Exam.Code:0931
Sub. Code: 6377

1078

B.E. (Electronics and Communication Engineering)
Seventh Semester
EC-708: Fiber-Optics Communication System

Time allowed: 3 Hours   Max. Marks: 50

NOTE: *Attempt* <u>*five*</u> *questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.*

x-x-x

1.
   a) Differentiate WDM and DWDM.
   b) Define Numerical Aperture.
   c) Why light travels within a cladding faster than it does within a core?
   d) "V number depends on the operating wavelength." Write an expression to justify the statement?
   e) What is Kerr effect?
   f) What do you mean by population inversion?
   g) Define timing jitter.
   h) Give examples of direct and indirect bandgap semiconductor materials.
   i) The refractive index of a material used for fabricating an LED is 3.2. Calculate its external quantum efficiency.
   j) Define chromatic dispersion.

Section-A

2. (a) Explain the block diagram of optical communication system explaining the different components of each block.
   (b) Derive $NA = n\sqrt{(2\Delta)}$ starting from basic laws.   (5,5)

3. (a) Calculate the limitation in transmission length caused by fiber loss if A=0.2dB/km, P_{in} = 0.029mW. and P_{out} = 0.001mw, where A is fiber attenuation, P_{in} is light power launched into the fiber, and P_{out} is power coupled to a photodiode.
   (b) Write a comparison between step index and graded index fibers. discussing their refractive index profiles. application area and bandwidth limitations.   (5,5)

4. (a) Calculate chromatic dispersion in a singlemode fiber at the 1550nm operating wavelength with $\Delta\lambda$ = 1nm. $D(\lambda)$= 15ps/nm.km and L = 1km.
   (b) Differentiate Self Phase Modulation and Cross Phase Modulation with the help of a suitable waveform diagram.   (5,5)

Section B

5. (a) Discuss: Absorption, spontaneous emission and stimulated emission.
   (b) Make a rise time budget for a 0.85μm, 170km fiber link designed to operate at 600 Mbps. The LED transmitter and si PIN receiver have rise times of 0.2 ns and 0.4, respectively. The graded index fiber has D= 18ps/km-nm. The LED spectral width is 0.15 nm. Can system be designed to operate with NRZ format?   (5,5)

6. (a) Briefly outline the advantages and disadvantages of the PIN photodiode in comparison with APD for use as optical detector in optical communication.
   (b) What is an optical coupler? Define the following terms related to optical couplers. Insertion loss. Splitting loss.   (5,5)

7. (a) With the help of a suitable labeled Eye Diagram, explain the significance of the terms: rise time. eye height and jitter.
   (b) Discuss the advantages and disadvantages of FSO over fiber optics system.   (5,5)

x-x-x