

Summer 2023  
EEE/ETE 111L  
Analog Circuits-I Lab (Sec-11)  
Faculty: Professor Dr. Monir Morshed(DMM)  
Instructor: Rokeya Siddiqua

**Lab Report 01: I-V Characteristics of diode.**

**Date of Performance:**  
12 August 2023

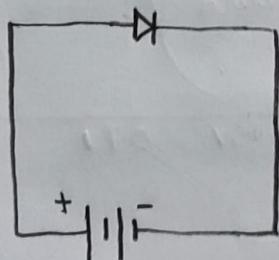
**Date of Submission:**  
19 August 2023

**Group no.: 05**

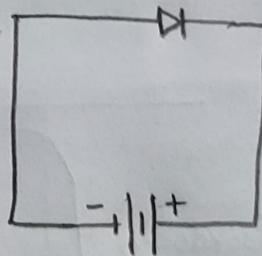
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Objective: Study the I-V characteristic of diode

Theory: A diode is a two terminal electronic component that primarily allows current to flow in one direction while blocking current in the opposite direction. It serves as a basic building block in electronics and is commonly used for various applications such as rectification, signal modulation, voltage regulation, and more. The fundamental property of a diode is its nonlinear current-voltage relationship, which results in the flow of current when the diode is forward biased (positive voltage applied to the anode with respect to the cathode) and the blockage of current when it's reverse-biased (positive voltage applied to the cathode with respect to the anode).



forward bias connection

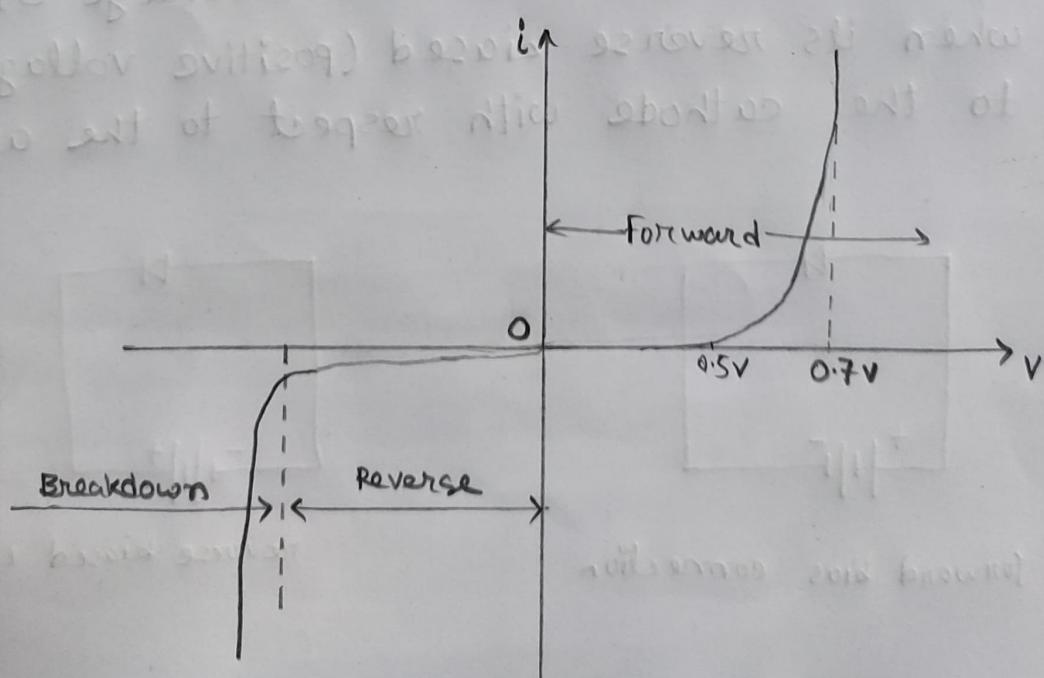


reverse biased connection

characteristics of diode:

Reverse Bias & Breakdown: At reverse bias, diode allows minimal current (microampere range). When reverse voltage increases, diode can reach breakdown, causing a sudden surge of reverse current. Testing this in labs can damage the diode permanently.

Cut-in Voltage (Threshold Voltage): Threshold voltage ( $V_T$ ) is the forward bias voltage where diode starts conducting significant current. For silicon,  $V_T$  is around 0.7 V; for germanium, it's about 0.3 V. Crossing this voltage allows diode to efficiently conduct in its characteristic curve.



I - v characteristics of Diode

## List of Equipment:

Serial No	Component Details	Specification	Quantity
01.	p-n Junction diode	1N4007	1 piece
02.	Resistor	1KΩ	1 piece
03.	DC power supply		1 unit
04.	Signal generator		1 unit
05.	Trainer Board		1 unit
06.	Oscilloscope		1 unit
07.	Digital Multimeter		1 unit
08.	Chords and wire		as required

## Circuit Diagram:

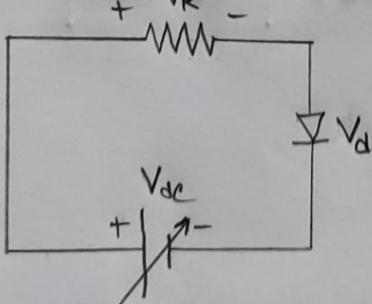


Figure : 1.1

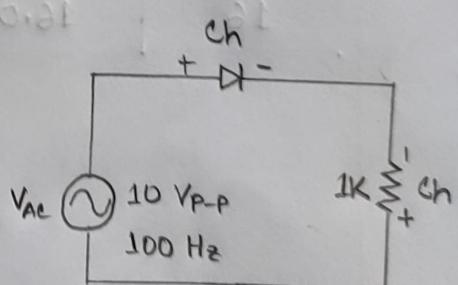


Figure : 1.2

Data Table:

$V_{max}$  for diode = 1.20 V

$V_{max}$  for resistor = 5.0 V

Experimental  $R = 0.994 \text{ k}\Omega$

Theoretical,  $R = 1 \text{ k}\Omega$

$$\% \text{ Error} = \left| \frac{1 - 0.994}{1} \right| \times 100\%$$

$$= 0.6\%$$

$V_R$ (volt)	Measured $V_{de}$ (volt)	$V_d$ (volt)	$V_R$ (volt)	$I_d = \frac{V_R}{R}$ (mA)
0	0 V	0 V	0 V	0 mA
1	0.983 V	0.460 V	0.522 V	0.525 mA
2	1.948 V	0.493 V	1.449 V	1.458 mA
4	3.940 V	0.524 V	3.410 V	3.431 mA
6	5.960 V	0.541 V	5.420 V	5.453 mA
8	7.990 V	0.556 V	7.430 V	7.475 mA
10	10.010 V	0.566 V	9.440 V	9.500 mA
12	12.020 V	0.574 V	11.440 V	11.510 mA
14	14.020 V	0.580 V	13.430 V	13.511 mA
16	16.070 V	0.589 V	15.480 V	15.563 mA

## Results:

For Q-point,  $V_{dc} = 2V$ ,

$$V_{dc} = V_d + I_d R \circ$$

$$\text{Let, } V_d = 0, I_d = \frac{V_{dc}}{R} = \frac{2}{1} = 2 \text{ mA}$$

$$I_d = 0, V_d = V_{dc} = 2V$$

From graph, we found Q-point is (0.469, 0.771).

That means,  $V_d = 0.469 \text{ V}$ ,  $I_d = 0.771 \text{ mA}$

Discussion: In this experiment, we observed the I-V characteristic of a diode. First we connected the diode as a forward bias connection as we connect the positive voltage source with the anode part of the diode. Then we measure the output voltage of the diode and the resistor. We applied multiple voltages and measured the output voltage. We draw a graph to observe the I-V characteristics.

After that, we connected an oscilloscope with our circuit & observed the I-V characteristics. In this part, we faced some problems. Our  $V_{max}$  was too high. There could be various reasons,

- i) It's possible that there was an error in measuring the voltage across the diode.
- ii) The oscilloscope settings might have been configured incorrectly.
- iii) Diodes can exhibit transient behavior in response to sudden changes in voltage.
- iv) Poor signal integrity in the circuit can cause voltage reflections especially in high-frequency applications.
- v) External noise or interference can introduce additional voltage fluctuations.
- vi) The  $V_{max}$  can fluctuate due to the diode malfunction or the function generator.

In short, we mainly observe the I-V characteristics and understood how a diode works as a semiconductor.

Simulation: Attached.

Graphs: Attached.

Attachment:

1. Signed Data Table.
2. Simulation.
3. Graph.
4. Printed Picture of Oscilloscope.

Contribution:

01. Mahmudul Hasan

Id: 2611551043

Contribution: circuit building & Oscilloscope operating.

02. Afrin Akter

Id: 2112246642

Contribution: Data measurement & putting values in the data table.

03. Joy Kumar Ghosh

Id: 2211424642

Contribution: Drawing graph, creating draft of the report & multisim.

04. Sazid Hasan

ID: 2211513642

Contribution: Report writing + Oscilloscope Operating.

05. Sabrina Haque Tithi

Id: 2031265642

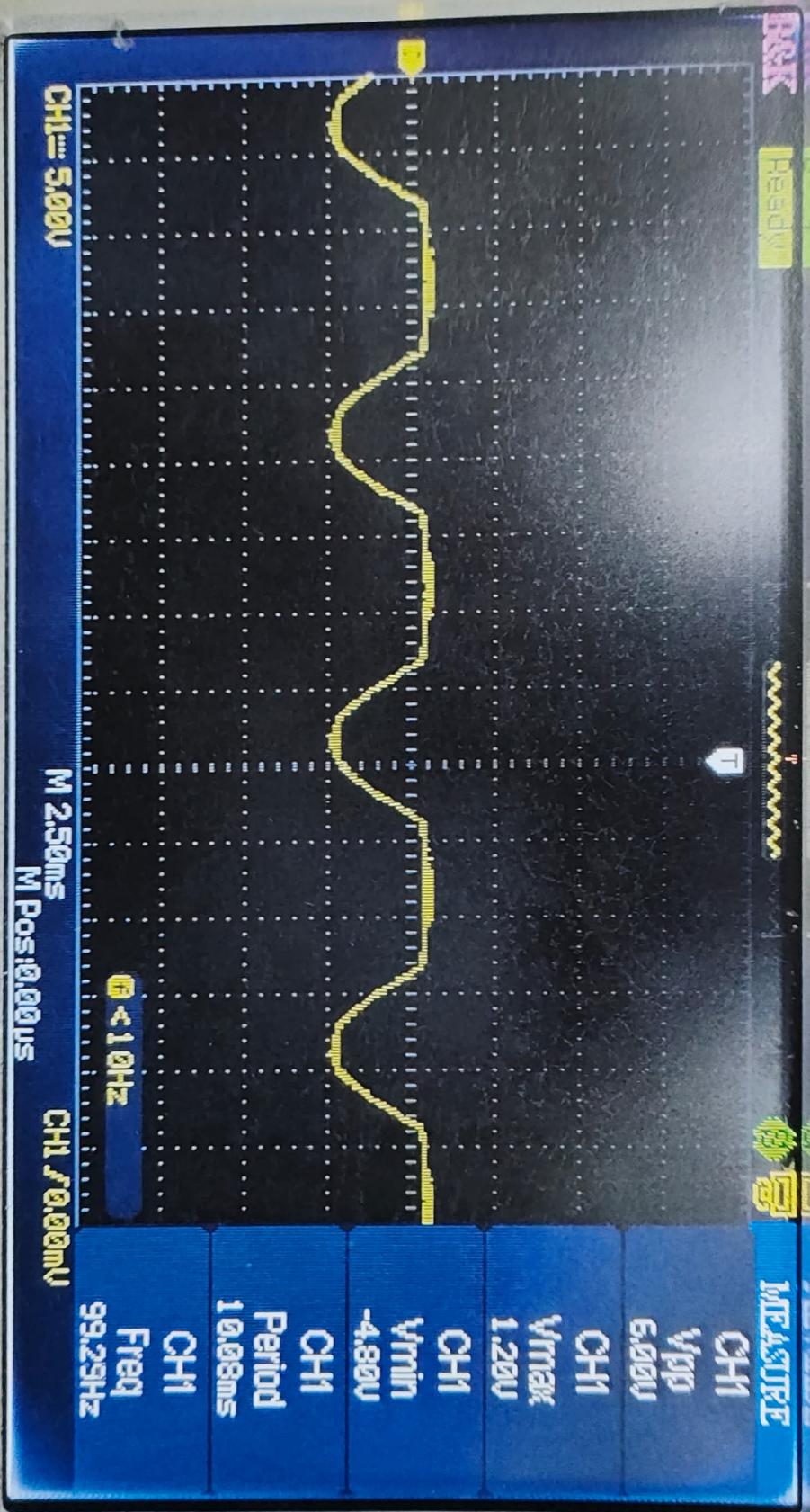
Contribution: Absent due to dengue.

**BK PRECISION**

**2190D**

Digital Storage Oscilloscope

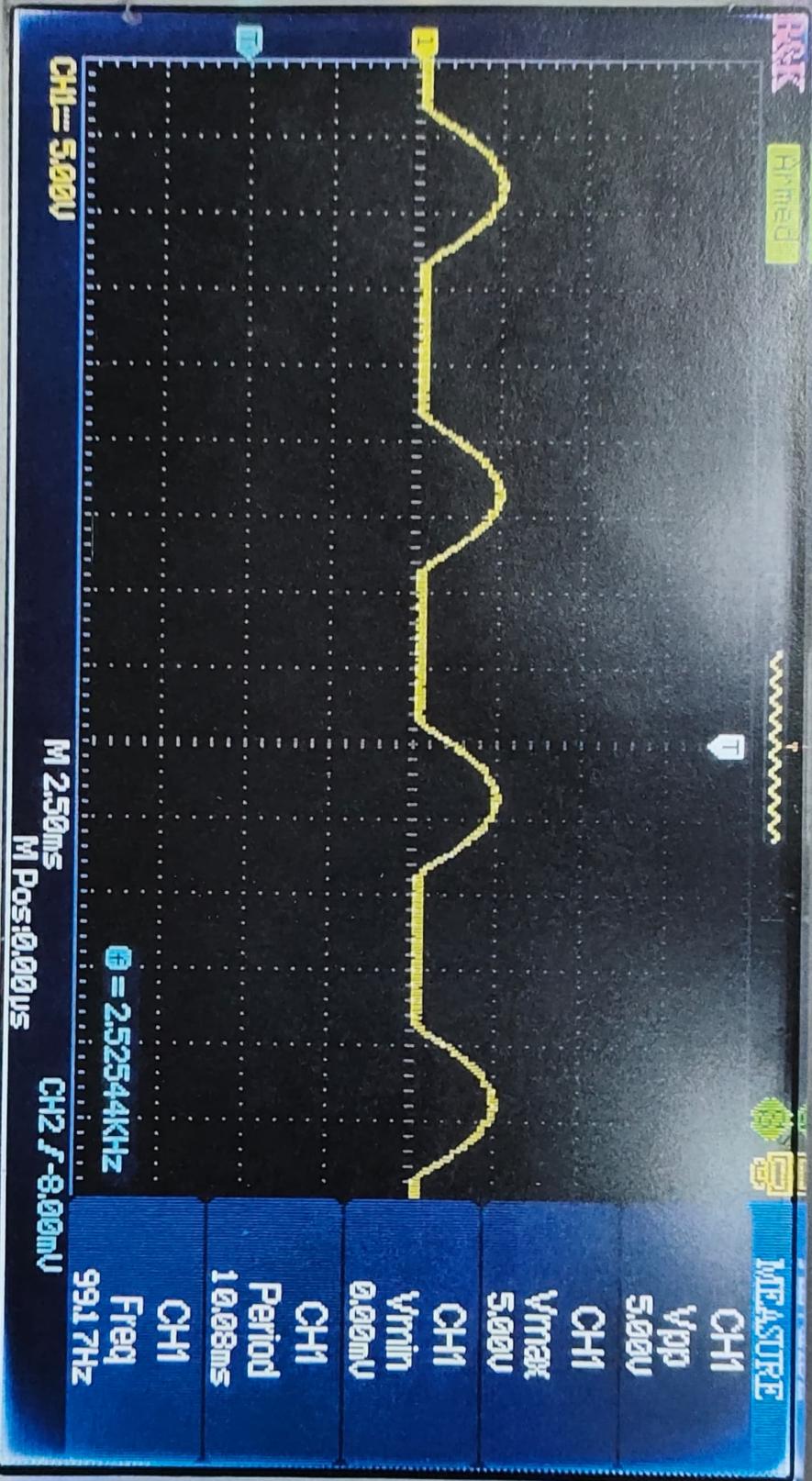
**100 MHz**  
**1 GSa/s**



2190D

Digital Storage Oscilloscope

100 MHz  
1 GSa/s



ON/OFF

