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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: VII - THEORY EXAMINATION (2024 - 2025)

Subject: Optical Communication and Network

Time: 3 Hours

Max. Marks: 100

General Instructions:*IMP: Verify that you have received the question paper with the correct course, code, branch etc.**1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.**2. Maximum marks for each question are indicated on right -hand side of each question.**3. Illustrate your answers with neat sketches wherever necessary.**4. Assume suitable data if necessary.**5. Preferably, write the answers in sequential order.**6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.***SECTION-A**

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1. Attempt all parts:-

- 1-a. Which optical component is used to combine signals from multiple sources onto a single optical fiber?(CO1,K2) 1
- (a) Optical amplifier
- (b) Optical splitter
- (c) Optical isolator
- (d) Optical coupler
- 1-b. What is the primary function of an optical attenuator in an optical communication system?(CO1,K1) 1
- (a) To amplify signals
- (b) To reduce the intensity of optical signals
- (c) To modulate signals
- (d) To split signals
- 1-c. The total attenuation in an optical fiber is the sum of:(CO2,K2) 1
- (a) Material absorption and dispersion
- (b) Intrinsic and extrinsic absorption
- (c) Reflection and refraction losses
- (d) Linear and non-linear scattering
- 1-d. The bending loss in optical fibers is more pronounced for:(CO2,K2) 1
- (a) Single-mode fibers

- (b) Multimode fibers
 - (c) Graded-index fibers
 - (d) Step-index fibers
- 1-e. The InGaAsP emitting LEDs are realized in terms of restricted are _____(CO3,K2) 1
- (a) Length strip geometry
 - (b) Radiance
 - (c) Current spreading
 - (d) Coupled optical power
- 1-f. _____ emitter-base and collector-base junction capacitances is achieved by use of hetero-structure along with _____ base resistance.(CO3,K2) 1
- (a) Low, high
 - (b) High, low
 - (c) Low, low
 - (d) High, negligible
- 1-g. What is the main advantage of optical networks over traditional copper-based networks?(CO4,K1) 1
- (a) Greater distance coverage
 - (b) Higher bandwidth and data transmission speed
 - (c) Lower cost of installation
 - (d) Easier maintenance and repair
- 1-h. Which of the following wavelength bands is commonly used in optical communication for long-distance transmission due to its low signal attenuation?(CO4,K2) 1
- (a) O-band (Original Band)
 - (b) C-band (Conventional Band)
 - (c) L-band (Long Band)
 - (d) U-band (Ultra Band)
- 1-i. The higher-order path layer in SONET/SDH is also known as the:(CO5,K2) 1
- (a) Virtual Tributary (VT)
 - (b) Synchronous Payload Envelope (SPE)
 - (c) Multiplex Section Overhead (MSOH)
 - (d) Administrative Unit Pointer (AUP)
- 1-j. In QoS, what does "jitter" refer to?(CO5,K2) 1
- (a) Unpredictable delays in packet delivery
 - (b) Constant delay in packet delivery
 - (c) The average speed of data transmission
 - (d) The total number of packets transmitted

2. Attempt all parts:-

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|------|---|---|
| 2.a. | What is the function of an optical amplifier?(CO1,K1) | 2 |
| 2.d. | Define Non linear effect in terms of effective length.(CO4,K2) | 2 |
| 2.b. | What factors influence the magnitude of bending losses in optical fibers?(CO2,K1) | 2 |
| 2.c. | How does the forward voltage affect LED performance?(CO3,K2) | 2 |
| 2.e. | How does the use of dense wavelength-division multiplexing (DWDM) enhance SONET/SDH networks?(CO5,K2) | 2 |

SECTION-B

30

3. Answer any five of the following:-

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| 3-a. | How does numerical aperture influence the acceptance angle?(CO1,K2) | 6 |
| 3-b. | In what ways does mode coupling impact the design of optical components in communication networks?(CO1,K2) | 6 |
| 3-c. | How does the refractive index variation with wavelength contribute to chromatic dispersion?(CO2,K2) | 6 |
| 3-d. | Describe the concept of material dispersion in intramodal dispersion.(CO2,K2) | 6 |
| 3.e. | Discuss the impact of temperature on laser diode characteristics.(CO3,K2) | 6 |
| 3.f. | Define scattering process in optical network. Define stimulated Brillouin scattering with example.(CO4,K1) | 6 |
| 3.g. | How does ATM differ from other networking technologies in terms of cell-based transmission?(CO5,K2) | 6 |

SECTION-C

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4. Answer any one of the following:-

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|------|--|----|
| 4-a. | Discuss the significance of the cut-off wavelength in determining the operational characteristics of single-mode fibers.(CO1,K2) | 10 |
| 4-b. | Explain the importance of the Mode Field Diameter in single-mode fiber design.(CO1,K2) | 10 |

5. Answer any one of the following:-

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|------|---|----|
| 5-a. | How does modal dispersion affect the performance of high-data-rate optical communication systems?(CO2,K2) | 10 |
| 5-b. | Discuss the challenges associated with measuring and characterizing fiber birefringence.(CO2,K2) | 10 |

6. Answer any one of the following:-

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|------|--|----|
| 6-a. | Explain the role of reverse bias voltage in the operation of avalanche photodiodes.(CO3,K2) | 10 |
| 6-b. | Discuss the impact of temperature on the noise characteristics of avalanche photodiodes.(CO3,K2) | 10 |

7. Answer any one of the following:-

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| 7-a. | Explain the concept of Wavelength Division Multiplexing (WDM) in optical | 10 |
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communication. How does WDM enhance the data transmission capacity of optical fibers?(CO4,K2)

- 7-b. Describe the International Telecommunication Union (ITU) grid used in Dense Wavelength Division Multiplexing (DWDM) systems. What is the standard channel spacing defined by ITU for DWDM applications?(CO4,K2) 10
8. Answer any one of the following:-
- 8-a. In what scenarios are fixed OADMs more suitable than reconfigurable ones, and vice versa?(CO5,K2) 10
- 8-b. Explain the impact of wavelength contention on the performance of All-Optical OXC configurations.(CO5,K2) 10

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