JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2016

B.Tech VIII Semester

COURSE CODE: 11B1WEC834   MAX. MARKS: 25

COURSE NAME: OPTICAL COMMUNICATION SYSTEMS

COURSE CREDITS: 03   MAX. TIME: 1 HR 30 MIN

Note: All questions are compulsory.

1. **a)** A step index fiber has a numerical aperture of 0.17 and a cladding refractive index of 1.46. Determine (i) the acceptance angle of the fiber when it is placed in water (refractive index 1.33) (ii) the critical angle at the core cladding interface.   **[2]**

   b) Derive an expression for the confinement factor G for the symmetric TE modes of a symmetrical SI planar waveguide.   **[3]**

2. **a)** A graded index fiber with a parabolic profile supports the propagation of 800 guided modes. The fiber has a relative refractive index difference of 2%, a core refractive index of 1.45 and a core diameter of 75μm. Calculate the wavelength of light propagating in the fiber. Estimate the maximum diameter of the fiber core which can give single mode operation at the same wavelength.   **[2]**

   b) Derive an expression for pulse broadening per unit length due to intermodal dispersion for a GI profile ($\alpha=2$) and a GI fiber with an optimum profile.   **[3]**

3. **a)** A SI single mode fiber has a core index of 1.48 and relative refractive index difference of 1%. If the material dispersion at 1.55μm for this fiber is 7 ps/nm/km, what should be the radius of the core be so that the total dispersion at this wavelength is zero. Also comment on the type of fiber.   **[2]**

   b) Derive an expression for waveguide dispersion in step index single mode fibers.   **[3]**

4. **a)** Calculate the injection efficiency of a GaAs diode in which $N_a=10^{21}m^{-3}$ and $N_d=10^{23}m^{-3}$. Assume that at room temperature of 300K, $\mu_e=0.85m^2/V/s$, $\mu_h=0.04m^2/V/s$ and that $L_e \approx L_h$. The symbols have their usual meaning.   **[2]**

   b) What are direct band gap and indirect band gap of semiconductors? Give at least two examples of each. Which of these are more suitable for fabricating LEDs and why?   **[3]**

5. **a)** A typical step-index single-mode fiber gas a core diameter of 8.2μm, and $\Delta=0.36\%$. Calculate w and w_p for operation at wavelength 1.310μm, given that the effective core index at this wavelength is 1.4677.   **[2]**

   b) Briefly explain the various types of losses in single mode fibers.   **[3]**

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