Assisgnment-11 Experiment-11

STUDY OF ATTENUATION AND PROPAGATION CHARACTERISTICS OF OPTICAL FIBER CABLE

I . ATTENUATION IN FIBERS

Aim

(i)   To determine the attenuation for the given optical fiber.

(ii)   To measure the numerical aperture and hence the acceptance angle of the given fiber cables.

Apparatus Required

Fiber optic light source, optic power meter and fiber cables (1m and 5m), Numerical aperture measurement JIG, optical fiber cable with source, screen.

Principle

The propagation of light down dielectric waveguides bears some similarity to the propagation of microwaves down metal waveguides. If a beam of power P_i is launched into one end of an optical fiber and if P_f is the power remaining after a length L km has been traversed , then the attenuation is given by,

Attenuation $= 10[\log (P_i/P_f)]/L$ dB /km

Formula

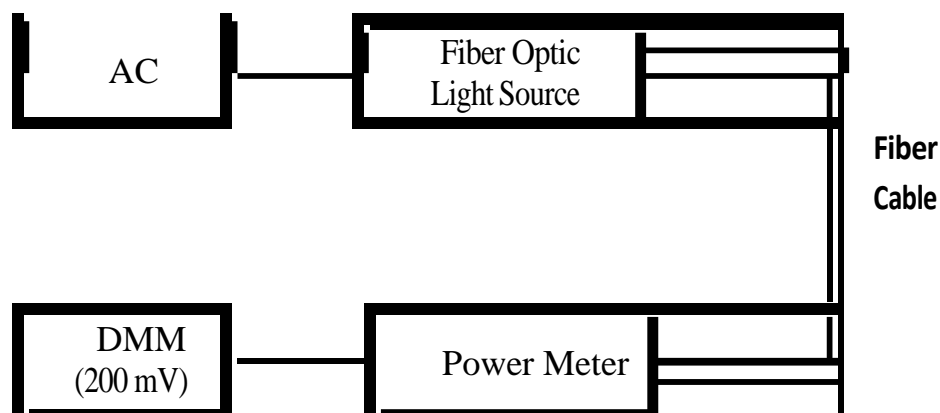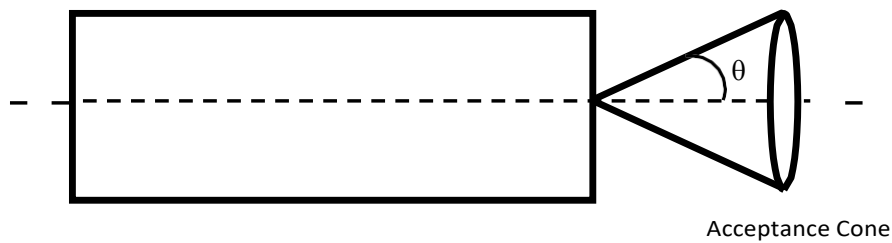Attenuation $= 10[\log (P_i/P_f)]/L$ dB /km

Fig.5.1 Setup for loss measurement

Table 9.1: Determination of Attenuation for optical fiber cables

$$L = 4 \text{ m} = 4 \times 10^{-3} \text{ km}$$

Source Level	Power output for 1m cable (P_i)	Power output for 5m cable (P_f)	**Attenuation**= $10[\log(P_i/P_f)]/L$ dB /km
Min	-27.8	-27.2	
Max	-14.2	-12.9	

Fig. 5.2. Numerical Aperture

Table 9.2: Measurement of Numerical Aperture

Circle	Distance between source and screen (L) (mm)	Diameter of the spot W (mm)	$NA = \dfrac{W}{\sqrt{4L^2 + W^2}}$	θ
5m	10	10		
	12	12		
	14	14		
	16	17		
	18	19		
1m	10	11		
	12	12		
	14	15		
	16	18		
	18	19		

Assignment Questions:

1. From P_i and P_f to calculate the attenuation for maximum and minimum level by using the formula and enter same in the respective coloum.

2. From L, W to calculate the Numerical Aperture (NA) by using the formula and enter values in the respective coloum. Also calculate the mean value for both 1m and 5 m cable.

3. From NA, by using the formula $\theta = \text{Sin}^{-1}$ (NA), calculate the acceptance angle. Find out the mean value of acceptance angle for 1m and 5m cable. **The final acceptance angle is twice the mean value**.

4. Write the result in the following order

      (i)   Attenuation at source level Minimum =   (dB/km)

      (ii)   Attenuation at source level Maximum =   (dB/km)

      (iii)   The numerical aperture of fiber is measured as 5m = ---- , 1m = --------

      (iv)   The acceptance angle is calculated as 5m = ---------, 1m = ----------

Finally, submit the scanned copy of your observation note book in GCR on (or) before THREE working days from the date of experiment.