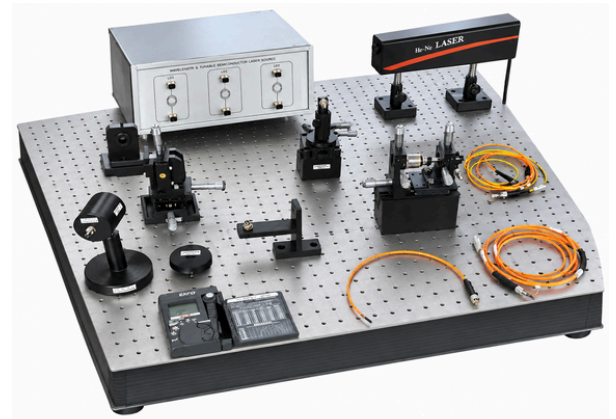


FOL-PHYSICS

Physics of Fiber Optic Lab



FEATURES

- This laboratory is designed to study the physics of fiber optics.
- It deals with the study of various important characteristics of optical fiber cable like numerical aperture, V number, attenuation, coupling loss and mode field diameter.

SPECIFICATIONS

Laser

- Source Type : He-Ne Laser
- Wavelength : 632.8nm
- Light : Red Visible
- O/P Power : 2mW
- Complete system with power supply

Laser to fiber coupler

- Laser to fiber coupler with Lens adjustment facility to adjust beam into core of fiber
- Coupling Efficiency : >70% for SM fibers > 90% for MM fibers
- Operation Wavelength : 180 to 2000nm
- Power Handling Capacity : >1watt

Laser power meter

- Digital display: 4039 full scale
- Bar graph display: 41-segment display
- Power Measurement : 0.01 μ W ~ 40.39mW
- Resolution : 1nW
- Power Supply : LR44 1.5 V x 2
- Over Load Indication : Displays "OL"
- Operation Wavelength : 400 ~ 1100 nm
- Calibrated to 633nm

Optical Patchcord ST-ST

- Single Mode : 9/125 μ m 1mtr.
- Multi Mode : 62.5/ 125 μ m 1 mtr.
- Multi Mode Fiber Pigtail : 62.5/125 μ m 1 mtr.
- Multi Mode : 100/140 μ m 1mtr.

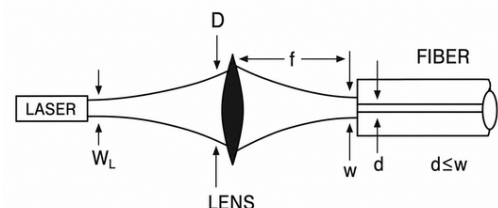
Spool

- 3 in 1 Multi Mode Spool (100m, 500m, 1000m)

Measurements & Method

Measurement of Coupling Loss

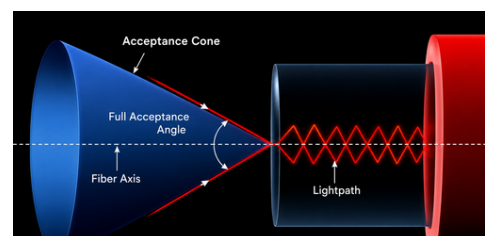
- In order to achieve maximum coupling efficiency, the fiber core diameter has to be bigger than the spot diameter.
- Another factor which determines the coupling efficiency is the matching of fiber numerical aperture to numerical aperture of the focused rays.
- The size of the single mode fiber is very small, around 4-9 microns.



- For minimum coupling loss couple alignment should be proper and LASER beam characteristics should be matched properly.

Measurement of Numerical Aperture

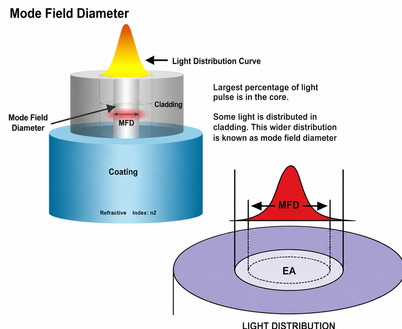
- Numerical Aperture is range of acceptance angles rotated around axis, where light can be coupled into a waveguide such as the core of an optical fiber.



- The blue cone is known as the cone of acceptance.
- Light waves within the acceptance cone can be collected in a small area which can then be sent into the optical fiber.
- Numerical aperture is measure of light gathering capacity of optical fiber. Light outside the acceptance cone cannot be coupled to onto optical fiber. It can be calculated quantitatively using formula $NA = n \sin \theta$

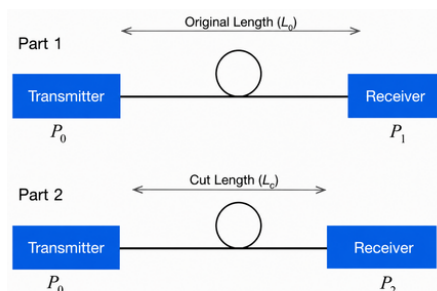
Measurement of Mode Field Diameter of an Optical Fiber

- The mode field diameter (MFD) represents a "measure of the transverse extent of the electromagnetic field intensity of a mode of light in a fiber cross section".
- In optical fiber, this typically is larger than the fiber core, since a portion of the light propagates through the cladding.
- MFD is determined using a Gaussian approximation of the intensity distribution with the MFD defined as the width of the curve at the $1/e^2$ power level.



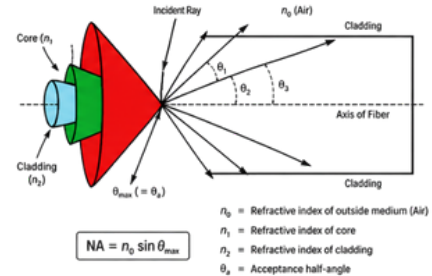
Measurement of Attenuation of an Optical Fiber by Cutback Method:

- The cutback method is used for measuring the total attenuation of an optical fibre.
- The cutback method begins by measuring the output power P_1 of the test fibre of known length 'L'. Without disturbing the input conditions, the test fibre is cut back to a shorter length.
- The output power P_2 of the short test fiber is then measured and the fibre attenuation 'A' and the attenuation coefficient 'a' are calculated

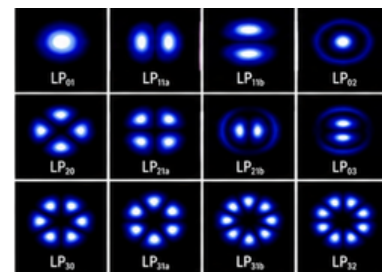


Mode Observation:

- Light propagates through the fiber core only at specific angles within the N.A. cone.
- The acceptance cone consists of discrete annular conical ray paths, not a continuous solid cone.



- In optical fiber, modes are different patterns of light intensity distribution around the core axis



ACCESSORIES

- Optical Bread Board : 01 No
- X-Y-Z Translation Stage : 01 No
- He-Ne Laser Source : 01 No
- Rotary Stage : 01 No Laser
- Power Meter : 01 No
- Laser to Fiber Coupler : 01 No
- He-Ne Laser Height Adjustable Stand : 02 No
- Laser to Fiber Coupler Holder : 01 No
- Laser to Fiber Coupler Holder Base : 01 No
- Rotary Stage Block : 01 No
- Rotary Fiber Holder With Receptacle : 01 No
- Fiber Coupler with V-Groove Fiber Holder : 01 No
- Fiber Coupler with V-Groove Fiber Holder Block : 01 No
- Photo Detector Holder : 01 No
- Photo Detector Cap With Receptacle : 01 No
- Photo Detector Cap With Knife-edge Slit : 01 No
- Fiber Holder Stand : 01 No
 - (a) Fiber Holder Stand Base : 01 No
 - (b) Fiber Holder Stand Horizontal Plate (with Receptacle) : 01 No
 - (c) Fiber Holder Stand Vertical Plate : 01 No
- Photo Detector Holder Adjustable Stand : 01 No

Fiber Cable

- 9/125 um SM ST-ST Patch Cord, 1 Meter : 01 No
- 62.5/125 um MM ST-ST Patch Cord, 1 Meter : 01 No
- 62.5/125 um MM Pigtail, 1 Meter : 01 No
- 100/140 um MM ST-ST Patch Cord, 1 Meter : 01 No
- 62.5/125 um MM ST-SC Patch Cord, 1 Meter : 02 No
- 3-in-1 MM Spool (100m, 500m, 1000m) : 01 No