

THAPAR INSTITUTE OF ENGINEERING & TECHNOLOGY, PATIALA
Electronics and Communication Engineering Department
End Semester Examination

99

EC-010 (Fiber Optic Communication) BE (ECE) Final Year

Max Marks: 45 Instructor: Dr. Harish Singla Time allowed: 3Hrs

Note: Attempt any five questions. All questions carry equal Marks. Assume suitable data if required. All notations/characters carry their usual meanings. All parts of a question should be attempted at one place.

1. (a) What is signal loss? List three major causes of it in an optical fiber and explain their mechanism.
(b) A typical single-mode fiber has a zero dispersion wavelength of $1.31 \mu\text{m}$ with a dispersion slope of $0.09 \text{ ps/nm}^2 \text{ Km}$. Compare the total dispersion for the fiber wavelengths of $1.28 \mu\text{m}$ and $1.55 \mu\text{m}$. When the material dispersion and profile dispersion at the latter wavelength are 1.35 ps/nm Km and 0.4 ps/nmKm , respectively, determine the wave-guide dispersion at this wavelength. (5,4)
2. (a) What is DFB? How does a DFB laser diode operate? What are the distinguishing characteristics of this type of laser diode? .
(b) Compare the electrical and optical bandwidths for an optical fiber communication systems and develop relationship between them. (5,4)
3. (a) What type of analysis are carried out to ensure the desired system performance. Explain any one of them.
(b) When 3×10^{11} photons each at wavelength of $0.85 \mu\text{m}$ are incident on a photodiode, on average 1.2×10^{11} electrons are collected at the terminals of the device. Determine the quantum efficiency and responsivity of the photodiode at $0.85 \mu\text{m}$. (5,4)
4. (a) Why we need multiplexing. Explain multichannel Frequency Modulation used for optical communication.

(b) A high input impedance amplifier which is employed in an optical fiber receiver has an effective input resistance of $4\text{ M}\Omega$ which is matched to a bias resistor of the same value. Determine the maximum bandwidth that may be obtained if the total capacitance is 6 pF . Also find out the mean square thermal current generated if it is operating at 300 K . (5,4)

5. (a) What are optical amplifiers? List the advantage of using optical amplifiers and explain the working of EDFA's.
- (b) The following parameters are established for a long-haul single mode optical fiber system operating at a wavelength of $1.3\text{ }\mu\text{m}$.

Mean Square power launched from transmitter	-3dBm
Cabled Fiber loss	0.4dB/Km
Splice loss	0.1 dB/Km
Connector losses at the transmitter and receiver	1 db each
Mean power required at the APD receiver	
When operating at 35 Mb/s (BER 10^{-9})	-55dBm
Required safety margin	07 dB

Determine the possible link length without repeaters when operating at 35 Mb/s (BER 10^{-9}). It may be assumed that there is no dispersion equalization penalty at this bit rate. (5,4)

6. Write short notes upon following

- (a) Eye Patterns
- (b) Avalanche photo diode
- (c) Various lensing systems used for source to fiber coupling