

GANPAT UNIVERSITY
B. Tech. Semester VI Electronics and Communication Engineering
Regular Examination April-June 2016
2EC603 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) Why multimode graded index fiber is better than multimode step index fiber in terms of bandwidth length product? Describe multimode graded index fiber in detail. 6
- (B) Silica has an estimated fictive temperature of 1400°K with an isothermal compressibility of $8 \times 10^{-11} \text{ m}^2 \text{ N}^{-1}$. The refractive index and the photo elastic coefficient for silica are 1.46 and 0.286 respectively. Determine the attenuation in terms of decibels per kilometer due to the fundamental Rayleigh scattering in silica at optical wavelengths of 1.30 μm and 1.55 μm . Boltzmann's constant is $1.381 \times 10^{-23} \text{ J K}^{-1}$. 6

OR

- Que.-1** (A) What is the significance of surface emitting LED? Draw and explain surface-emitting LED. 6
- (B) A single-mode step index fiber has a core diameter of 8 μm and a core refractive index of 1.48. Estimate the shortest wavelength of light, which allows single-mode operation when the relative refractive index difference for the fiber is 1%. 4
- (C) Define following terms: 2
- (a) Critical Angle (b) Acceptance Angle

- Que.-2** (A) Explain the fundamental working principle of LASER. Give the details of Distributed feedback LASER. 6
- (B) A graded index fiber with a parabolic index profile supports the propagation of 650 guided modes. The fiber has a numerical aperture in air of 0.3 and a core diameter of 60 μm . Determine the wavelength of the light propagating in the fiber. Further estimate the maximum diameter of the fiber which gives single-mode operation at the same wavelength. 5

OR

- Que.-2** (A) Discuss about functionality of individual element of an optical fiber transmission link. 6
- (B) Write short note on dispersion shifted fibers. 5
- Que.-3** (A) What is Normalized Frequency in optical fiber? Discuss about modes in cylindrical fiber. 6
- (B) What is the difference between linear scattering and non-linear scattering? Give details of Mie scattering and Rayleigh scattering. 6

SECTION-II

- Que.-4 (A) Draw and explain Erbium doped fiber amplifier architectures. 6
 (B) A silicon avalanche photodiode has a quantum efficiency of 70% at a wavelength of 850 nm. Suppose 0.5 μ W of optical power produces a multiplied photocurrent of 12 μ A. Find out the multiplication M. 6

OR

- Que.-4 (A) An InGaAs p-i-n photodiode has the following parameters at a wavelength of 1500 nm : $I_D = 6$ nA, $\eta = 0.80$, $R_L = 1500 \Omega$ and the surface leakage current is negligible. The incident optical power is 500 nW and the receiver bandwidth is 40 MHz. Find the various noise terms of the receiver. 6
 (B) Explain in detail about Avalanche Photodiode. 4
 (C) Give the difference between stimulated emission and spontaneous emission. 2

- Que.-5 (A) Describe SONET STS-1 frame structure. Draw and explain bidirectional line switched SONET / SDH Rings. 6
 (B) Write short note on operational principles of WDM system. 5

OR

- Que.-5 (A) Why splicing is required in optical communication link ? Describe different fiber splicing techniques. 6
 (B) Describe basic applications of optical amplifiers. 5
- Que.-6 (A) Design 8x8 star optical coupler using 2x2 optical couplers. 6
 (B) Define following terms of 2x2 biconical tapered fiber coupler: 6
 (a) Coupling ratio (b) Excess loss (c) Insertion loss

End of Paper