North South University

Department of Electrical & Computer Engineering

LAB REPORT - 1

Course Code: EEE111L

Course Title: ANALOG ELECTRONICS-I LAB

Section: 6

Lab Number: 1

Experiment Name:

I-V Characteristics of diode

Experiment Date: 11-2-2023 & 18-2-2023

Date of Submission: 25-2-2023

Submitted by Group Number:

Group members: 4

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Course Instructor: MHUD

Submitted To: Md. Anisur Rahman Asif

1. Experiment name:

I-V Characteristics of diode.

2. Objectives:

The objective of this experiment is to study the I-V characteristic of diode.

3. Apparatus:

Serial no.	Component Details	Specification	Quantity
1.	p-n junction diode	1N4007	1 piece
2.	Resistor	1KΩ	1 piece
3.	DC power supply		1 unit
4.	Signal generator		1 unit
5.	Trainer Board		1 unit
6.	Oscilloscope		1 unit
7.	Digital Multimeter		1 unit
8.	Chords and wire		as required

4. Theory:

A diode is a semiconductor device that allows electrical current to flow in one direction while blocking it in the opposite direction. It is a bi-polar that one end is positive and another is negative. A diode can be in two states depending on the direction of power. If a diode’s positive end is connected to a power supply's positive end then it will be in Forward biasing and behave as a short circuit. And if the diode’s positive end is connected to a power supply's negative end then it will be in Reverse biasing and behave as an open circuit.

5. Circuit Diagram:

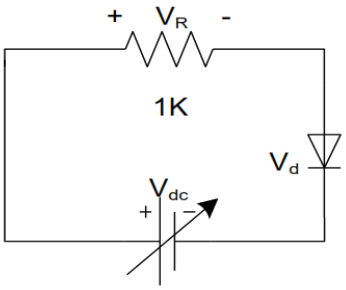


Figure: Circuit Diagram for Obtaining Diode Diode Forward Characteristics.

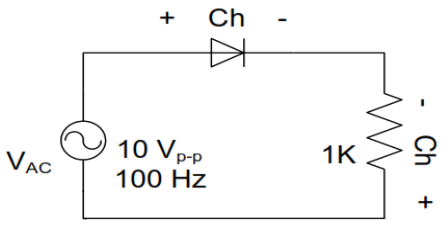


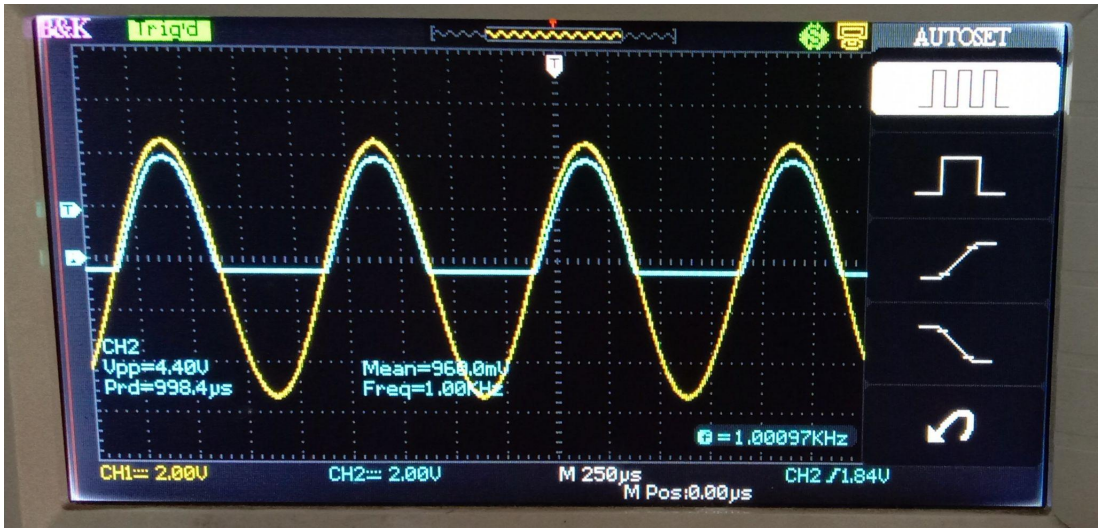
Figure: Circuit Diagram for Obtaining Characteristics From Oscilloscope.

6. Experimental Procedure:

- First we had to measure the resistance of the resistor accurately using a digital multimeter(DMM) and construct the circuit.
- Then we also measured vary input voltage(V_{dc}), diode voltage(V_d) and resistor voltage(V_R) accurately using DMM and recorded the data on the data table.
- We obtained maximum value of V_d without increasing V_{dc} beyond 25 volts and calculated the values of I_d using Ohm's law.
- Again, we had to construct the circuit using a signal generator, make a proper connection and observe the output from the oscilloscope.
- We repeated the process by increasing the input supply frequency 5 KHz.

7. Results:

From the result we can see that when the forward voltage across the diode is 0V, the forward current is 0 mA. As the voltage is being supplied and increased across the diode, the current is also increased. When this voltage becomes large enough to overcome the barrier potential of the P-N junction, a considerable increase in the forward current occurs. Once the voltage being supplied is over 0.7 V, the voltage of the resistor and the current in the circuit suddenly rise rapidly. The voltage of the diode only increases slightly from here. While the other current and voltage readings increase proportionally with the increase of the supply voltage. On the other hand, during the experiment, we also noticed attenuation(1x) in the oscilloscope.

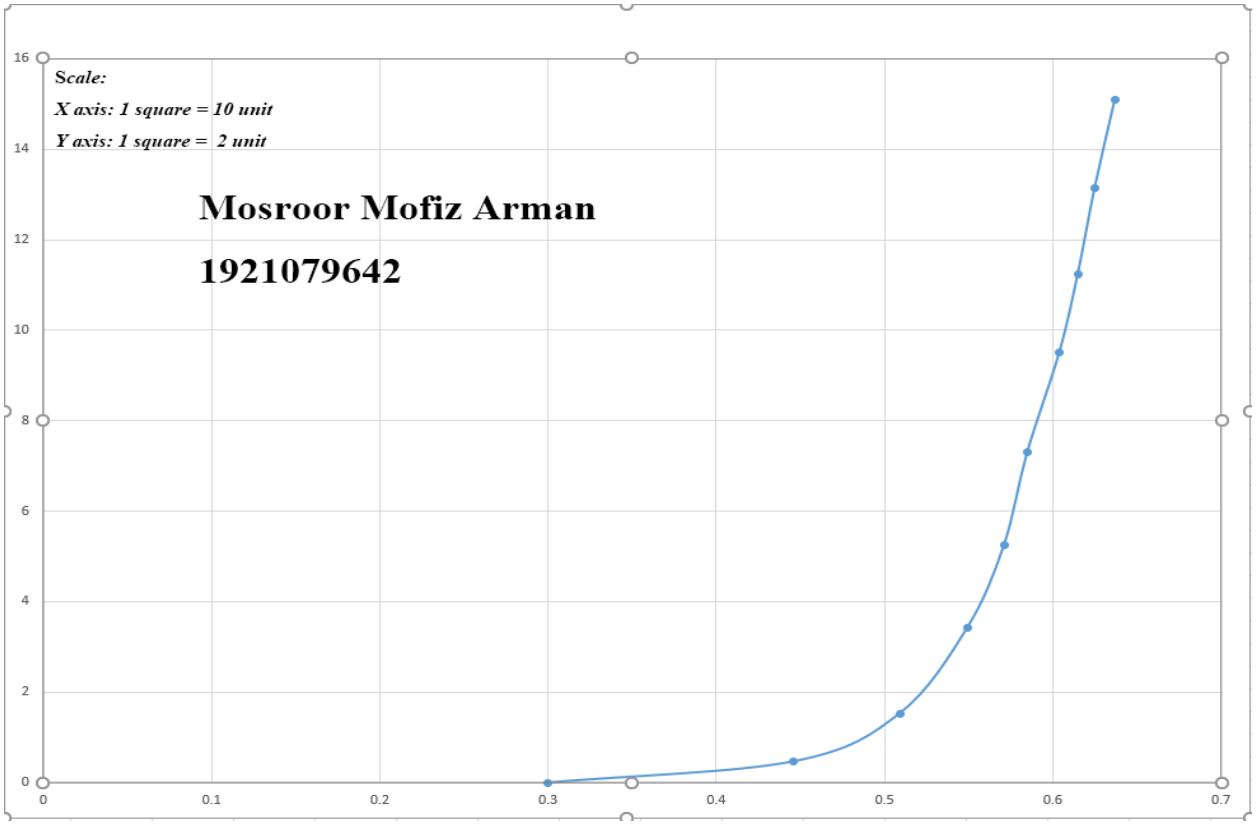


So, we can assume that the diode is a silicon diode because once we are supplying over 0.7 V, current starts flowing through the circuit.

8. Questions and Answers (Q/A):

1. **Draw the I - V characteristics curve of diode from the reading obtain in this experiment.**

Answer: The I - V characteristics curve of diode:



2. Calculate static resistance for I_d = 5 mA and I_d = 10 mA.

Answer: We know, $R_d = \frac{V_d}{I_d}$

For I_d = 5 mA, $V_d\ is$ 0.57 V (From graph)

So, $R_d = \frac{0.57\ V}{5\ mA}$ = 0.114 kΩ

For I_d = 10 mA, $V_d\ is$ 0.61 V (From graph)

So, $R_d = \frac{0.61\ V}{10\ mA}$ = 0.061 kΩ

3. Determine the Q- point for the circuit in figure - 6, when Vdc = 8 volt.

Answer: From the data table, we can see that for 8 volt V_{dc}, V_d is 0.585 volt and I_d is 7.31 mA. So, the Q-point is (0.585, 7.31).

9. Discussion:

The discussion part of the experiment has been attached with the lab report.

10. Experimental Data Table:

The experimental data table of the experiment has been attached with the lab report.

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ID: 1921079642 Lab no: Exp-01.

Discussion:

In this experiment we learned about how a diode works and it's depending on the direction of power. We have also learned about forward and reverse biasing circuits and its relation with open and short circuit. In this experiment, we have worked with forward biasing circuit with 1 KΩ resistance. Actually we didn't get 1KΩ resistance from the resistor, we got 0.992KΩ resistance from the resistor. The threshold voltage of the diode in our experiment approximately between 0.5V to 0.6V. we got that threshold voltage after constructing the circuit and measuring the V_{dc}, V_d & V_R. After that we calculated

I_d by multiplying V_R and Resistance 0.992KΩ. In our experiment, we are very careful about our resistance, voltage value and for that reason, we measured that resistance and voltage values before constructing the circuit. Therefore, we completed our experiment.

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Discussion (2):

In this experiment, we learned about oscilloscope. Oscilloscope is a visualization tool which is used to measure voltage & frequency. In short it is called scope. It has two channels and those channels are used for input & output works. The signal being measured is input to the oscilloscope through a probe which is connected to the input terminals of the oscilloscope. The probe converts the electrical signal into a voltage that displays on the scope. Ground parts must be connected to the black of its supplier that why its called ground reference measurement device. we also learn about scope's attenuation which is the loss or reduction in amplitude or strength of the

signal as it travels through the system. we can be added the two vertical amplitude visualization knob and one horizontal amplitude visualization knob. On the other hand, we also learned about the three ways to measure voltage frequency in oscilloscope - block count, cursor and measure button. Lastly we built the circuit as shown in the circuit diagram with the help of one 1kΩ resistor, one 1N4007 p-n junction diode and signal generator. we also used DMM to measure the voltage across through the resistor and diode. Although we also used the DMM to measure the resistance of the resistor before building the circuit. Lastly we used oscilloscope to visualize the frequency, ~~before~~ took the measurement from the scope and ~~finish~~ completed our experiment.

Experimental Setup :

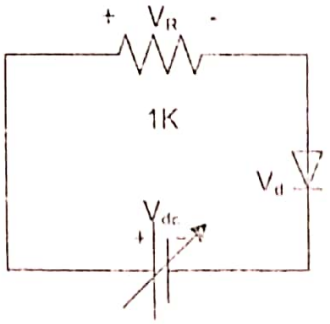

Figure 2.6 : Circuit Diagram for Obtaining Diode Diode Forward Characteristics.

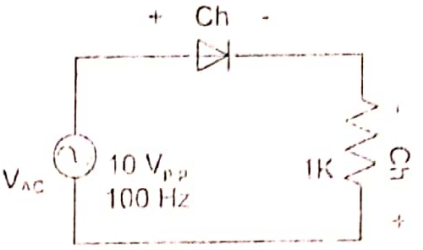

Figure 2.7 : Circuit Diagram for Obtaining Characteristics From Oscilloscope.

Procedure :

1. Measure the resistance accurately using multimeter.
2. Construct the circuit as shown in figure - 1.6.
3. Vary input voltage V_{dc}. Measure V_{dc}, V_d, V_R for the given values of V_d and record data on data table. Obtain maximum value of V_d without increasing V_{dc} beyond 25 volt.
4. Calculate the values of I_d using the formula, $I_d = V_R / R$.
5. Construct the circuit as shown in figure - 1.7.
6. Make proper connection and observe the output from the oscilloscope.
7. Repeat the step 5 and 6 by increasing the input supply frequency 5 KHz.

R=0.992 KΩ

Data Table :

V_{dc} (volt)	Measured V_{dc} (volt)	V_d (volt)	V_R (volt)	$I_d = V_R / R$ (mA)
0	0.3	0.3	0	0
1	1.67	0.446	0.47	0.47
2	2.03	0.509	1.52	1.53
4	4.14	0.549	3.46	3.41
6	6.13	0.571	5.20	5.24
8	8.02	0.585	7.25	7.31
10	10.16	0.609	9.43	9.51
12	12.17	0.615	11.15	11.24
14	14.07	0.625	13.03	13.14
16	16.09	0.637	14.97	15.09

11. Simulation:

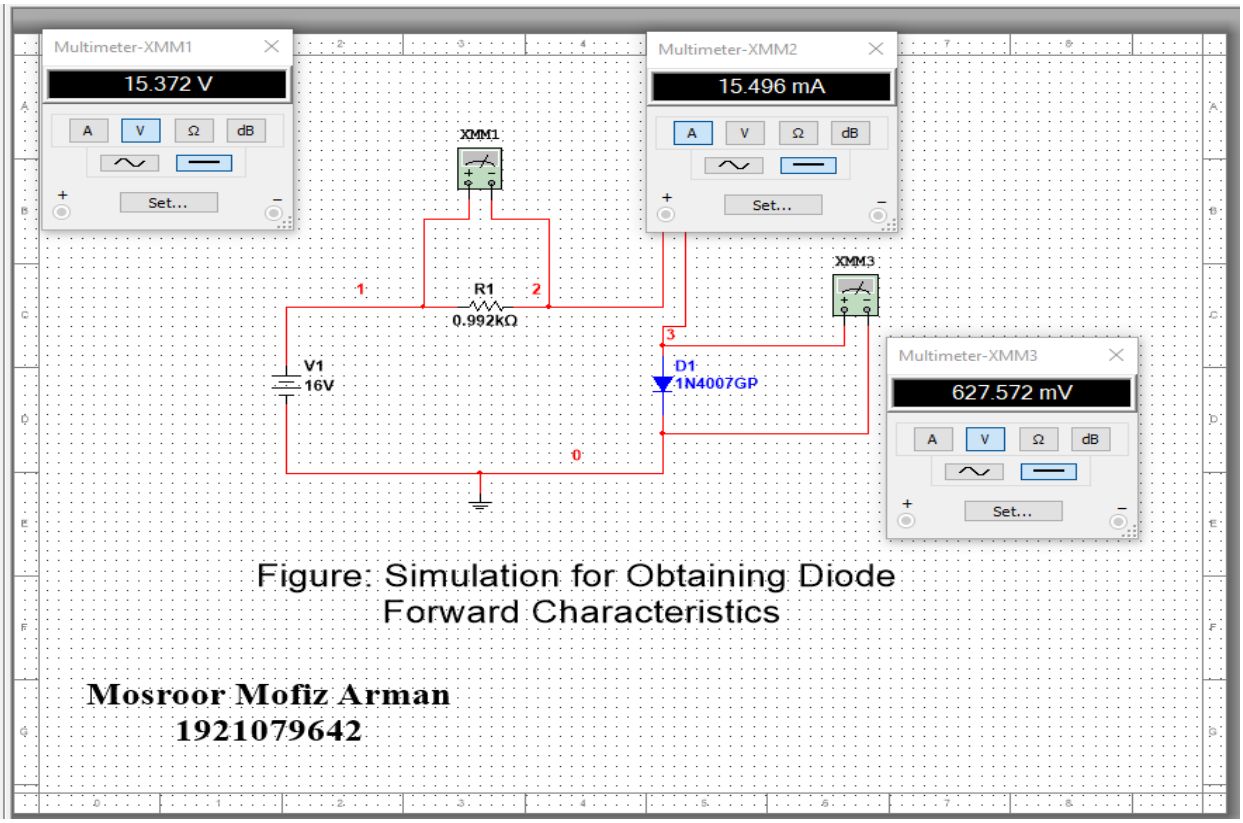

Figure: Simulation for Obtaining Diode Forward Characteristics

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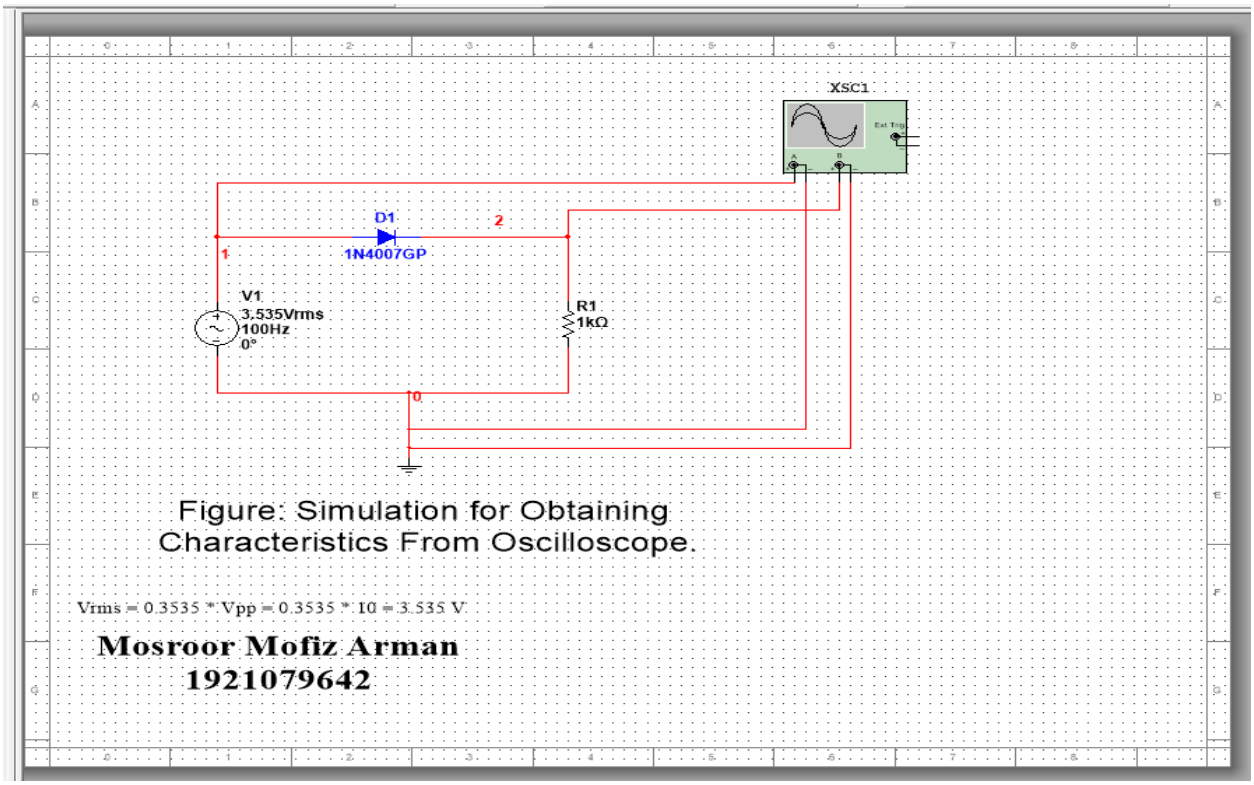

Figure: Simulation for Obtaining Characteristics From Oscilloscope.

Vrms = 0.3535 * Vpp = 0.3535 * 10 = 3.535 V

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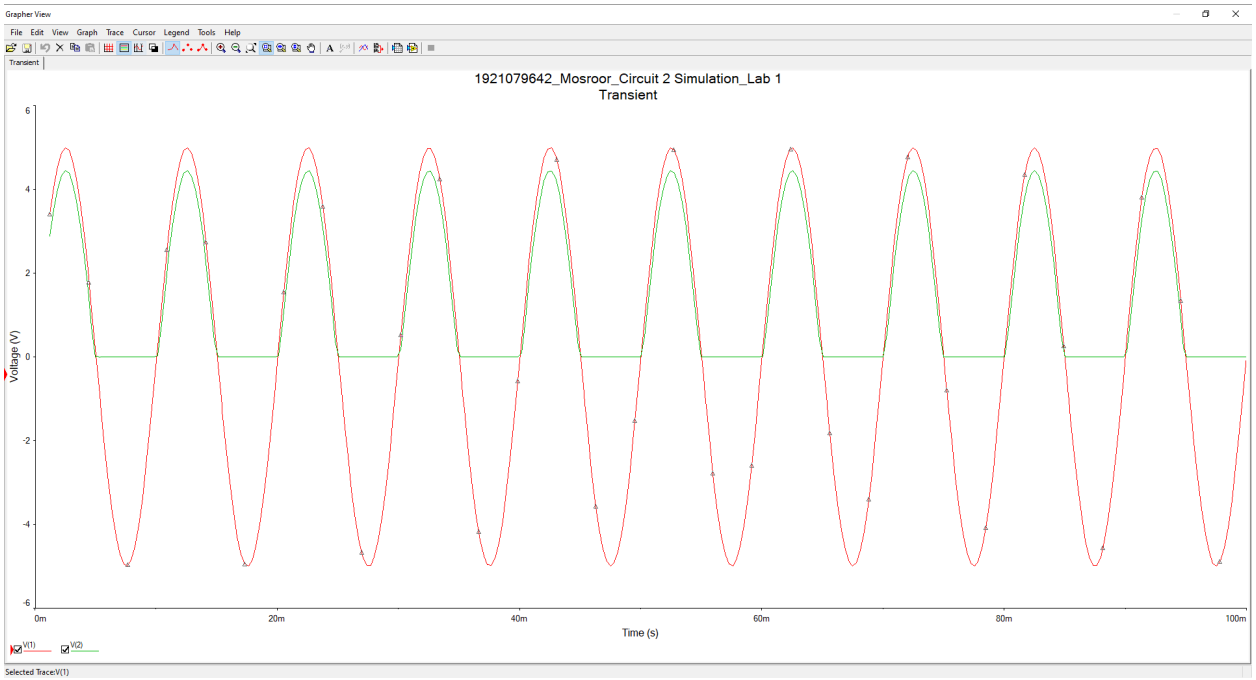
Grapher View
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Transient
1921079642_Mosroor_Circuit 2 Simulation_Lab 1
Transient
Voltage (V)
6
4
2
0
-2
-4
-6
0m
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60m
80m
100m
Time (s)
V(1)
V(2)
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