18PYB101J MODULE-5

LECTURE 16

- **Solving Problems**

1. Calculate the V – number and number of modes propagating through the fiber having a = 50 μm, n_1 = 1. 53, n_2 = 1.50 and λ = 1μm.

n1 = 1.53 ; n2 = 1.50; λ = 1μm.

$$\text{V - Number} = \left(\frac{2\pi a}{\lambda}\right) \times \text{N.A} = \left(\frac{2\pi a}{\lambda}\right) \times (n_1^2 - n_2^2)^{\frac{1}{2}}$$

$$= \frac{2 \times 3.142 \times 50}{1}\left(1.53^2 - 1.50^2\right)^{\frac{1}{2}}$$

$$= 94.72$$

$$M_N = \frac{V^2}{2} = \frac{94.72^2}{2} = 4486$$

The number of modes propagating through the fiber

V – number = 94.72 ; No. of modes = 4486

2. The relative refractive index difference for an optical fiber is 0.05. If the entrance end of the fiber is facing the air medium and refractive index of core is 1.46, estimate the numerical aperture

Hint: $n_1 = 1.46$; $\Delta = 0.05$;

$$\text{N.A} = n_1 \times (2\Delta)^{1/2} = 1.46 \times (2 \times 0.05)^{\frac{1}{2}} = 0.46$$

3. Find the core radius necessary for single mode operation at 850 nm of step index fiber with $n_1 = 1.480$ and $n_2 = 1.465$.

Hint: $n_1 = 1.480$; $n_1 = 1.465$;

$$V = \left(\frac{2\pi a}{\lambda} \right) \times \text{N.A}$$