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Printed Page:-4 **Subject Code:- AEC0701**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: VII - THEORY EXAMINATION (2025 - 2026)
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 20

1. Attempt all parts:-

1-a. Which optical communication system component is responsible for compensating for signal attenuation in optical fibers? (CO1,K2) 1

(a) Optical amplifier
(b) Optical transducer
(c) Optical modulator
(d) Optical splitter

1-b. Which type of optical fiber supports multiple modes of light propagation? (CO1,K2) 1

(a) Single-mode fiber
(b) Graded-index fiber
(c) Step-index fiber
(d) Multimode fiber

1-c. Brillouin scattering is an example of: (CO2,K1) 1

(a) Linear scattering
(b) Non-linear scattering
(c) Material absorption
(d) Extrinsic absorption

1-d. Bending losses in optical fibers occur when: (CO2,K2) 1

(a) The fiber is straight
(b) The fiber is twisted
(c) The fiber is bent beyond a certain radius
(d) The fiber is stretched

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1-e. The absorption coefficient of semiconductor materials is strongly dependent on _____(CO3,K1) 1

(a) Properties of material
(b) Wavelength
(c) Amount of light
(d) Amplitude

1-f. Which process gives the laser its special properties as an optical source? (CO3,K2) 1

(a) Dispersion
(b) Stimulated absorption
(c) Spontaneous emission
(d) Stimulated emission

1-g. What is the advantage of using optical packet switching over traditional electrical packet switching? (CO4,K2) 1

(a) Lower cost
(b) Lower power consumption
(c) Limited scalability
(d) Higher data transmission speed

1-h. What is the purpose of multiplexing in optical networks? (CO4,K2) 1

(a) To convert optical signals into electrical signals
(b) To increase the speed of data transmission
(c) To amplify optical signals
(d) To combine multiple signals into a single channel for transmission

1-i. Which layer of SONET/SDH is responsible for frame synchronization?(CO5,K2) 1

(a) Section Layer
(b) Line Layer
(c) Path Layer
(d) Payload Layer

1-j. What is the role of the Differentiated Services Code Point (DSCP) in QoS? (CO5,K2) 1

(a) It marks the priority of IP packets
(b) It specifies the route for packet forwarding
(c) It encrypts the payload of IP packets
(d) It determines the source and destination IP addresses

2. Attempt all parts:-

2.a. How does total internal reflection play a role in optical fibers?(CO1,K2) 2

2.b. What factors contribute to the attenuation of light in optical fibers? (CO2,K2) 2

2.c. Describe the basic structure of an LED. (CO3,K2) 2

2.d. What is channel spacing in optical network? (CO4,K2) 2

2.e. How does SONET address the challenges associated with multiple data rates in a network? (CO5,K3) 2

SECTION-B 30

3. Attempt all parts:-

3.a. Answer any <u>one</u> of the following:-

3.a.(i)	How does the acceptance angle affect the ability of an optical fiber to capture light? (CO1,K3)	6
3.a.(ii)	How do phase and group velocities relate to the speed of light in a medium?(CO1,K4)	6

3.b. Answer any one of the following:-

3.b.(i)	Describe the role of fiber coatings in reducing bending losses. (CO2,K2)	6
3.b.(ii)	How does dispersion affect the quality of transmitted signals in optical fibers? (CO2,K3)	6

3.c. Answer any one of the following:-

3.c.(i)	How does the injection current influence the performance of a laser diode?(CO3,K3)	6
3.c.(ii)	Discuss the difference between avalanche photodiodes and PIN photodiodes. (CO3,K3)	6

3.d. Answer any one of the following:-

3.d.(i)	Define multiplexing techniques in optical communication network. What is the significance of Wavelength Division Multiplexing (WDM) in optical networks? (CO4,K3)	6
3.d.(ii)	Define scattering process in optical network. Define stimulated Brillouin scattering with example.(CO4,K3)	6

3.e. Answer any one of the following:-

3.e.(i)	How does ATM facilitate the efficient transfer of data in networks? (CO5,K3)	6
3.e.(ii)	How does QoS impact the overall performance of a network? (CO5,K3)	6

<u>SECTION-C</u> 50

4. Answer any <u>one</u> of the following:-

4-a.	Discuss the factors that can influence the Mode Field Diameter in single-mode fibers. (CO1,K3)	10
4-b.	How does chromatic dispersion differ from modal dispersion, and how is it relevant to single-mode fibers? (CO1,K3)	10

5. Answer any <u>one</u> of the following:-

5-a.	How does material dispersion contribute to overall fiber dispersion in both multimode and single-mode fibers? (CO2,K3)	10
5-b.	How does graded-index multimode fiber help mitigate intermodal dispersion compared to step-index fibers? (CO2,K3)	10

6. Answer any <u>one</u> of the following:-

6-a.	Explain the impact of excess noise factor on the performance of avalanche photodiodes. (CO3,K4)	10
6-b.	Discuss the challenges associated with integrating photodiodes into high-density and high-speed optoelectronic systems. (CO3,K3)	10

7. Answer any <u>one</u> of the following:-

7-a.	Discuss the significance of Code Division Multiplexing (CDM) in optical	10

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communication. How does CDM allow multiple signals to share the same frequency spectrum? (CO4,K4)

7-b.	Describe the differences between circuit-switched networks and packet-switched networks. How does the optical layer facilitate packet switching in optical networks? (CO4,K3)	10

8. Answer any <u>one</u> of the following:-

8-a.	What is the difference between routing and forwarding? Compare static vs. dynamic routing. (CO5,K3)	10
8-b.	How do advancements in optical amplification technologies contribute to the efficiency of optical line amplifiers? (CO5,K3)	10