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EXP.NO: 5

Name of experiment: Transmission characteristics of optical fibers

Purpose of experiment: To study the transmission losses of optical fiber.

Apparatus: Optical fiber (1m, 0.5m) lengths (grating, step index) fibers, Oscilloscope, Detector, Bread board, LED, Power supply.

Theory:

Theoretical studies were carried out in the early years of the present century that the idea of a communication system based on the propagation of light within circular dielectric wave guide was considered seriously. The transmission characteristics are at most importance when the suitability of optical fibers for communication purpose is investigated. The transmission characteristics of most interest are those attenuation (or loss) and bandwidth. Attenuation or transmission loss of optical fibers has proved to be one of the most important factors in bringing about their wide acceptance in telecommunication. Signal attenuation within optical fibers as with metallic conductors is usually expressed in the logarithmic unit of the decibel which is used for comparing two power levels may be defined for a particular optical wavelength as the ration of the input (transmitted) optical power Pi into a fiber to the output (received) optical power Po from the fiber us: -

$$\textbf{Number of decibels (dB)} = 10 \log_{10} P_i/P_o \qquad (1)$$

In optical fiber communication the attenuation is usually expressed decibels per unit length (dB.Km-1) following: -

$$\alpha_{\mathrm{dB}}\, L = 10 \log_{10}\left(\frac{P_i}{P_o}\right) \qquad (2)$$

where α_{dB} is the signal attenuation per unit length in decibels and L is the fiber length.

Procedure 1. Connect the detector circuit shown in figure 1 and laser diode to the power supply. 2. Connect the output of the detector to the channel one of the oscilloscopes and determine the laser power. 3. Set the equipment as shown in figure 2 and determine the laser power using step index fiber optic. 4. Vary the voltage supplied to the laser diode from 2 to 5volt step 0.5 volt and determine the power of the with and without fiber optic. 5. Draw laser power with fiber via laser power without fiber optic. 6. Determine the attenuation factor from the graph.

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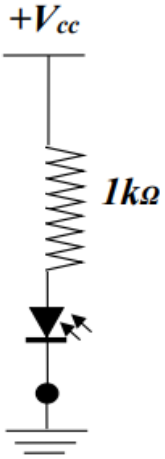

Figure (1): Detector circuit.

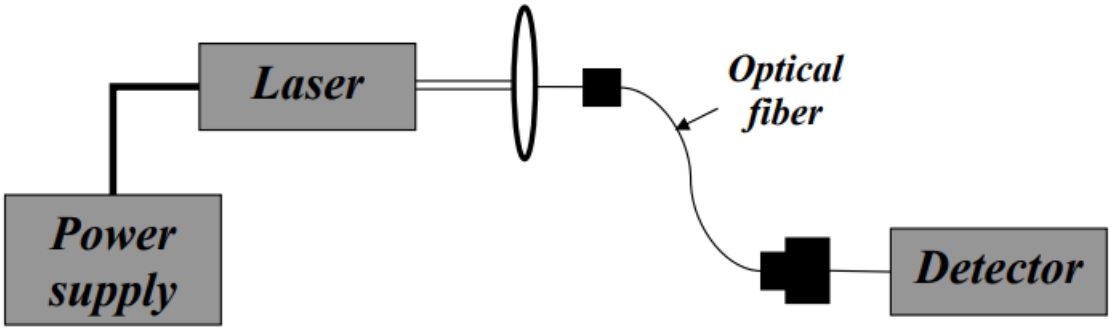

Figure (2): Experiment setup.

Discussion

Q1) What are the advantage of the fiber optics?

Q2) Describe the types of the materials absorption losses within optical fiber?

Q3) Discuss the effects of the type and length of the optical fiber to the power of the laser beam?

Q4) What are the kinds of attenuation in fiber optics?