[1] Draw the block diagram of optical communication system and explain the function of its items.

[2] Derive a formula for the critical angle.

[3] Show that the NA of the symmetrical slab is equal to $n_1\sqrt{(2\Delta)}$ if n_1 is approximately equal to n_2 and Δ is the fractional change in the refractive index.

[4] A fiber line has core index of refraction 1.46 and its refractive index fractional difference is 0.01, calculate its basic parameters (consider the outer media is air).

[5] A fiber line has core index of refraction 1.448 and 0.21 numerical aperture. Find the refractive index fractional difference the cladding index of refraction.

[6] An optical fiber has a numerical aperture of 0.2 and a cladding refractive index of 1.59 determines: (i) The acceptance angle for the fiber in water which has a refractive index of 1.33. (ii) The critical angle at the core – cladding interface.

[7] The velocity of light in the core of a step index fiber is $2.01x10^8$ m/sec, and the critical angle at the core-in cladding interfaces 80 degree. Determine the numerical aperture and the acceptance angle at the fiber in air, assuming it has a core diameter suitable for consideration by ray analysis .The velocity of light in vacuum is $3x\ 10^8$ m/sec.

[8] Determine the condition imposed on the wavelength for single mode propagation for the fiber of core and cladding index 1.446 index, 1.440 respectively and the core diameter is 8 μm.

[9] A step index fiber of core radius and index 5μm and 1.46 respectively. If the refractive index fractional difference is 0.01 , then find the numerical aperture and the maximum operating frequency for single mode propagation

[10] A graded index fiber with a core axis refractive index of 1.5 has a characteristic index profile (α) of 1.9, a relative refractive index difference of 1.3% and a core diameter of 40 μm. Estimate the number of the guided modes propagating in the fiber when the transmitted light has a wavelength 1.55 μm, and determined the cutoff value of the normalized frequency for single-mode transmission in the fiber.

[11] A multimode step index fiber of core diameter and relative index difference of 80μm and 1.5% respectively is operating at a wavelength of 0.85μm. If the refractive index of the core is 1.48, then find the normalized frequency of the fiber and the number of guided modes. Then estimate the new maximum core diameter for single mode propagation for the given wave length and relative index difference and also when the relative index difference is reduced 10 times.

[12] A graded index fiber with a core with a parabolic refractive index profile (α=2) and diameter of 50 um. The fiber has numerical aperture of 0.2. Estimate the number of the guided modes propagating in the fiber when the transmitted light has a wavelength 1 μm.

[13] A graded index fiber with a core with a parabolic refractive index profile and a core radius 25μm and core index in the centre =1.5. The fiber relative index difference is 2%. Estimate the modal field diameter of the transmitted light at a frequency $3x10^5$ GHz.

Good Luck

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