AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

FACULTY OF ENGINEERING

ELECTRONIC DEVICES LAB

Spring 2021-2022

Section: R

Group: 01

LAB REPORT ON

Determination of Characteristic Curve of a Diode

Supervised By

S. M. IMRAT RAHMAN

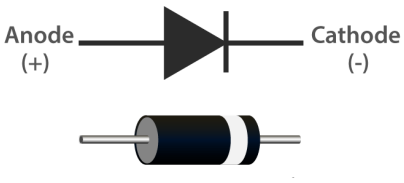
Submitted By:

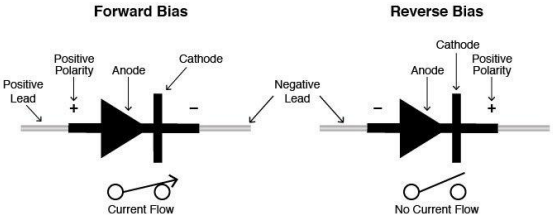
Name	ID
1. Md.Hamid Uddin	19-40250-1
2. Md.Jisun Abedin Aurnob	19-40318-1
3. Wathin Marma	19-40379-1
4. Rifat Al Mamun Rudro	19-39909-1
5. Jahnnabi Mazumder	19-40294-1

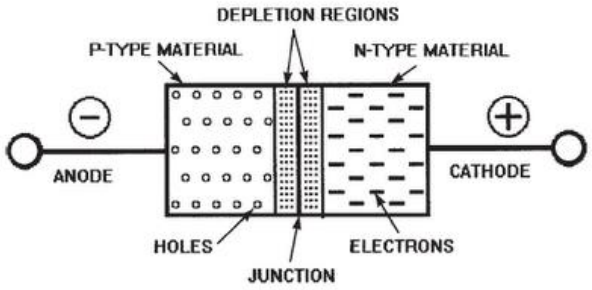
Date of Submission: **February 08, 2022**

Introduction:

A diode is one of the most basic electronic devices, capable of passing current only in one direction. A P-N junction is the most common type of diode. In this type of diode, one material (n) with charge carriers that are electrons abuts another material (p) with charge carriers that are holes. A depletion region forms at their interface, across which electrons diffuse to fill holes on the p-side. This effectively halts the flow of electrons. The IV characteristics curve of a diode starts at the zero point and the curve will increase gradually. But the forward current and voltage will be very small. When the forward voltage exceeds the internal barrier voltage of the diode's P-N junction, an avalanche occurs, and the forward current rapidly increases, causing the curve to rapidly climb.







Theory and Methodology:

A diode is basically a two-terminal PN junction device created by simply connecting an n-type and a p-type material together. There are three important characteristics of a diode and they are

1. Forward Bias
2. Reverse Bias
3. Avalanche Breakdown

When a diode is forward biased it conducts current (I_F) in forward direction. The value of I_F is directly dependent on the amount of forward voltage. The positive current passes through the diode and operates in the top right quadrant of its I-V characteristics curve. Starting at the zero intersection, the curve increases gradually into the forward quadrant but the forward current and voltage are extremely small. When the forward voltage reaches the internal barrier voltage of the

diode's P-N junction, which is roughly 0.7 volts for silicon, avalanche occurs, and the forward current increases fast for a relatively tiny increase in voltage, resulting in a non-linear curve.

A diode is reverse biased when a negative voltage is applied to the pn junction. When a diode is reverse biased, it produces a little amount of reverse current. In general, this means that reverse current remains constant over a large part of reverse voltage and operates in the lower left quadrant of its I-V characteristic curves. When the reverse voltage of a diode is increased from the start, there is a very slight change in the reverse current. At the breakdown voltage (VBR) point, the current increases very rapidly and the curve of the reverse current increases fast. The voltage across the diode remains reasonably constant at this time.

The constant-voltage characteristic leads to a number of applications of diode under reverse bias condition. The application of the high reverse voltage across the diode is responsible for current conduction in a reverse-biased diode are called as Avalanche breakdown. When we apply a high reverse voltage across the diode

Simulation Model:

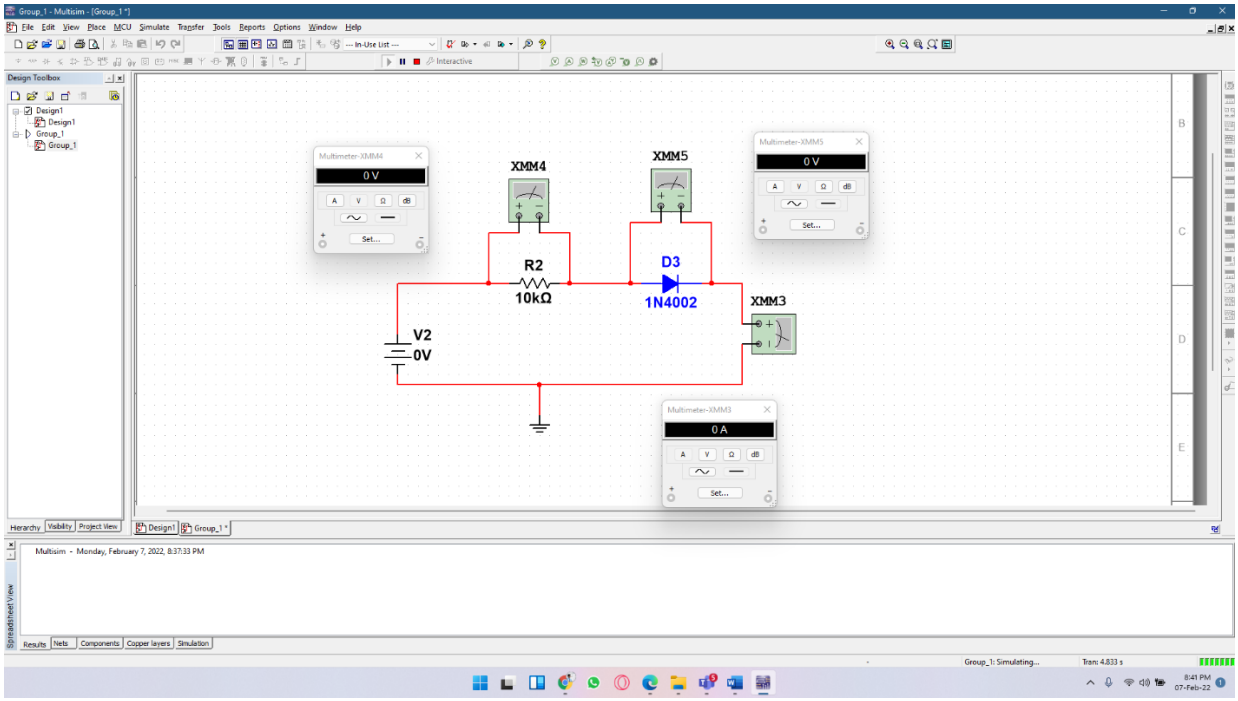


Fig 01: Showing output for 0 V

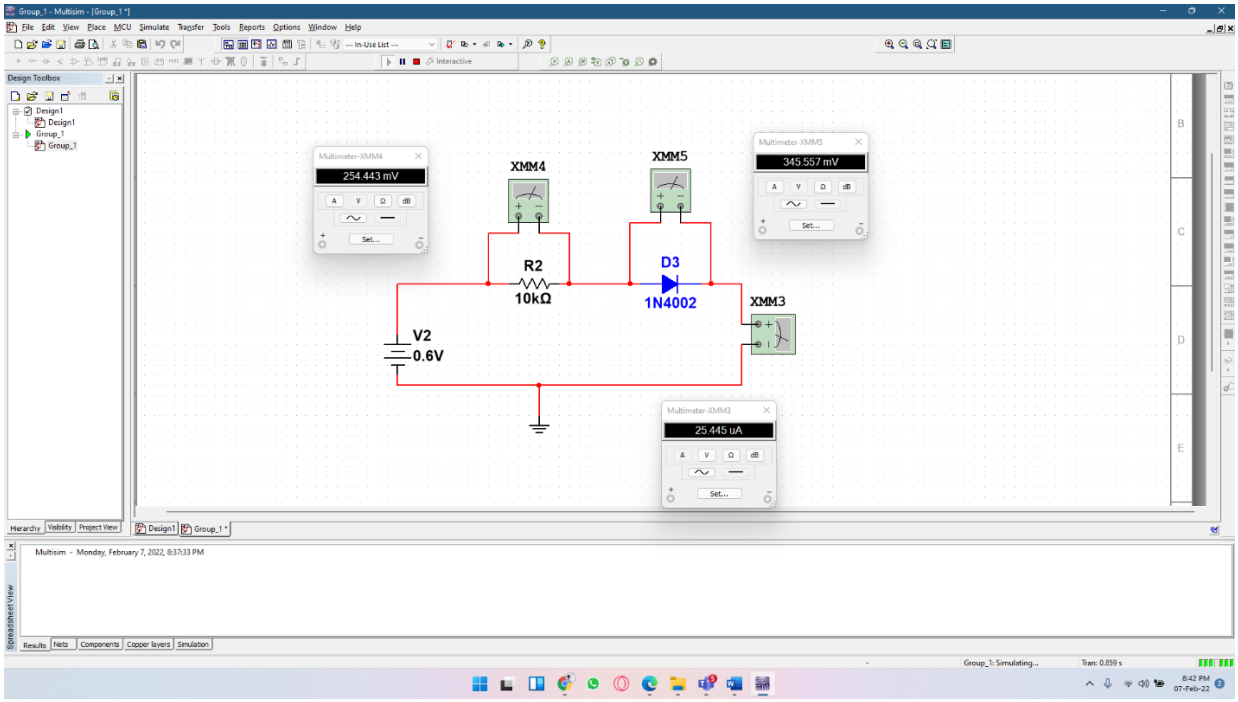


Fig 02: Showing output for 0.6 V

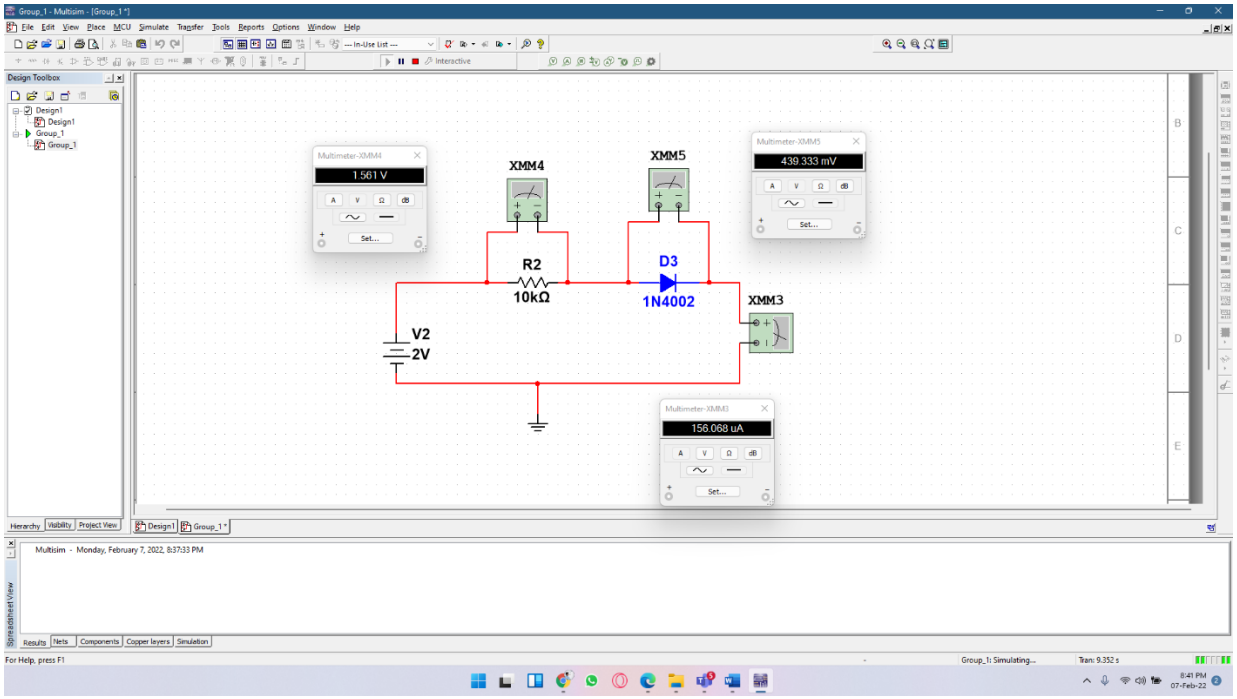


Fig 03: Showing output for 2 V

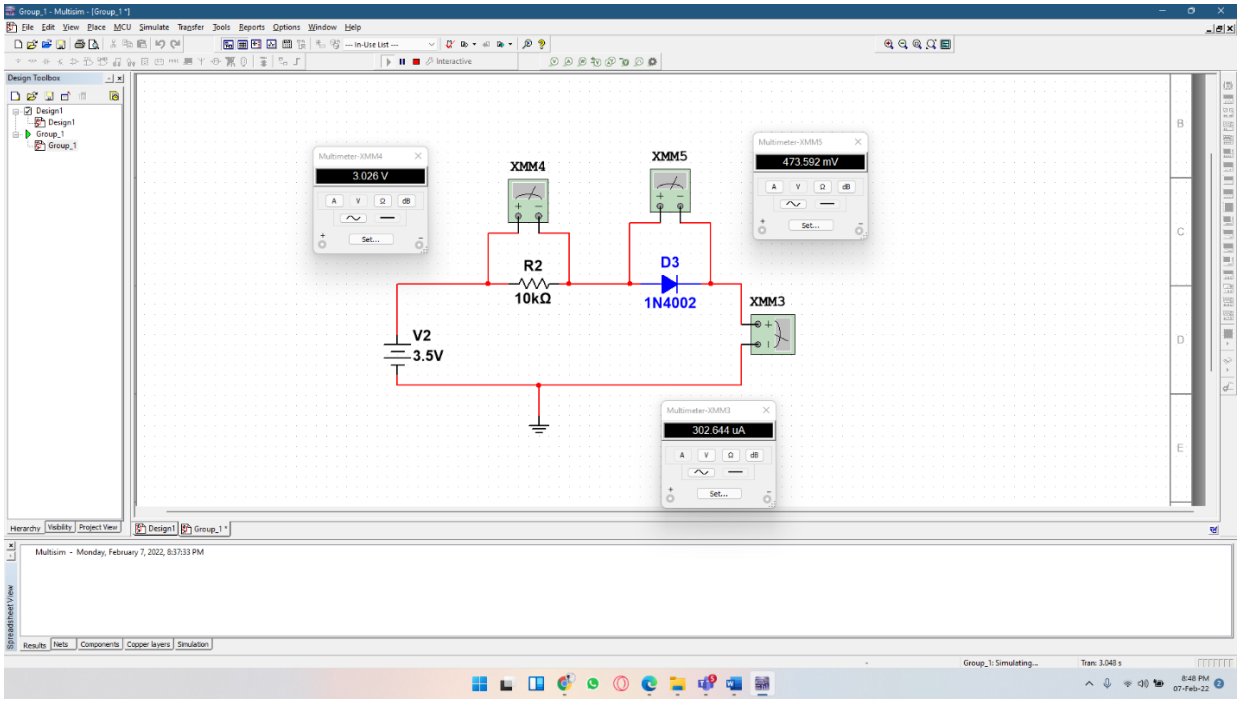


Fig 04: Showing output for 3.5 V

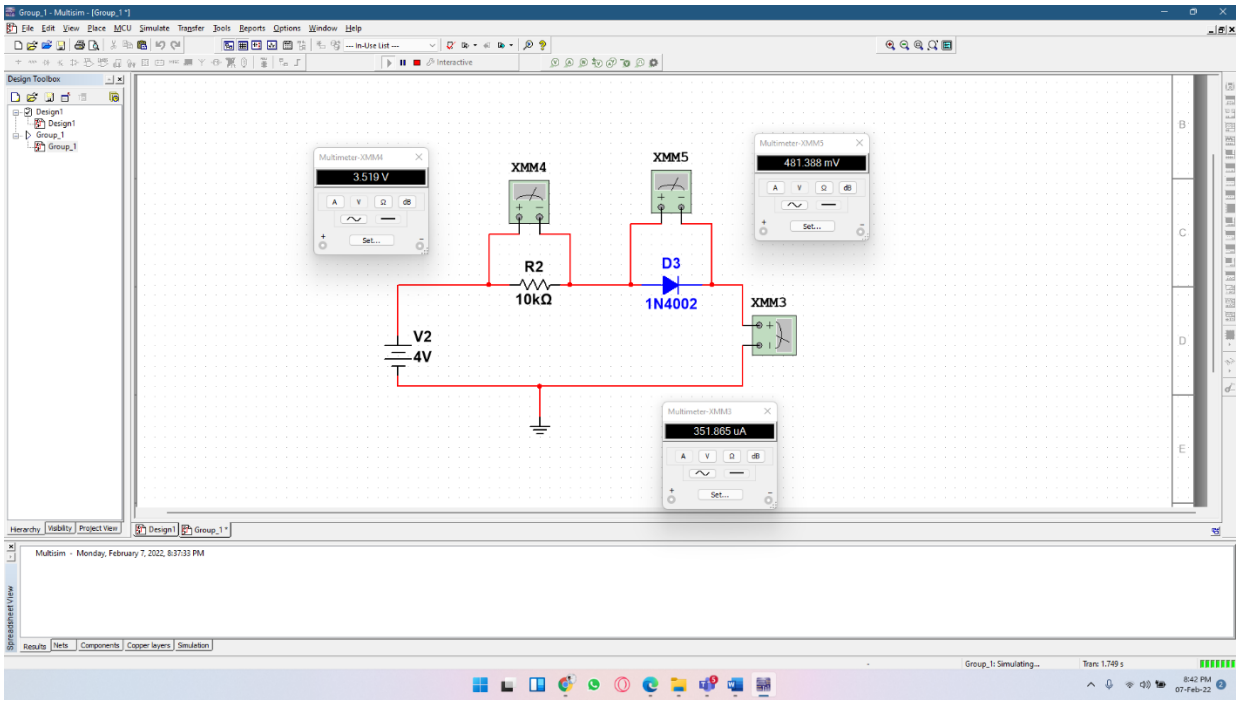


Fig 05: Showing output for 4 V

Result analysis:

Data Table For Diode Characteristics			
V_s.(V)	V_D(V)	V_R(V)	$I_d = V_R$/(10K) (mA)
0	0	0	0
0.1	98.184	1.816 mV	0.0018
0.2	188.164	11.836 mV	1.184
0.3	255.577	44.423	4.442
0.4	298.244	101.756	10.176
0.5	325.945	174.055	17.406
0.6	345.557	254.443	25.445
0.7	360.465	339.535	33.954
0.8	372.386	427.614	42.762
0.9	382.271	517.729	51.773
1	390.692	609.308	60.931
1.5	420.278	1.08	107.973
2	439.333	1.561	156.068
2.5	453.355	2.047	204.667
3	464.437	2.536	253.559
3.5	473.592	3.026	302.644
4	481.388	3.519	351.865

0	0
98.184	0.0018
188.164	1.184
255.577	4.442
298.244	10.176
325.945	17.406
345.557	25.445
360.465	33.954
372.386	42.762
382.271	51.773
390.692	60.931
420.278	107.973
439.333	156.068
453.355	204.667
464.437	253.559
473.592	302.644
481.388	351.865

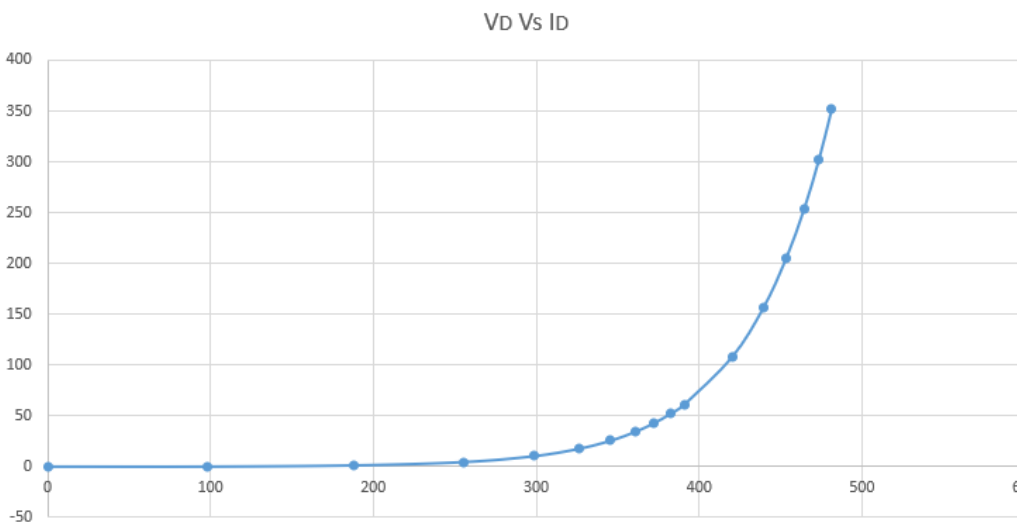


Fig 06: V_D vs I_d Characteristic Curve For The Diode

We have given a sequence of voltage(V) 0 to 4 volt then taken the reading of diode voltage V_D and resistor voltage V_R then we also taken the diode current. After taking the readings we have plotted the values of V_D and I_d and we got the IV characteristic curve for the diode. The diode was forward biased and we can see in the graph it started at the zero point, then the curve increases gradually but the forward current and voltage are very small. When the forward voltage exceeds the diodes P-N junctions internal barrier voltage, which for silicon is about 0.7 volts, after that voltage avalanche occurred and we can see the forward current increased quickly for that the curve increased suddenly.

Conclusion:

In this experiment, we have measured the value of 10k resistor as shown in the figure 4. It was implemented and measured by PSpice according to the Figure 4. Firstly, without the power supply all the components were connected. Then measure the voltage between the two terminals while turning on the DC voltage and fix it to 0V. Here the range of the voltage 0-4 V. So, while changing the voltage, the diode voltage VD and resistor voltage VR and diode current Id were noted and plotted an IV characteristics curve for the diode. From the curve we can actually state that when the voltage was 0 there was no current but after the voltage exceed the 0.7 volts the current started to increase gradually. Because as we know for forward bias condition the voltage must be 0.7V and its only applicable for silicon. So, we can say that it has followed the basic characteristics traits of a silicon diode.