



Handwritten signature

Printed Pages : 4

TEC701

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0304

Roll No.

--	--	--	--	--	--	--	--	--	--

B.Tech

(SEM VII) ODD SEMESTER THEORY EXAMINATION 2009-10 OPTICAL FIBER COMMUNICATION

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

1 Attempt any four of the following : 5×4=20

- (a) Determine the refractive indices of the core and the cladding material of a fiber if numerical aperture is 0.22 and refractive index difference $\Delta = 0.012$.
- (b) Find the maximum diameter allowed for a fiber having core refractive index 1.53 and cladding refractive index 1.50. The fiber is supporting only one mode of a wavelength of 1200 nm.
- (c) Explain with suitable diagram evanescent field.
- (d) Explain wave theory for optical propagation in a cylindrical waveguide.
- (e) Explain block diagram of optical fiber communication system.



Handwritten calculation: $n = \frac{2 \times 0.22}{1.2}$

- (f) Find the maximum diameter of a core for a single mode optical fiber operating at $1.55 \mu\text{m}$ with $n_1 = 1.55$ and $n_2 = 1.48$.

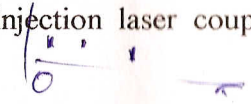
2 Attempt any four of the following : $5 \times 4 = 20$

- (a) Briefly explain the reasons for pulse broadening due to material dispersion in optical fibers.
- (b) Calculate NA, multipath pulse broadening and bandwidth length product of a silica fiber with $n_{\text{core}} = 1.465$ and $n_{\text{clad}} = 1.45$.
- (c) Explain polarisation state in a single mode fiber modal birefringence.
- (d) Explain overall fiber dispersion in single mode fiber.
- (e) Compute the maximum dispersion for an optical graded fiber with $n_{\text{core}} = 1.46$ and $\Delta = 0.03$. The length of fiber is 5 km.
- (f) Explain linear and nonlinear scattering losses.

3 Attempt any two of the following : $10 \times 2 = 20$

- (a) With the suitable diagram give the mechanism of light from an LED and its use as an optical source for communication.

- (b) Discuss the relationship between electrical and optical modulation bandwidth for an optical fiber communication system. Estimate the 3dB optical bandwidth corresponding to a 3dB electrical bandwidth of 50 MHz.
- (c) Discuss the semiconductor injection laser. How is the efficiency of the laser defined? How is injection laser coupled to a fiber?



4 Attempt any two of the following : $10 \times 2 = 20$

- (a) How is silicon RAPD operated? How does it differ from p-i-n photodiode? What are the advantage and disadvantage?
- (b) Define quantum efficiency and responsivity of a photodetector. Calculate the transit time for silicon photodiode which has a saturation of 10^5ms^{-1} . The depletion layer thickness is $7 \mu\text{m}$.
- (c) Briefly discuss receiver structure. What is a PIN-FET hybrid receiver?

5 Attempt any two of the following : $10 \times 2 = 20$

- (a) Discuss the major considerations in the design of digital drive circuit for
- (i) An LED source
- (ii) An injection laser source.

- (b) Discuss with the aid of a suitable block diagram, a coherent optical fiber communication system.
- (c) Outline the major techniques employed to achieve nonsynchronous optical ASK and FSK heterodyne detection. Indicate the benefits of these schemes over the corresponding synchronous demodulation schemes.

