

**B.Tech. - VIEP - ELECTRONICS AND
COMMUNICATION ENGINEERING
(BTECVI)**

00783

Term-End Examination

December, 2016

BIEL-017 : OPTICAL FIBER COMMUNICATION

Time : 3 hours

Maximum Marks : 70

Note : *Attempt any seven questions. All questions carry equal marks. Assume missing data, if any. Use of scientific calculator is permitted.*

1. (a) A graded index fiber with a core axis refractive index of 1.5 has a characteristic index profile (α) of 1.90, a relative refractive index difference of 1.3% and a core diameter of 40 μm . Estimate the number of guided modes when the transmitted light has a wavelength of 1.55 μm . 5

(b) With the help of a neat diagram, explain the block diagram of an optical fiber communication system. 5

2. Explain what is meant by the critical bending radius for an optical fiber. A multimode graded index fiber has a core refractive index of 1.46 with the cladding refractive index of 1.45. The critical radius of curvature which allows large bending losses to occur is 84 μm . Determine the wavelength of the transmitted light. 5+5=10
3. (a) Derive an expression for the rms pulse broadening due to intermodal dispersion in step index multimode optical fiber. 5
- (b) Why is dispersion in graded index fiber less as compared to step index fiber? Explain optimum near profile parameter. 5
4. Describe with the help of suitable diagrams, the major strategies and structures utilized in the fabrication of injection laser. 10
5. (a) Estimate the optical power coupled into a 50 μm diameter step index fiber with a numerical aperture of 0.18 from a DH surface emitter with an emission area diameter of 75 μm and a radiance of 60 $\text{Wsr}^{-1}\text{cm}^{-2}$. The Fresnel reflection at index matched semiconductor fiber interface may be considered negligible. 5
- (b) Draw and explain a neat diagram of surface emitter LED. 5

6. (a) When 10^{11} photons per second, each with an energy of 1.28×10^{-19} J, are incident on an ideal photodiode, calculate
- (i) the wavelength of the incident radiation, and
 - (ii) the output photocurrent. 5
- (b) Discuss various sources of noise in optical fibre communication. 5
7. Discuss the APD in detail with the help of a neat diagram and derive the expression for the SNR in an APD receiver. 5+5=10
8. Briefly describe what is meant by the following terms related to injection laser : 5+5=10
- (a) Relaxation Oscillations
 - (b) Threshold current dependence on temperature
9. Draw and explain the block diagram of an optical receiver. 10
10. Write short notes on any *two* of the following : 2×5=10
- (a) Step and Graded Index Fibers
 - (b) Phototransistors and Photoconductors
 - (c) Line Coding