

1048

B.E. (Electronics and communication Engineering)

Sixth Semester

EC-602: Fiber Optics Communication System

Time allowed: 3 Hours

Max. Marks: 50

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

x-x-x

1.
  - a) What is DWDM? How it differs from WDM.
  - b) Define mode field diameter. How it differs from diameter of the fiber?
  - c) Why light travels within a cladding faster than it does within a core? Explain with suitable mathematical support.
  - d) "V number depends on the operating wavelength." Write an expression to justify the statement?
  - e) Define the radiative recombination and non radiative recombination? Give examples of the material used. (2×5)

Section-A

2. a. Explain the block diagram of optical communication system explaining the different components of each block. Discuss the various advantages of Optical Fiber Communication. (5,5)  
b. Define Numerical Aperture. Derive  $NA = n \sqrt{2\Delta}$ .
3. (a) Differentiate the material dispersion and waveguide dispersion.  
(b) Calculate the limitation in transmission length caused by fiber loss if  $A = 0.2 \text{ dB/km}$ ,  $P_{in} = 0.029 \text{ mW}$  and  $P_{out} = 0.001 \text{ mW}$ , where  $A$  is fiber attenuation,  $P_{in}$  is light power launched into the fiber, and  $P_{out}$  is power coupled to a photodiode. (3,3,4)  
(c) What is Splicing? Discuss the various types of splicing techniques.
4. (a) For an optical fiber communication system of 2 km length, the 3 dB pulse widths at the input and output are 0.5 ns and 11 ns, respectively. Find the pulse broadening for the fiber and the maximum bit rate.  
(b) Write a comparison between step index and graded index fibers, discussing their refractive index profiles, application area and bandwidth limitations.  
(c) Discuss the various means of mitigating the Stimulated Raman Scattering. (2, 4, 4)

Section B

5. (a) Define the Quantum efficiency and responsivity of a photodetector. Derive an expression for the responsivity of an intrinsic photodiode in term of the quantum efficiency of the device and the wavelength of the incident radiation. Also find the wavelength at which quantum efficiency and responsivity are equal.  
(b) The total efficiency of an injection laser with a GaAs active region is 29%. The voltage applied to the device is 2.7V and the bandgap energy for GaAs is 1.43eV. Calculate the external power efficiency of the device. (6,4)
6. (a) Make a rise time budget for a  $0.85 \mu\text{m}$ , 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  $D = 18 \text{ ps/km-nm}$ . The LED spectral width is 0.15 nm. Can system be designed to operate with NRZ format?  
(b) Differentiate an amplifier and a repeater. Discuss the principle of operation of EDFA. (5,5)
7. (a) Define Eye Diagram. Explain the following terms with the help of a suitable labeled eye diagram: rise time, eye height and jitter. (6,4)  
(b) Write short note on FSO.