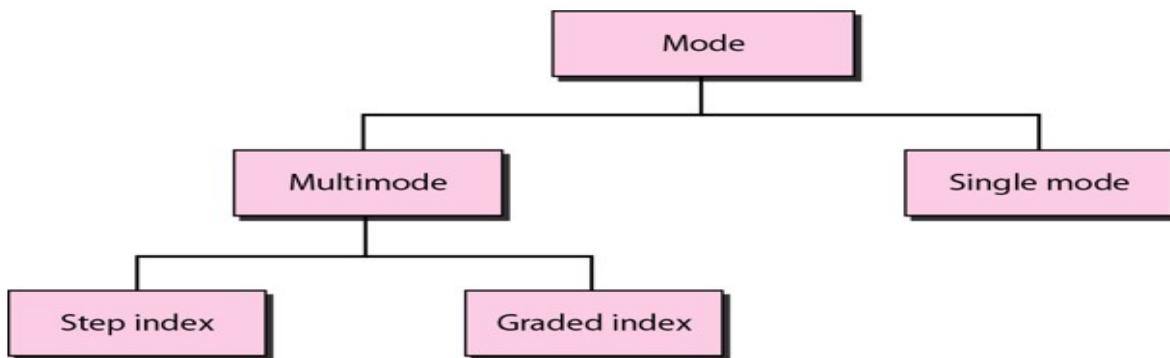


Propagation Modes of Fiber Optic Cable:

The modes in a optical fiber refer to the “transverse modes” or paths of electromagnetic waves when isolated within a wave guide (optical fiber).Current technology supports two modes(**Multimode** and **Single mode**) for propagating light along optical channels, each requiring fiber with different physical characteristics. Multimode can be implemented in two forms: **Step-index** and **Graded-index**.



Multimode Propagation Mode:

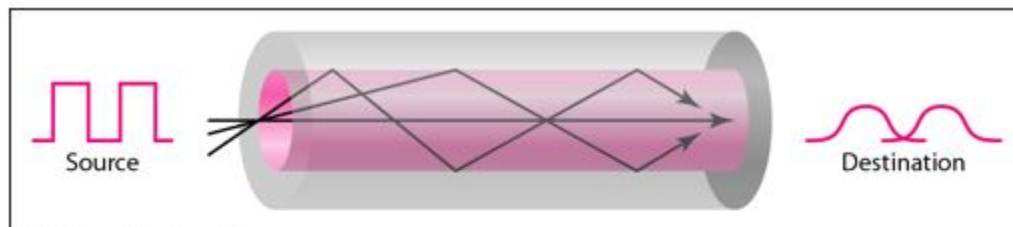
Multimode is so named because multiple beams from a light source move through the core in different paths. How these beams move within the cable depends on the structure of the core. The Multi-mode allows multiple modes to pass through due to its larger core. The multiple modes passing cause pretty large losses during transmission and thus, can only be used over shorter distances and lower bandwidths.

1)multimode step-index fiber:

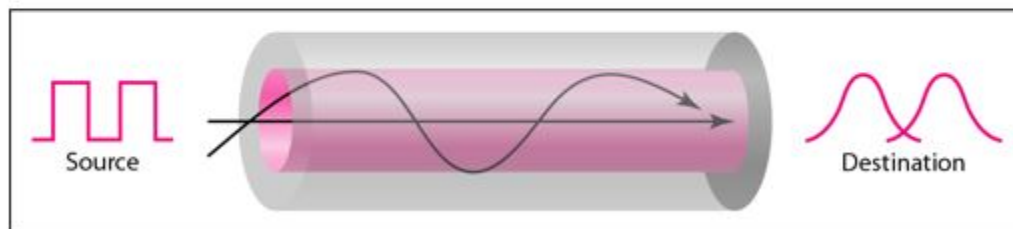
In multimode step-index fiber, the density of the core remains constant from the centre to the edges. A beam of light moves through this constant density in a straight line until it reaches the interface of the core and the cladding. The term step-index refers to the suddenness of this change, which contributes to the distortion of the signal as it passes through the fiber.

2) multimode graded-index fiber:

In multimode graded-index fibre, this distortion gets decreases through the cable. The word index here refers to the index of refraction. This index of refraction is related to the density. A graded-index fibre, therefore, is one with varying densities. Density is highest at the centre of the core and decreases gradually to its lowest at the edge.



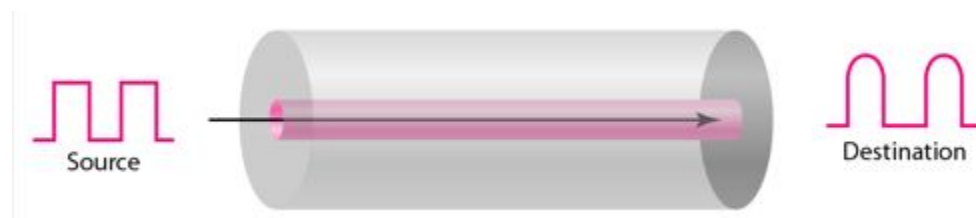
a. Multimode, step index



b. Multimode, graded index

Single Mode:

Single mode uses step-index fibre and a highly focused source of light that limits beams to a small range of angles, all close to the horizontal. The single-mode fibre itself is manufactured with a much smaller diameter than that of multimode fibre, and with substantially lower density. The decrease in density results in a critical angle that is close enough to 90 degree to make the propagation of beams almost horizontal. This application is typically used in long distance.



Exercise:

1. Explain the different propagation modes of optical fiber cable.
2. Which mode is used in long distance communication?