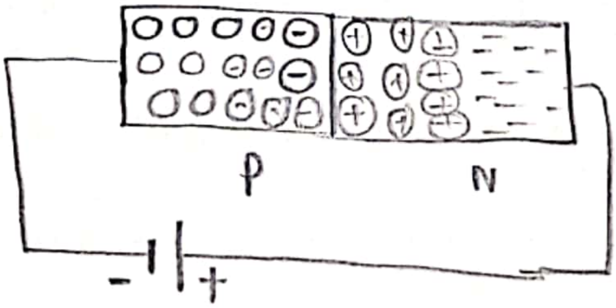


Fig-05: Reverse Bias

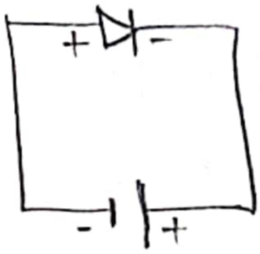
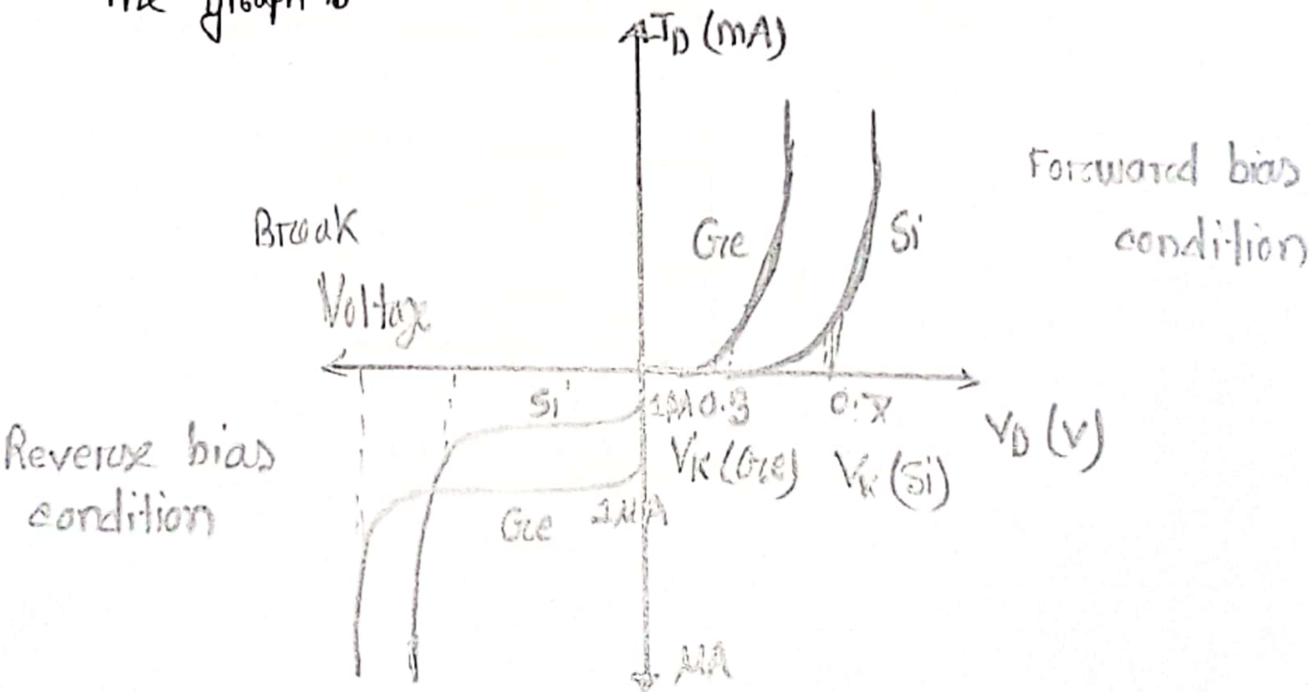


Fig-06: Reverse Bias

Diode shows non linear graph, where, $y \neq mx + c$

The graph is



The point at which the diode changes from no-bias condition to forward bias condition occurs when the electrons and holes are given sufficient energy to cross p-n junction.

For Silicon diode $\cong 0.7V$

Germanium diode $\cong 0.3V$

In reverse bias at first there are reverse saturated current and voltages are negative. After some points there, where voltage break down exists and it varies from component to component. At that point it will be damaged permanently.

Circuit diagram & Simulation:

you can write the theory in a more concise way

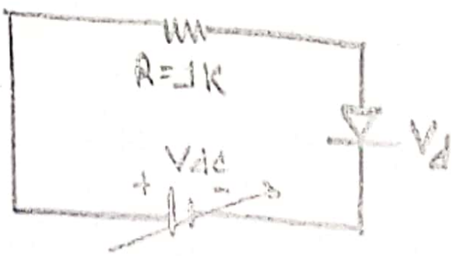
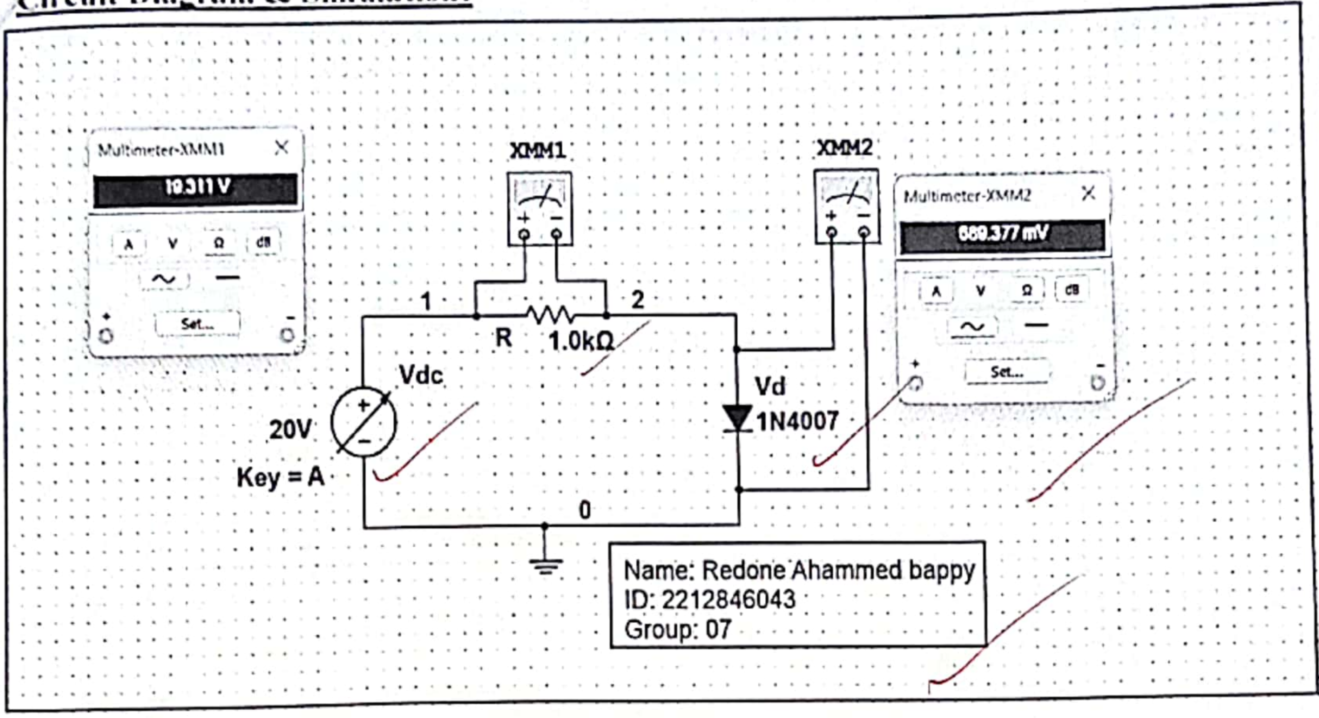


Fig-3: Diode forward Bias Configuration

Circuit Diagram & Simulation:



Group-07 NORTH SOUTH UNIVERSITY

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Data Collection:

Experiment: 1

Theoretical value: R = 1KΩ

0.0006

Measured value: R = 1kΩ 1.00kΩ

V_{dc} (volt)	V_d (volt)	V_R (volt)	$I_d = V_R / R$ (mA)
102.8mV 0.1	0.969 V	0. V	0 mA
0.3	0.261 V	0.6 V	0.0006 mA
0.5	0.438 V	0.65 V	0.065mA
0.7	0.485 V	1897 V	0.1897mA
0.9	0.509 V	.319 V	0.319 mA
1	0.522 V	.415 V	0.415 mA
2	0.582 V	1.354 V	1.354 mA
3	0.609 V	2.332 V	2.332 mA
4	0.628 V	3.372 V	3.372 mA
6	0.651 V	.538 V	0.538 mA
8	0.666 V	.736 V	0.736 mA
10	0.678 V	.936 V	0.936 mA
12	0.687 V	1.139 V	1.139 mA
14	0.695 V	1.340 V	1.340 mA
16	0.701 V	1.539 V	1.539mA
18	0.707 V	1.741 V	1.741mA
20	0.712 V	1.935 V	1.935mA

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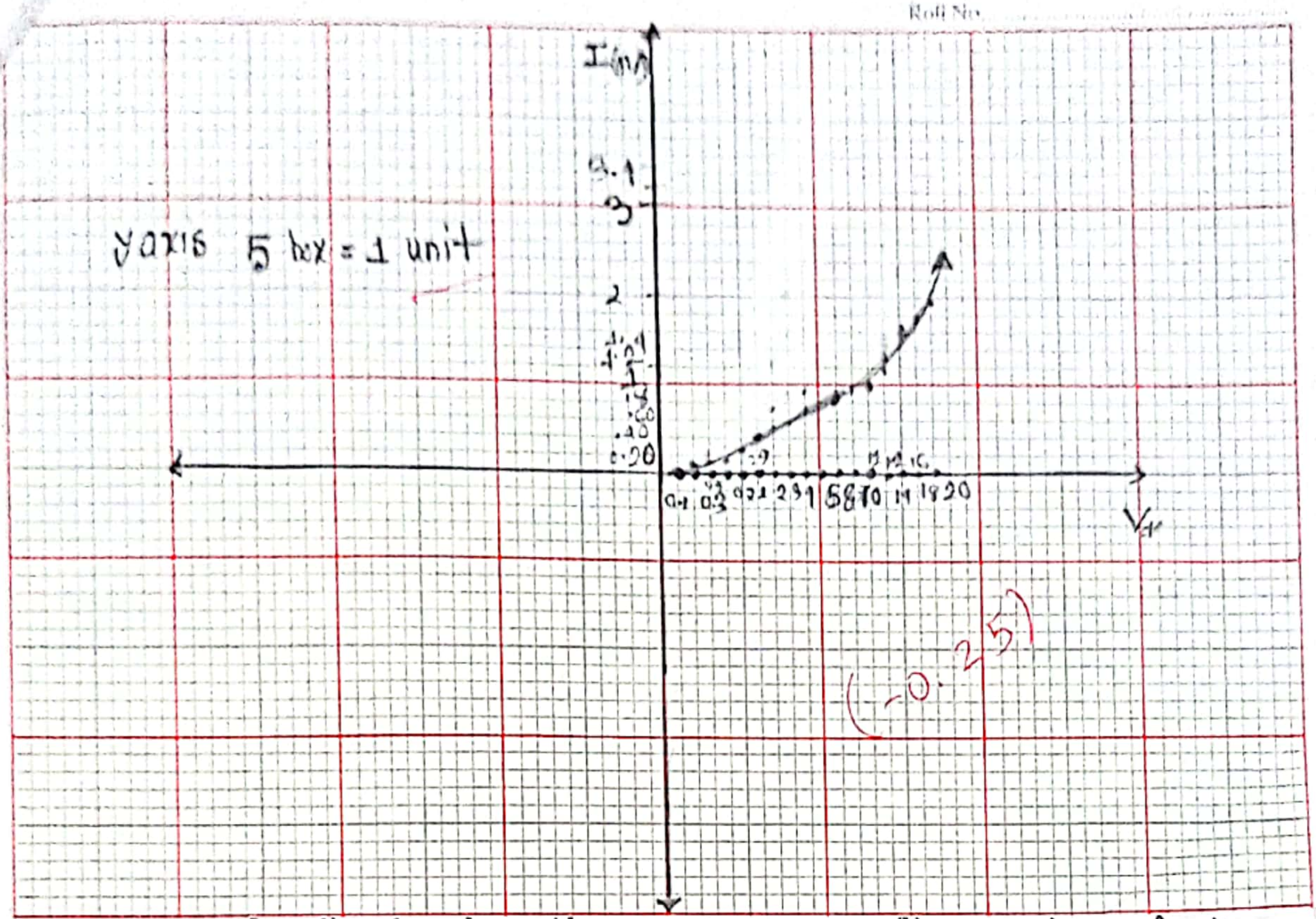
Report:

1. Taking readings from the data table, draw curve of diode in a graph paper with proper scale [x-axis: 0.2 V per unit, y-axis: any suitable range].
2. What is dynamic and static resistance of a diode?
3. From the graph, find Vd for corresponding values of Id = 5 mA and Id = 10 mA and calculate the static resistance.
4. Considering Vdc = 2 volt, find the load line (Showing all calculations)
5. Draw the load line in the curve of diode and find Q-point.

Roll No.



to change in voltage at a specific region of the VI curve.

$$r_d = \frac{\Delta V_d}{\Delta I_d}$$

When the voltage is increased, the current may not increase proportionally.

In the forward bias region: $r_d = \frac{26mV}{I_D}$

The resistance r_d depends on the amount of the current (I_D) in the diode.

Static resistance: Static resistance is the normal ohmic resistance in accordance with ohm's law. It is the ratio of voltage and current

Question and Answers:

1.

2. Dynamic Resistance: Dynamic Resistance is a concept of resistance used in PN junction in Electronics. Dynamic resistance refers to the change in current in response to change in voltage at a specific region of the VI curve.

$$r_d = \frac{\Delta V_d}{\Delta I_d}$$

When the voltage is increased, the current may not increase proportionally.

In the forward bias region: $r_d = \frac{26mV}{I_D}$

The resistance r_d depends on the amount of the current (I_D) in the diode.

Static resistance: static resistance is the normal ohmic resistance in accordance with ohm's law. It is the ratio of voltage and current and is a constant at a given temperature.

$$R_D = \frac{V_D}{I_D}$$

3. From the graph, where, $I_d = 5mA$

$V_d = \cdot 62 V = 620 mV$

when, $I_d = 10$ mA

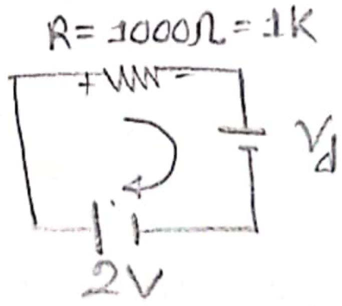
at 5 mA $r_d = \frac{620}{5} = 124 m\Omega$, $V_d =$ ~~10~~ 665 mV (−0.25)

at 10 mA, $r_d = \frac{665}{10} = 66.5 m\Omega$

Ans.

4. $V_{dc} = 2$ Volt

$R = 1K = 1000\Omega$



$-2 + 1000 I_d + V_d = 0$

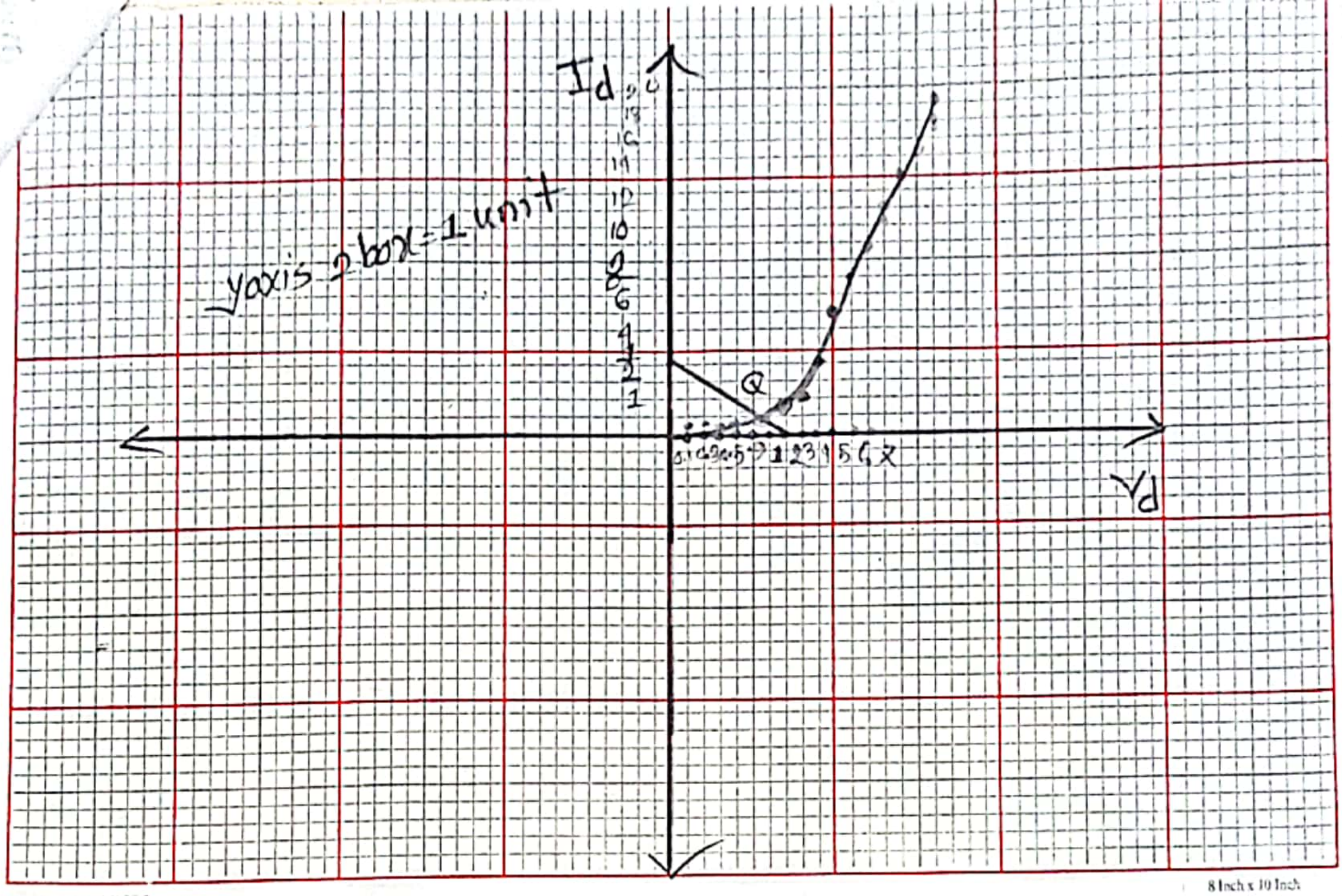
$1000 I_d + V_d = 2$

$500 I_d + .5 V_d = 1$

or, in kilo ohm,

$-2 + I_d + V_d = 0$

$\frac{V_d}{2} + \frac{I_d}{2} = 0$ — (i)


Id
yaxis 2 box = 1 unit
Q
Vd

Comparism with,

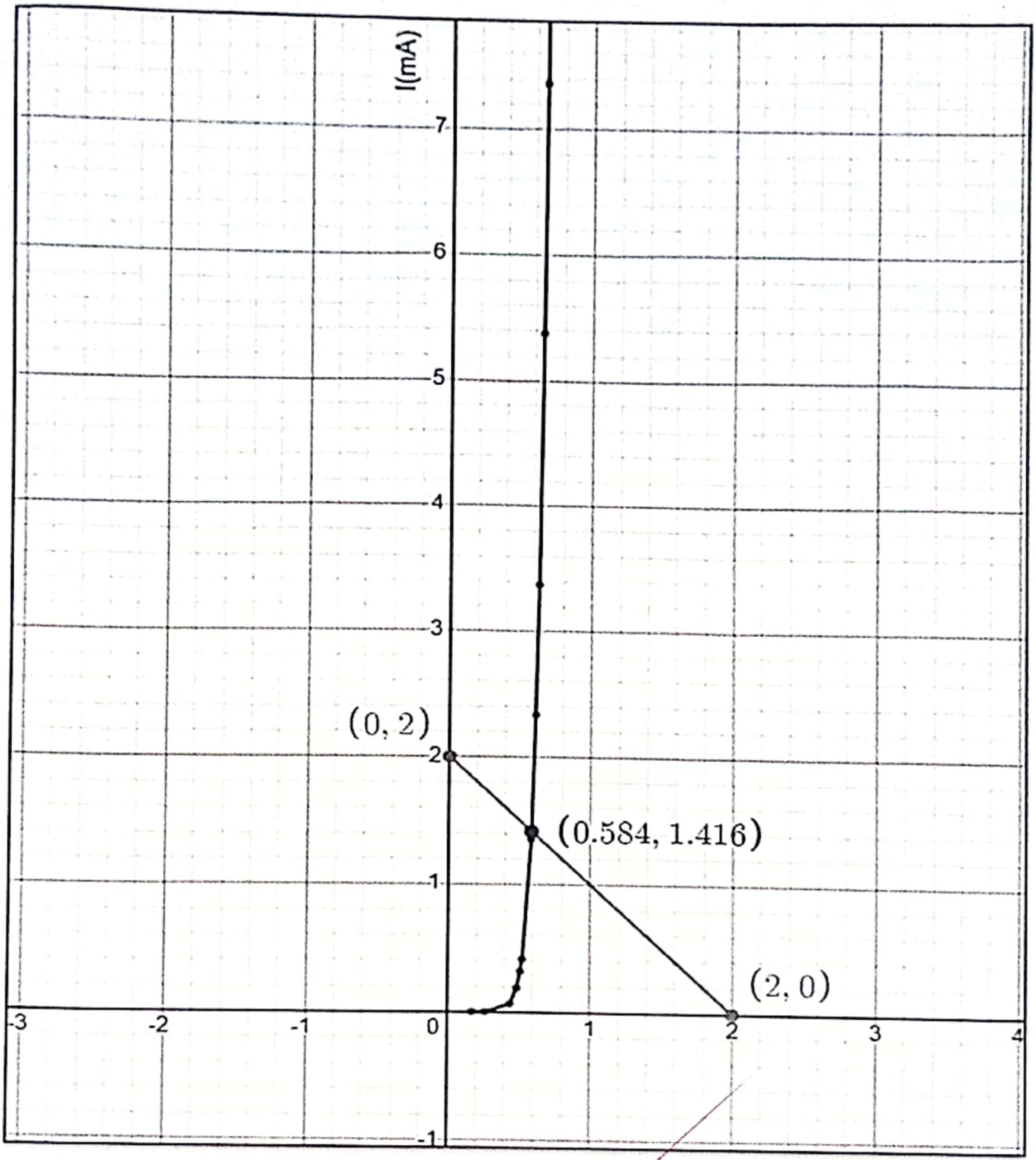
$$\frac{x}{a} + \frac{y}{b} = 1$$

hence, $V_d = (2,0)$

$I_d = (0,2)$

$(-0,5)$

Questions & Answers:



Discussion:

In this experiment we learned the diode voltage and diode current behaviour and their relation. At the beginning of the experiment, we gathered theoretical knowledge about how a diode could behave when different voltage is applied across the diode. Then we collected the necessary apparats to sp conduct this experiment. Then we measured their practical values and noted them on the datasheet. While building the circuit on the breadboard we ensured all the connections were rigid and connecting wires were not unnecessarily long. As the theoretical and practical values may differ, we used practical values of the components to calculate the diode current to less measurement or calculation error, Then we measured the V_d and V_R and noted them on the table. Then we calculated the diode current ~~ø~~for different Source voltages. While measuring the Voltage using DMM, we found some fluctuation in reading. The possible reason for fluctuation is a loose connection between the terminal and the corroded or oxidized terminal of the circuit elements.

~~Th~~ To reduce the measurement fluctuation, we cleaned the terminals and strongly connected them to the breadboard. We also noticed that our measurement values are a little off compare to the simulation because we didn't have the same values of resistance and also the measurement error of the DMM is added with it. So, we choose the resistor R to be as close as possible to 1kΩ.

After ploting the graph using table data, Vd on the X- axis and Id (mA) on the y-axis. We found an exponential graph representing the diode's voltage and current relation. On the graph we can see that Id increases rapidly at the range of 0.6V to 0.7V.

Also, as we increase the source voltage V_{dc} the voltage drop across the diode dosent Increase that much after 0.701V, but the current increases rapidly. This 0.701V voltage drop is ~~necessary~~ ~~to overcome the potential difference and at the~~ occurs across the diode due to the potential differ-ence at the depletion region. This 0.7V is necessary to overcome the potential difference and to turn on the diode so that the diode starts to conduct.

At the end of the experiment, we can conclude that the diode is not a linear device. Rather than the diode current is exponentially related to the diodes voltage.

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