Experiment No. 2: Diode Characteristics

Objectives:

To study the characteristics of silicon and germanium diodes.

Equipment:

DC power supply

Function Generator

Digital Multimeter (DMM)

Components

Diodes: Silicon (D1N4002), Germanium (D1N4148)

Resistors: 1kΩ, 1MΩ

Theory:

Diode:

A diode is a two-terminal electronic component that conducts current primarily in one direction; it has low resistance in one direction, and high resistance in the other.

Characteristics:

- Three important characteristics of a diode are,
- first of all, the forward voltage drops. Under a forward bias condition, this should be about 0.7 volts.
- Then there is the reverse voltage drop. In the reverse, when we reverse bias the diode the depletion layer widens and usually, the applied voltages are felt across the diode.
- Then there is the reverse breakdown voltage. Reverse voltage drop that will reverse current flow and, in most cases, destroy the diode.

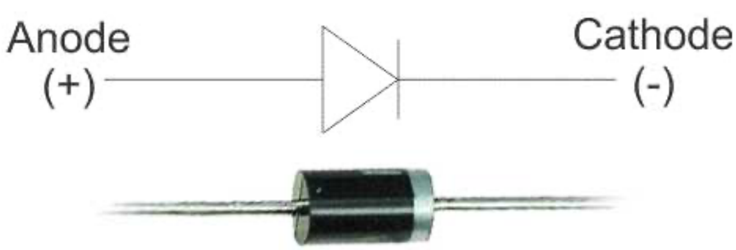


Figure 11 Diode

Function Generator

A function generator is usually a piece of electronic test equipment or software used to generate different types of electrical waveforms over a wide range of frequencies. Some of the most common waveforms produced by the function generator are the sine, square, triangular and saw tooth shapes.

Figure 2 Function Generator

Power Supply

A *power supply* is an electronic device that supplies electric energy to an electrical load. The primary function of a *power supply* is to convert one form of electrical energy to another and, as a result *power* supplies are sometimes referred to as electric *power* converters.

Figure 3 DC Power Supply

Digital Multimeter

A digital multimeter (DMM) is a test tool used to measure two or more electrical values principally voltage (volts), current (amps) and resistance (ohms). It is a standard diagnostic tool for technicians in the electrical/electronic industries.

Figure 4 Digital Multimeter

Procedure

Part A: Forward-bias Diode Characteristics

1. Construct the circuit of *Fig. 3.1* with the supply (E) is set at 0 V. Record the measured value of the resistor.

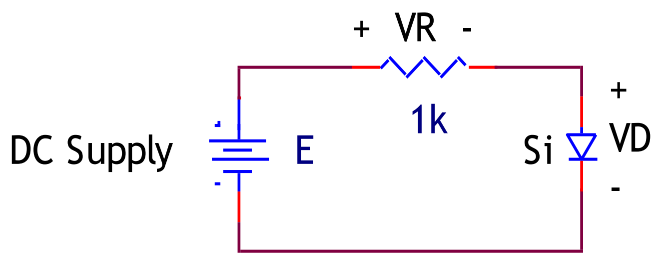


Fig. 3.1

2. Increase the supply voltage until V_D reads 0.1 V. Then measure current I_D and record the results in Table 3.1
3. Repeat step 2 for the remaining settings of V_D shown in the Table 3.1.
   Plot on a graph paper I_D versus V_D for the silicon. Complete the curves by extending the lower region of each curve to the intersection of the axis at $I_D = 0$ mA and $V_D = 0$ V.

Part B: Reverse-bias Diode Characteristics

1. Construct the circuit of *Fig. 3.2* with E is set at 20V. Record the measured value of the resistor.

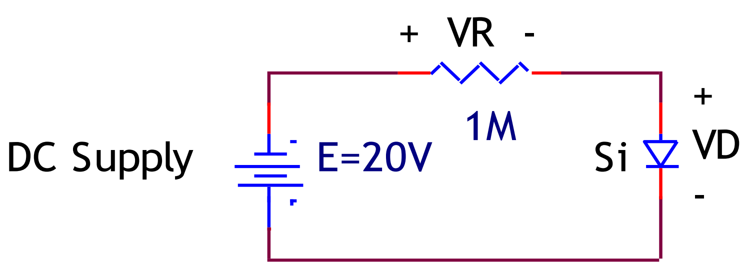
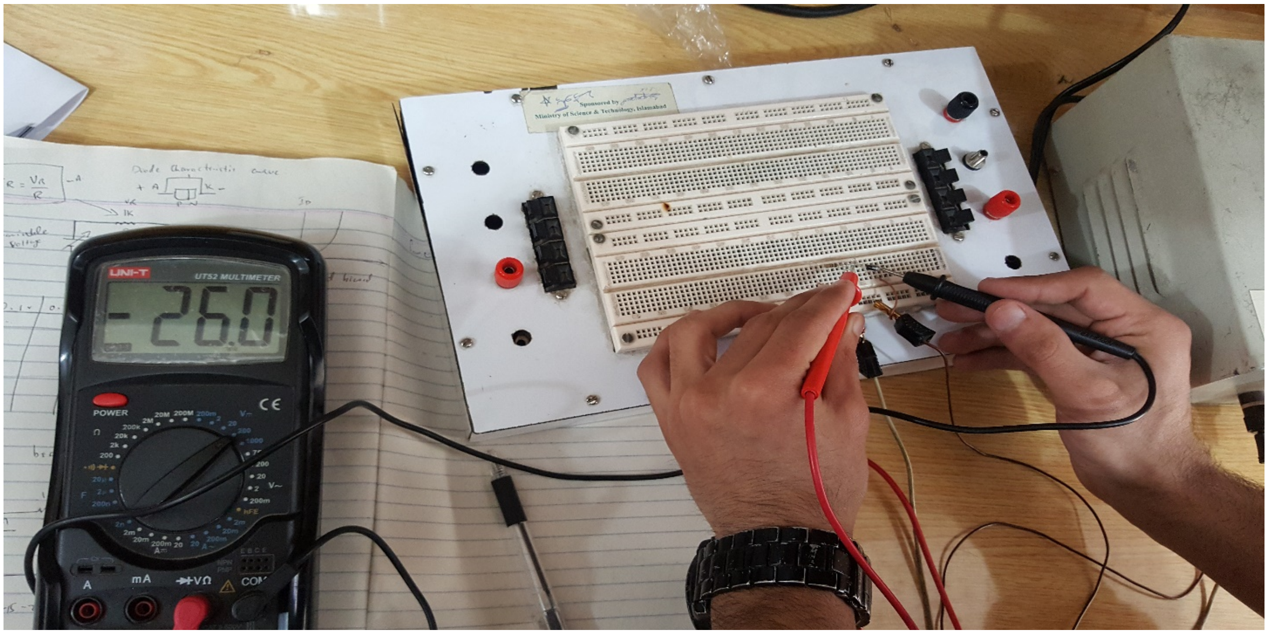


Fig. 3.2

2. Measure the voltage V_D. Measure the reverse saturation current, I_s.

Results and Calculations:



Part A (Forward Bias):

R (measured) = **1k Ω**

I_D (measured). Fill in Table 3.1

V_D (V)	0.13	0.21	0.37	0.42	0.51	0.60
V_R (V)	0.5 mV	0.7 mV	14.5 mV	26.2 mV	2V	12.72V
I_D (mA)	0.0005mA	0.0007mA	0.0145mA	0.0262mA	2mA	12.72mA

Table 3.1(Silicon Diode)

Part B (Reverse Bias):

R (measured) = **1M Ω**

Silicon Diode

V_D (V)	-10.77	-15.21	-20.8	-25.0
V_R (V)	-4.3 mV	-5.3 mV	-5.6 mV	-5.9 mV

I_D (nA)	-4.3 nA	-5.3 nA	-5.6 nA	-5.9 nA

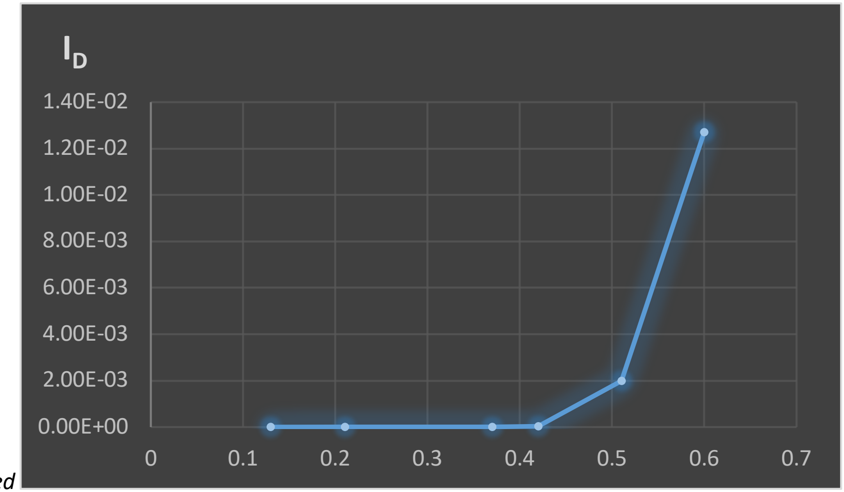


Figure 4 Forward Biased

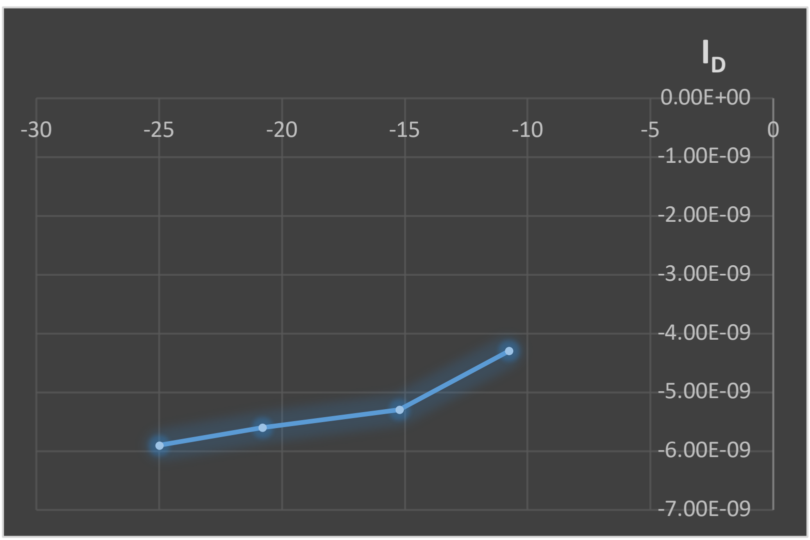


Figure 5 Reverse Biased

Conclusion:

Hence, we practically observed the characteristics of diode in both forward and reversed biased using digital multimeter. In forward biased we saw the gradual increase in current I_D with the increase in voltage V_D. whereas in reverse biased we selected V_D from -10.77V to -25.0V on which we got the values of current I_D from -4.3 nA to -5.9 nA.
