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GANPAT UNIVERSITY

B. TECH SEM. VI ELECTRONICS & COMMUNICATION ENGINEERING
REGULAR EXAMINATION MAY-JUNE-2012
EC 603 OPTICAL FIBER COMMUNICATION

TIME: 3 HOURS **TOTAL MARKS: 70**

INSTRUCTIONS:

1. Attempt all questions.
2. Answers to the two sections must be written in separate answer books.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

SECTION-I

Que.-1 **(A)** A single mode step index fiber with a core refractive index of 1.43 has a critical bending radius of 8.7 mm when illuminated with light at a wavelength of 1.35 μm. If the cutoff wavelength for the fiber is 1.15 μm, calculate its relative refractive index difference. Give the details of single mode step index fiber. **6**

(B) Define following terms in detail. **6**
(1) Critical Angle (2) Acceptance Angle (3) Skew Ray

OR

Que.-1 **(A)** What is the difference between Linear scattering and Nonlinear scattering? Explain the Linear scattering losses in detail. **6**

(B) Silica has an estimated fictive temperature of 1400 K with an isothermal compressibility of 7×10^{-11} m^2 N^{-1}. The refractive index and the photoelastic coefficient for silica are 1.46 and 0.286 respectively. Determine the attenuation in decibels per kilometer due to the fundamental Rayleigh scattering in silica at optical wavelengths of 0.63 μm, 1.00 μm and 1.30 μm. Boltzmann's constant is 1.381×10^{-23} $J K^{-1}$. **6**

Que.-2 **(A)** Explain modes in cylindrical fiber. **6**

(B) A single-mode step index fiber has a core diameter of 7 μm and a core refractive index of 1.49. Estimate the shortest wavelength of light which allows single-mode operation when the relative refractive index difference for the fiber is 1%. **5**

OR

Que.-2 **(A)** Explain Dispersion shifted fibers. **6**

(B) Define phase velocity and group velocity with necessary equations. **5**

Que.-3 **(A)** Explain different types of optical fiber splices in detail. **6**

(B) Differentiate the following in detail : **6**
(i) Intramodal dispersion
(ii) Intermodal dispersion

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SECTION-II

Que.-4 **(A)** What is impact ionization? Describe the Avalanche Photodiode. **6**

(B) An InGaAs p-i-n photodiode has the following parameters at a wavelength of 1550 nm : $I_D = 4$ nA, $\eta = 0.90$, $R_L = 1000\ \Omega$ and the surface leakage current is negligible. The incident optical power is 300 nW and the receiver bandwidth is 40 MHz. Find the various noise terms of the receiver. **6**

OR

Que.-4 **(A)** A silicon avalanche photodiode has a quantum efficiency of 65% at a wavelength of 900 nm. Suppose 0.5 μW of optical power produces a multiplied photocurrent of 10 μA. Findout the multiplication M. **6**

(B) Discuss about Erbium doped fiber amplifiers. **6**

Que.-5 **(A)** Give the details about light source material. **6**

(B) A double – heterojunction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and non – radiative recombination times of 30 ns and 100 ns respectly. The drive current is 40 mA. Find out bulk recombination lifetime, internal quantum efficiency and internal power. **5**

OR

Que.-5 **(A)** Draw and explain the basic applications of optical amplifiers. **6**

(B) Define following terms : **5**

(i) Multiplication Factor (M) (ii) Quantum Noise Current

Que.-6 **(A)** Write short note on WDM technology. **6**

(B) Explain working of Optical receiver system. **6**

End of Paper