TypesofOptical fibres:

The optical fibres are classified under 3 categories.They are

a) Step index Single mode fibre(SMF)

b) Step index multimode fibre(MMF)

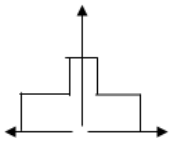
c) Graded index Multi Mode Fibre (GRIN)

This classification is done depending on the refractive index profile and the number of modes that the fibre can guide.

Refractive Index Profile(RI):

Generally in any types of optical fibre, the refractive index of cladding material is always constant and it has uniform value throughout the fibre. But in case of core material, the refractive index may either remain constant or subjected to variation in a particular way.

This variation of RI of core and cladding materials with respect to the radial distance from the axis of the fibre is called refractiveindex profile. This can be represented as follows,



RI profile of Step index fibre

X axis: Radial distance from the centre of the fibre

StepindexSinglemodefibre(SMF):

A single mode fibre has a core material of uniform refractive index(RI) value. Similarly cladding also has a material of uniform RI but of lesser value. This results in a sudden increase in the value of RI from cladding to core. Thus its RI profile takes the shape of a step. The diameter value ofthe coreisabout8to10μmandexternaldiameter of cladding is60 to 70 □m. Because ofits narrow core, it canguide just a single mode as shown in Figure. Hence it is called single mode fibre. Single mode fibres are most extensively used ones and they constitute 80% of all the fibres that are manufactured in the world today. They need lasers as the source of light. Though less expensive, it is very difficult to splice them(joining ofoptical fibres). Since single mode is propagating through the fibre, intermodal dispersion is zero in this fibre. They find particular application in submarine cable system.

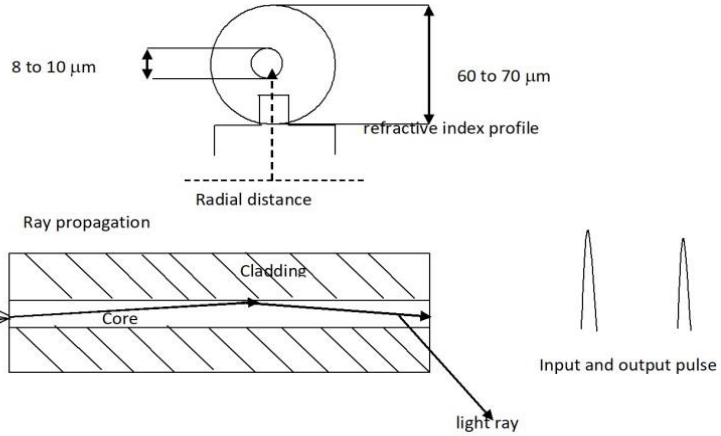


Fig: Step Index Single Mode Fibre

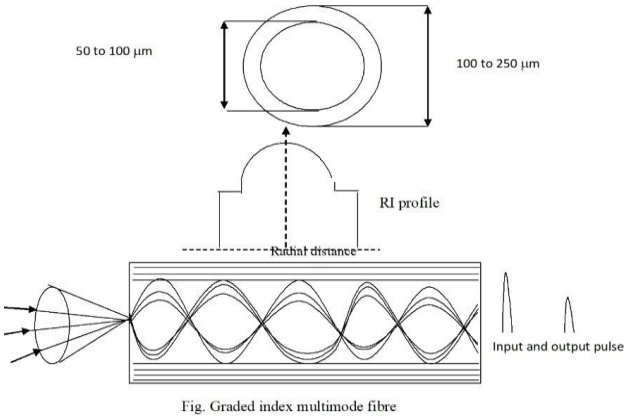


Fig. Graded index multimode fibre

Stepindexmultimodefibre (MMF):

The geometry of a step-index multimode fibre is as shown in below figure. It's construction is similar to that ofa single mode fibre but for the difference that, its core has a much larger diameter bythe virtue of which it will be able to support propagation of large number of mode

asshown inthe figure. Its refractive index profile is also similar to that of a single mode fibre but with larger plane regions for the core.

The step-index multimode fibre can accept either diode laser or LED (light emitting diode) as source of light. It is the least expensive of all. Since multi modes are propagating through this fibre with different paths, intermodal dispersion is maximum in this fibre. Its typical application is in data links which has lower bandwidth requirements.

Differencesbetweensingleandmultimodefibres:

Singlemodefibre	Multimodefibre
• Only one mode can be propagated • Smaller core diameter • Low dispersion of signal • Can carry information to longer distances • Launching of light and connectingtwofibresare difficult	• Allows large number of modes for light to pass through it • Larger core diameter • More dispersion of signal • Information can be carried to shorter distances only • Launching of light and connecting of fibres is easy

Differencesbetweenstepandgradedindexfibres:

Step index fibre	Graded index fibre
• Refractiveindex of coreis uniform • Propagation of light is in the form of meridional rays • Step index fibres has lower bandwidth • Distortion is more (in multimode) • No. of modes for propagation $N_{step}=V^2/2$	• Refractive index of core is not uniform • Propagation of light is inthe form of skew rays • Graded index fibres has higher bandwidth • Distortionisless • No. of modes for propagation $N_{grad} = V^2/4$