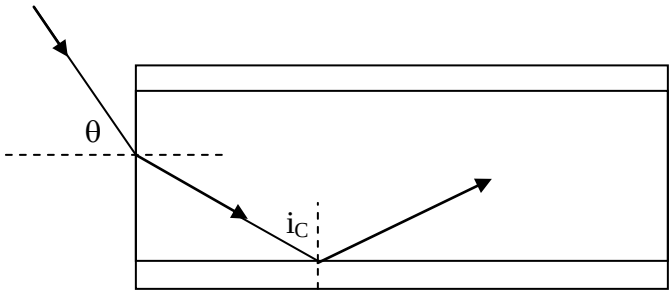
Q- Find the maximum angle of incidence $\theta_1$ of a ray on the plane surface that would propagate through an optical fiber that has a core index of refraction of 1.499, a core radius of 44.00 μm, and a cladding index 1.496.

The optical fiber is based on the principle of total internal reflection. When light goes from denser to rarer medium and the angle of incidence is greater than critical angle the light is reflected totally and come back the same denser medium. Hence the minimum angle of incidence on the core cladding interface must the critical angle $i_C$ and the maximum angle of incidence $\theta$ must be such that the angle of refraction r at the end of the fiber is $90^0 - i_C$




Now the critical angle at an interface is given by

Sin $i_C$ = refractive index of rarer medium/ refractive index of dancer medium
= 1.496/1.499 = 0.998

Gives $i_C = 86.4^0$

And hence $r = 90^0 - 86.4^0 = 3.6^0$

And hence the angle of incidence $\theta$ is given by

$\mu = \sin\theta / \sin r$

Or $1.499 = \sin\theta / \sin 3.6^0$

Or $\sin\theta = 1.499 * \sin 3.6^0 = 1.499 * 0.0628 = 0.0941$

Gives $\theta = 5.4^0$