Experiment 7

Equipment required

Link-A kit, 20 MHz Dual Trace Oscilloscope, 1 & 3 Meter Fiber cable, Power supply, Voltmeter, Current meter, Jumper Connecting Wires-4.

Theory In optical fiber communication system, electrical signal is first converted into optical signal with the help of E/O conversion device as LED. After this optical signal is transmitted through optical fiber, it is retrieved in its original electrical form with the help O/E conversion device as photo detector. Different technologies employed in chip fabrication lead to significant variation in parameters for the various emitter diodes. All the emitters distinguish themselves in offering high output power coupled into the plastic fiber. Data sheets for LEDs usually specify electrical and optical characteristics, out of which are important peak wavelength of emission, conversion efficiency (usually specified in terms of power launched in optical fiber for specified forward current), optical rise and fall times which put the limitation on operating frequency, maximum forward current through LED and typical forward voltage across LED. Photo detectors usually come in variety of forms like photoconductive, photovoltaic, transistor type output and diode type output. Here also characteristics to be taken into account are response time of the detector, which puts the imitation on the operating frequency, wavelength sensitivity and responsivity.

Procedure (A) Characteristics of Fiber Optic LED

1. Make the jumper and switch settings as shown in the jumper diagram. Keep pot P4 in fully clockwise position.
2. Connect the ammeter with the jumper connecting wires (provided along with the kit) in jumpers JP3 as shown in the diagram.
3. Connect the voltmeter with the jumper wires to JP5 and JP2 at positions as shown in the diagram.
4. Switch on the power supply. Keep the potentiometer P3 in its minimum position (fully anticlockwise position), P4 is used to control biasing voltage of the LED. To get the VI characteristics of LED, rotate P3 slowly and measure forward current and corresponding forward voltage of the LED, Take number of such readings for forward voltage, forward current & optical power. Keep SW towards VI position.

5. For each reading taken above, find out the power, which is product of I and V. This is the electrical power supplied to the LED. Data sheets for the LED specifies optical power coupled into plastic fiber when forward current was 10 micro A as 200microW. This means that the electrical power at 10mA current is converted into 200 micro W of optical energy. Hence the efficiency of the LED comes out to be approx. 1.15%.

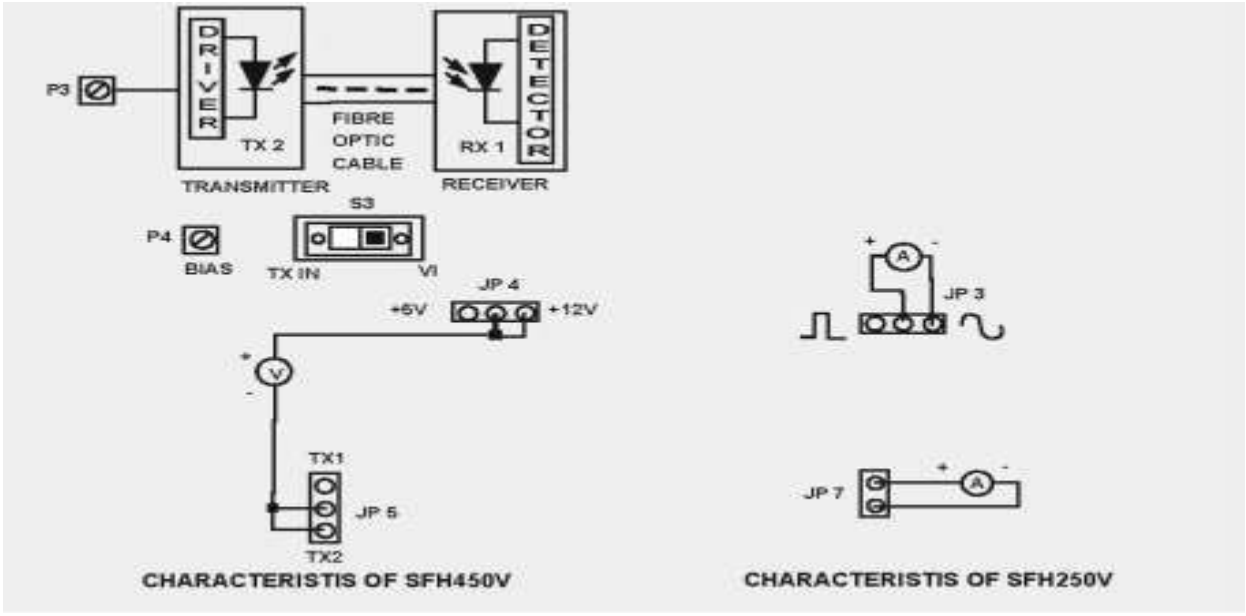
6. With this efficiency assumed, find out optical power coupled into plastic optical fiber for each of the reading in step 4. Plot the graph of forward current v/s output optical power of the LED.

7. Repeat the above procedure by using SFH 450V (950 nm) LED.

(B) Characteristics of detector 1. Make the jumper and switch settings as shown in the jumper diagram. Keep pot P4 in fully clockwise position. 2. Connect the ammeter with the jumper connecting wires (provided along with the kit) in jumpers JP7 as shown in the diagram. 3. Connect 1Meter Fiber between TX1 & RX1. 4. Measure the current flowing through Detector (RX1) SFH250V at corresponding optical power output (Normally in u A) as per the table. 5. We can observe that as incident optical power on detector increases, current flowing through the detector increases.

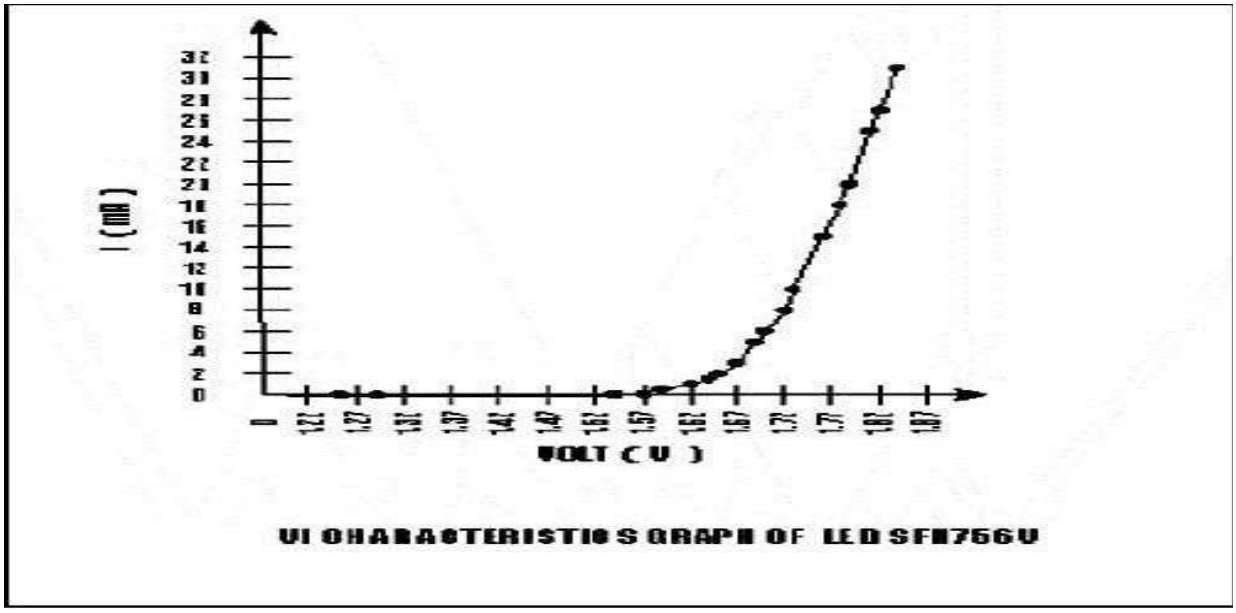
Observations

S No	**Forward Voltage of LED (V)**	**Forward Current of LED (mA)**	**Electrical Power Pi = V * I**	**Optical power of LED Po = Pi * 1.15%**	**Output current (μ A)**

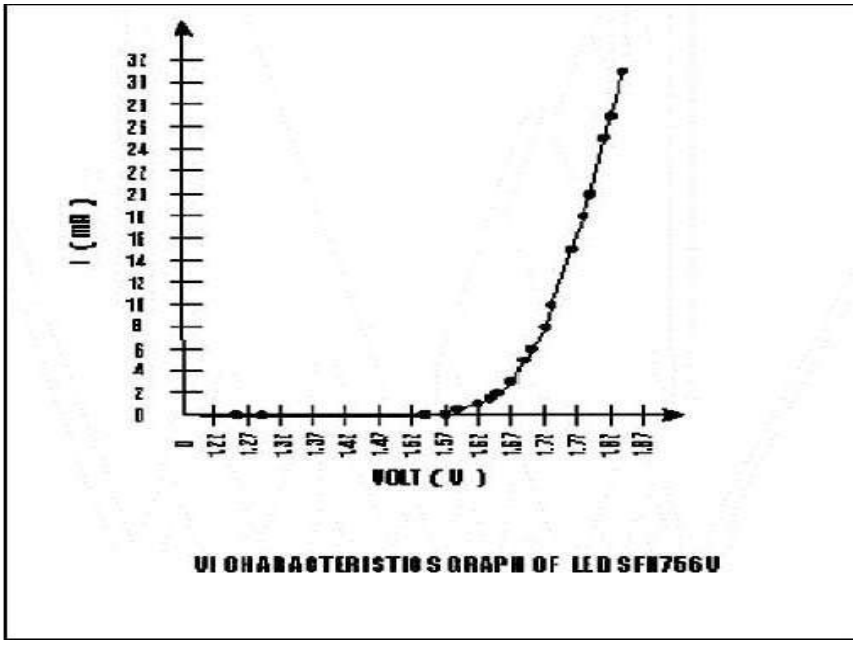


CHARACTERISTIS OF SFH450V

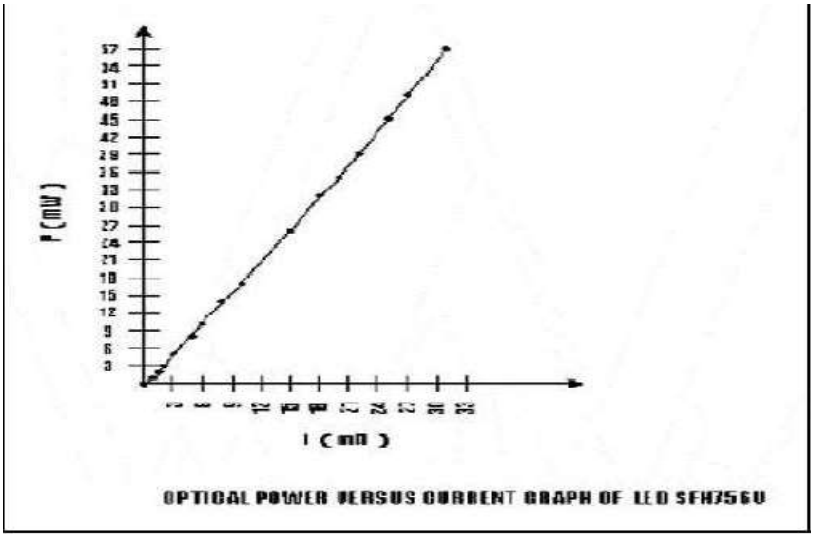
CHARACTERISTIS OF SFH250V



VI CHARACTERISTICS GRAPH OF LED SFH756V



VI CHARACTERISTICS GRAPH OF LED SFH756V



OPTICAL POWER VERSUS CURRENT GRAPH OF LED SFH756V

Precautions

It is very important that the optical sources be properly aligned with the cable and the distance from the launched point and the cable be properly selected to ensure that the maximum amount of optical power is transferred to the cable.

Result:

The characteristics of LED **&**DETECTOR are found.