Abu Dhabi University

CEN 304 - Electronic Devices and Circuits

Lab Report 1
DC and AC Characteristics of Diodes

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Section 1

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Abstract

The purpose of this lab was to educate us in different modes of operation of diodes. Also, measuring current through the diode in Forward and reverse bias mode. Additionally, this lab aimed to get us familiarized in AC and DC characteristics of diode and plotting the curve of a diode.

1 Introduction

In First Exercise, we measure the voltage across the diode when its in forward and reveres bias. Finally record these values.

In Second Exercise, we measure the current through the diode when its in forward and reveres bias given specific voltages. Finally record these values in a table given. The table is given in the results and discussions.

In Third Exercise, we observe the AC characteristics of a diode by connecting a function generator to it which generates sinusoidal wave as input to the diode and then measure and record the output signal using oscilloscope.

2 Experiment Set-up

2.1 Exersice 1

First we connect the red side of the diode to the positive side of the DC supply. The red side indicates the positive side of the diode. So in essence we are connecting the positive side of the diode to the positive side of the supply so the diode is in forward bias. We connect the voltmeter across the diode to measure the voltage across it. *Figure 1* gives the circuit diagram for this.

Second we connect the red side of the diode to the negative side of the DC supply. The red side indicates the positive side of the diode. So in essence we are connecting the positive side of the diode to the negative side of the supply so the diode is in backward bias. We connect the voltmeter across the diode to measure the voltage across it.

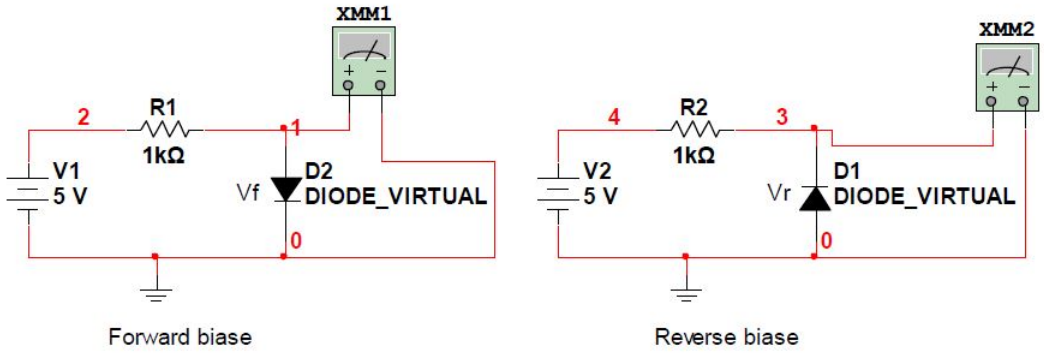

Figure 1: This is how we setup the circuit for Exercise 1

2.2 Exersice 2

First we connect the red side of the diode to the positive side of the DC supply. The red side indicates the positive side of the diode. So in essence we are connecting the positive side of the diode to the positive side of the supply so the diode is in forward bias. The other side of the diode is connected to the multi-meter which is set to measure current (Ammeter). *Figure 2 A* gives the circuit diagram for this.

Second we connect the red side of the diode to the negative side of the DC supply. The red side indicates the positive side of the diode. So in essence we are connecting the positive side of the diode to the negative side of the supply so the diode is in backward bias. The other side of the diode is connected to the multi-meter which is set to measure current (Ammeter). *Figure 2 B* gives the circuit diagram for this.

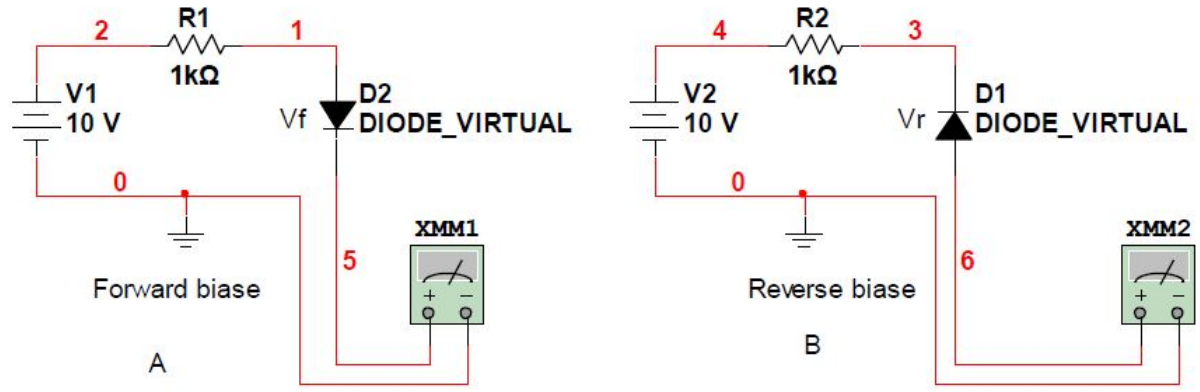

Figure 2: This is how we setup the circuit for Exercise 2

2.3 Exersice 3

Function generator was set-up to give input to the circuit in as sin wave. Oscilloscope's both channels were utilized to detect the voltage input and voltage across the diode. Then we tweaked with the Oscilloscope settings until both signals were aligned. Then we reversed the polarity of diode and observed the change in the oscilloscope's readings. 9. Keep the connections as they are because you will need them in the next part.

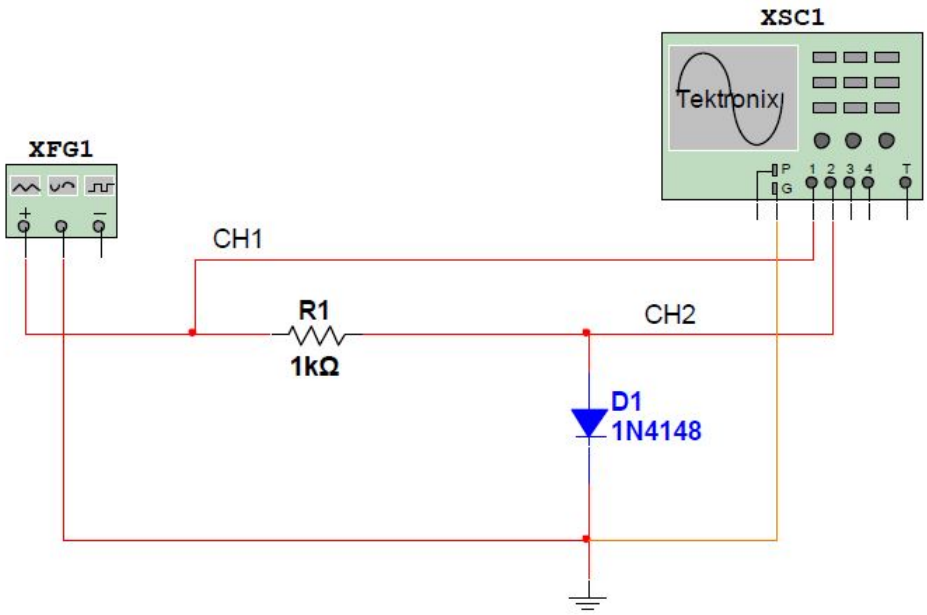

Figure 3: This is how we setup the circuit for Exercise 3

3 List of Equipment used

- Breadboard.
- Digital Multi Meter.
- DC Power Supply.
- Oscilloscope.
- Wires.
- Resistors.
- Function Generator.
- Crocodile Clip Cables.
- Silicon Diode 1N4148.

4 Procedure

4.1 Exercise 1 and 2

- The circuit have been build such that 5 DC voltage power supply is in series with resistor and diode is forward bias.
- The voltage across the diode was measured by voltmeter.
- Then reverse the diode to be as reverse bias and measured the voltage across it.
- In the same circuit, we measured the current for forward diode by connecting the red wire to negative side of diode and black wire to the ground,while for reverse bias we reversed the bias and connected the red wire to positive side and black wire to the ground.
- Then we changed the voltage supplier form 0 to 10 to see the change in current for both forward and reverse bias.

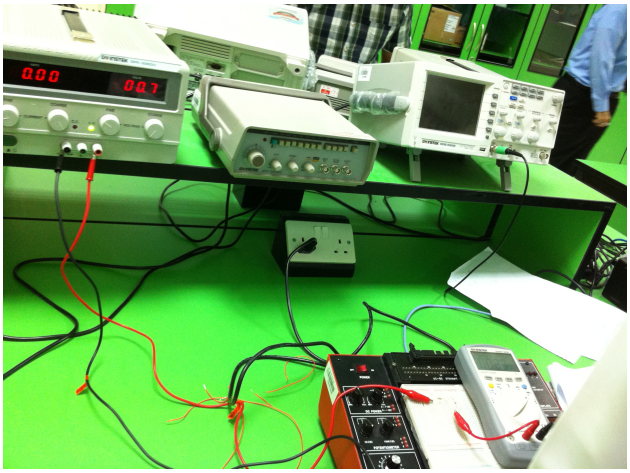

Figure 4: Overall experiment set-up for the exercise 2.

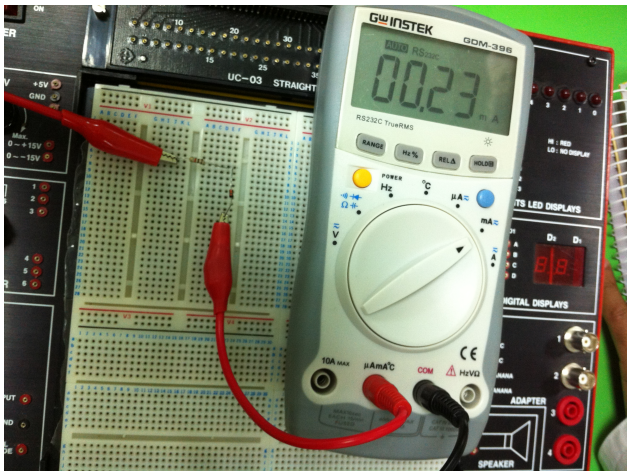

Figure 5: Close up of the Exercise 2 connections. Multi-meter is configured to measure current

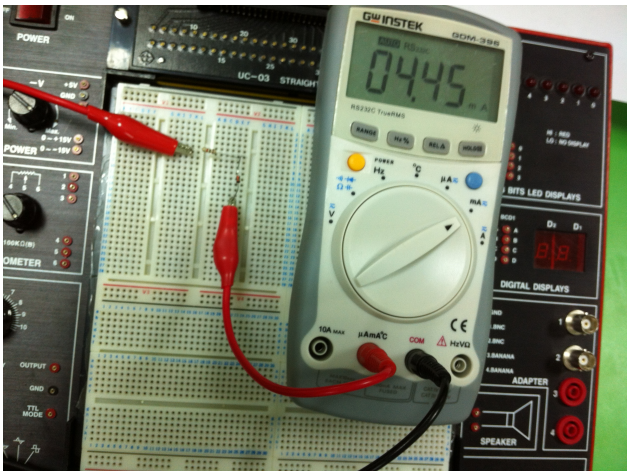

Figure 6: Changing voltages and getting different values of current for the table in Exercise 2

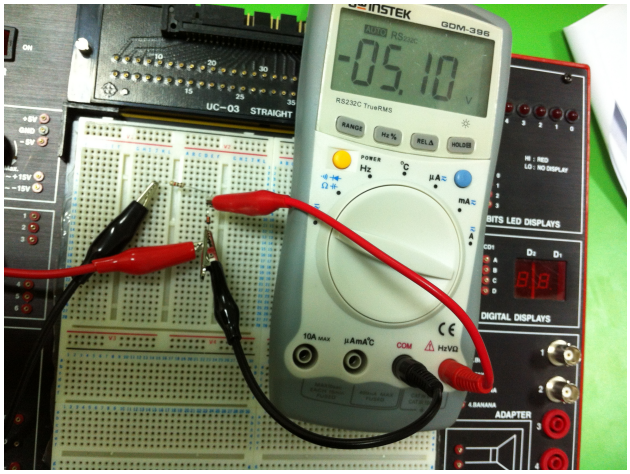

Figure 7: Figure showing how to measure the voltage across the diode

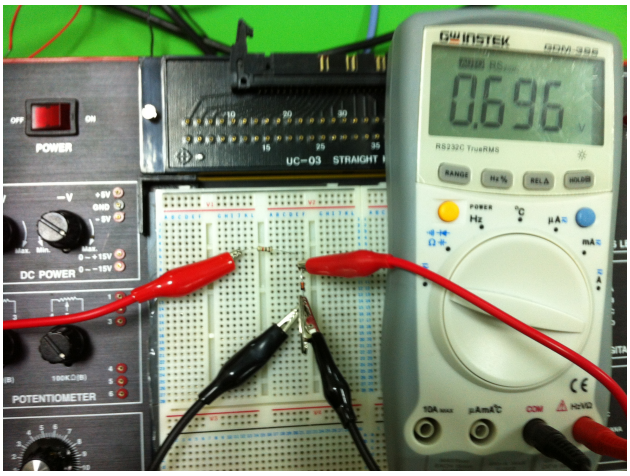

Figure 8: The voltage across the diode is almost 0.7. This proves that the diode is in forward bias

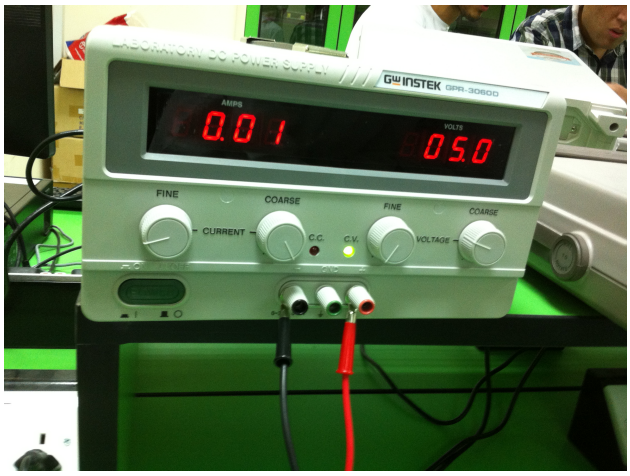

Figure 9: The power supply used

4.2 Exercise 3

- We disconnected the DC power and connected the function generator to applied AC voltage.
- Then setted the function generates output sin wave, 2 voltage peak and 10 KHZ.
- Connected the channel 1 to the resistor and CH 2 to diode.
- To compare two signal we position them at the centre of the oscilloscope screen.
- We reversed the diode and did same steps.

5 Results and Discussions

5.1 Exercise 1

The Following was our Result for Exercise 1.

	Silicon
Forward Voltage	0.7 V
Reverse Voltage	5.1 V

Figure 10: Forward and Backward Voltages across the silicon diode

5.2 Exercise 2

The Following was our Result for Exercise 2.

voltage (V)	Current (A)	Voltage (V)	Current (A)
0	0u	0	0
0.1	0u	-0.1	0
0.2	0.2 u	-0.2	0
0.3	0.3u	-0.3	0
0.4	0.02m	-0.4	0
0.5	0.05m	-0.5	0
0.6	0.15m	-0.6	0
0.7	0.23m	-0.7	0
0.8	0.29m	-0.8	0
0.9	0.4m	-0.9	0
1	0.5m	-1	0
2	1.45m	-2	0
3	2.45m	-3	0
4	3.44m	-4	0
7	6.46m	-7	0
8	7.49m	-8	0
9	8.48m	-9	0
10	9.56m	-10	0

Figure 11: Table of values of current through the diode in reverse or forward bias on different voltages across it

6 Conclusion

- From our results we conclude that when the diode is in the forward bias, the voltage across it is 0.7 V if it is Silicon and 0.3 if Germanium. So the appropriate approximation of real simulation will be to include this 0.7 V loss in the equations.
- In the reversed bias mode the voltage across the normal silicon diode can be HUGE until the breakdown voltage is reached.
- Diode can be responsive to very high frequencies of AC and is very useful in AC to DC conversion.
- Diode can be used to protect the highly sensitive components of a circuit where a circuit cannot afford the reverse current to flow in it. In this case a protection diode is used in parallel to the whole circuit. This diode turns ON and starts to conduct (short-circuit) when reverse polarity of V is applied and does not conduct when correct polarity of V is applied.

7 Plotting the characteristic curve of a diode

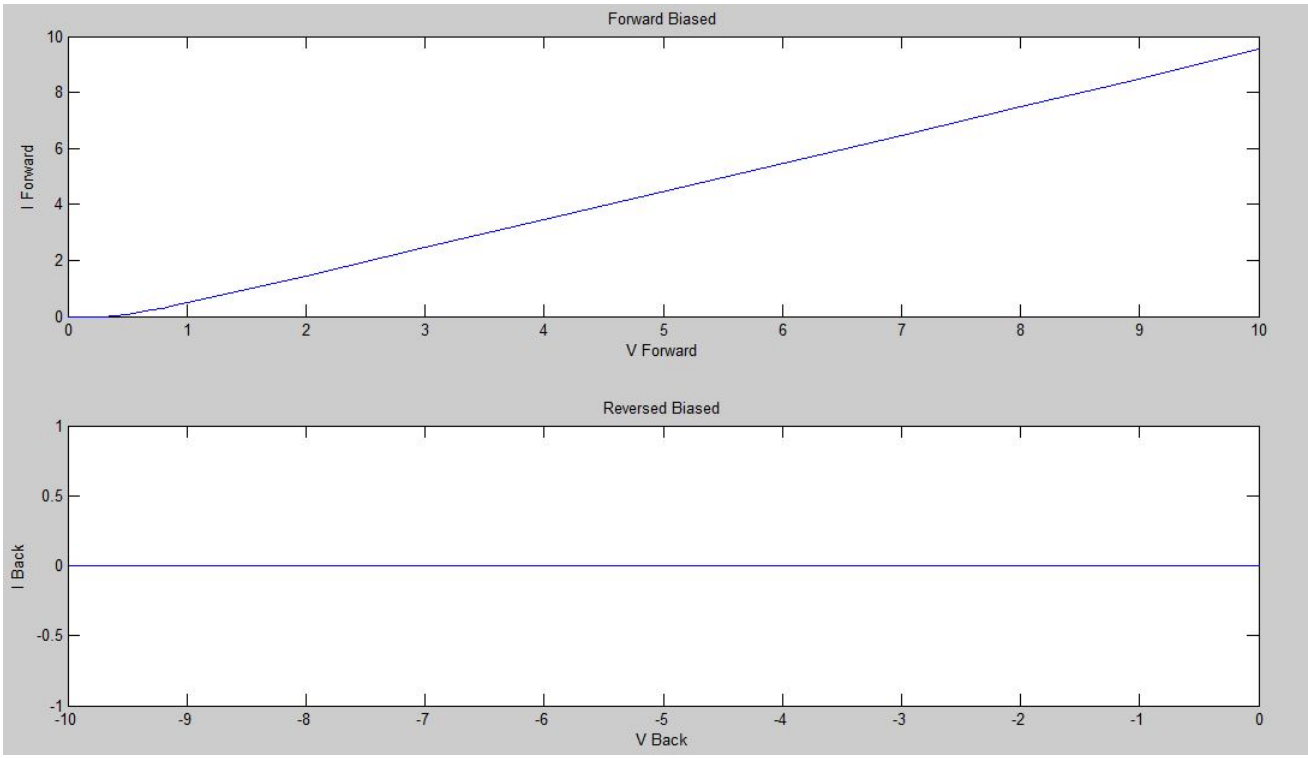

Figure 12: These graph shows the characteristics of a diode in forward and reversed bias. **The difference is that in reversed biased, high voltages across the diode result in higher resistance, therefore approx. no current passes through. While for the forward bias, Once the forward voltage has increased above 0.7 the diode starts to conduct sharply causing the current through it to be high.**