

B.E / BTech ( Full Time). DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2011

ELECTRONICS AND COMMUNICATION ENGINEERING

SEVENTH SEMESTER - R - 2008

EC 9402 – OPTICAL COMMUNICATION

(Regulation – 2008)

Time: 3 hours

Max.Mark: 100 Marks

Answer ALL Questions

Part A – (10 x 2 = 20 ) Marks

1. What do you understand by “Weakly guiding approximation”?
2. A step index fiber has a normalized frequency  $V = 26$  at 1300 nm wavelength. If the core radius is 25  $\mu\text{m}$ , find the numerical aperture.
3. Define Group velocity of an optical pulse.
4. Why Non linear effects predominate in single mode fibers rather than Multi mode fibers?
5. Determine the approximate external quantum efficiency of an LED having a refractive index of 3.5.
6. In a Fabry Perot AlGaAs Laser , operating at 900 nm, has 500  $\mu\text{m}$  length and a refractive index of 4.3. Calculate the frequency and wavelength spacing.
7. Determine the mean square Shot noise in a PIN photo diode circuit, when a photo current of 0.28  $\mu\text{A}$  flows through a receiver circuit of bandwidth 20 MHz.
8. Define “Quantum Limit “ in a photo detector.
9. Calculate the excess loss in a a 32 X 32 single mode coupler made from a cascade of 3 dB fused fiber 2 X 2 couplers, where 5 percent of the power is lost in each element.
10. What are the factors that determine the gain in a semiconductor optical amplifier ?

Part – B

(16 x 5 = 80)

11. (i) Discuss any two techniques of fiber preform fabrication. (8)  
(ii) Explain fiber drawing process. (4)  
(ii) What are the limitations of ray theory in explaining optical signal propagation in fibers. (4)

- 12.(a)(i) Enumerate the different mechanisms leading to dispersion in single mode optical fiber with necessary mathematical expressions. (12)  
(ii) Brief about profile dispersion in multimode fibers. (4)

(Or)

- (b)(i) Explain about any two schemes for polarization maintenance in single mode optical fibers. (12)  
(ii) Specify the difference between Stimulated Brillouin and Stimulated Raman Scattering in optical fibers. (4)

- 13.(a)(i) Explain the lasing action in a Fabry perot laser diode and derive the expression for threshold gain. (12)  
(ii) An InGaAsP LED emitting at 1310 nm has radiative and Non radiative recombination times of 40 and 100 ns respectively. Calculate the optical power generated when driven by 30 mA current. (4)

(Or)

- (b)(i) Enumerate any two techniques for lateral confinement of optical waves in laser diodes. (10)  
(ii) List the features of laser sources for free space communication. (6)

- 14(a)(i).Derive the expression for SNR in the case of APD based optical receiver. (10)  
(ii) Determine the magnitude of various noise sources in an optical receiver employing an InGaAs PIN photo diode with a bandwidth of 20 MHz. The receiver parameters are  $\lambda = 1310 \text{ nm}$ ,  $P_{in} = -30 \text{ dBm}$ ,  $I_D = 2\text{nA}$ ,  $\eta = 0.8$  and  $R_L = 2 \text{ K Ohms}$ . (6)

(Or)

- (b)(i) Compare the features of homodyne and heterodyne detection schemes. (4)  
(ii) Design a multimode fiber optic link for 1 Gbps, BER of  $10^{-9}$  and 10 Km. Also plot the link loss budget. (12)

- 15.(a)(i) Discuss about the architecture of SONET / SDH Rings with neat diagrams. (10)  
(ii) Explain the implementation of WDM technique in optical fiber. (6)

(Or)

- (b) (i) Write a detailed note on amplification mechanism in EDFA. (8)  
(ii) Brief about the principle of optical isolator and optical fiber based filter. (8)