LOSSES IN OPTICAL FIBRES

1.Absorption loss:

Therearetwotypesofabsorption;

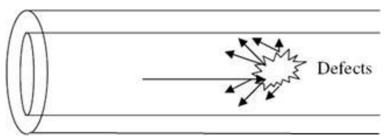
(a) Absorptionby impurities.

(b) Intrinsicabsorption.

In the case absorption by impurities, the type of impurities is generally transition metal ions such as iron, chromium, cobalt and copper. During signal propagation when photons interact withthese impurities, the electron absorbs the photons and get excitedto higher energy level. Later these electrons give up their absorbed energy either as heat energy or light energy. The re-emission of light energy is of no use since it will usually be in a different wavelength or at least in different phase with respect to the signal. The other impurity which would cause significant absorption lossis the OH^- (Hydroxyl) ion, which enters into the fibre constitution at the time of fibre fabrication.**In Intrinsic absorption** it is the absorption bythe fibre itself, or it is the absorptionthat takes place in the material assuming that there are no impurities and the materialis freeofallinhomogeneitiesandthissetsthelowest limit on absorption for a given material.

2.Scatteringloss:

The signal power loss occurs due to the scattering of light energy due to the obstructionscaused by imperfections and defects, which are of molecular size, present inthe bodyofthe fibre itself. The scattering oflightbytheobstructionsisinverselyproportionaltothefourthpower of the wavelength of the light transmitted through the fibre. Such a scattering is called Rayleigh scattering. The loss due to the scattering can be minimized by using the optical source of large wavelength.



3 Bendinglosses(radiation losses):

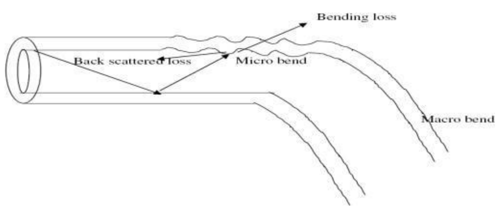
There are two types of bending losses in optical fibre a) macroscopic and b) microscopic bending loss.

a) Macroscopicbends:

Macroscopic bends occurs due the wrapping of fibre on a spool or turning it around a corner. The loss will be negligible for small bends but increases rapidly until the bending reaches a certain critical radius of curvature. If the fibre is too bent, then there is possibility ofescaping the light ray through cladding material without undergoing any total internal reflection at core-cladding interface.

b) *Microscopicbends:*

This type of bends occurs due to repetitive small-scale fluctuations in the linearity of the fibre axis. Due to non-uniformities in the manufacturing of the fibre or by non-uniform lateral pressures created during the cabling of the fibre. The microscopic bends cause irregular reflectionsat core-cladding interfaceand someofthemreflectsbackor leakthroughthefibre.Thislosscouldbeminimizedbyextrudinga compressible sheath over the fibre which can withstand the stresses while keeping the fibre relatively straight.



4 Couplinglosses:

Coupling losses occur when the ends of thefibres are connected. At the junction of coupling, air film mayexist or joint may be inclined or may be mismatched and they can be minimized by following the technique called splicing.

ApplicationsofOptical Fibres:

Point-to-pointCommunication

The use of optical fibres in the field of communication has revolutionized the modern world. An optical fibre acts as the channel of communication (like electrical wires), but transmits the information in the form of optical waves. A simple p to p communication system using optical fibres is illustrated in the figure.

Themain componentsofptopcommunication is

1) Anopticaltransmitter,i.e.,thelightsourcetotransmitthe signals/pulses
2) Thecommunicationmedium(channel)i.e.,opticalfibre
3) Anopticalreceiver,usuallyaphotocelloralightdetector,to convert light pulses back into electrical signal.