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
20

1. Attempt all parts:-

1-a.   Which of the following is a key component in an optical communication system for transmitting signals?(CO1,K1)   1

   (a)   Transistor

   (b)   Laser diode

   (c)   Capacitor

   (d)   Resistor

1-b.   In optical fibers, what property allows light to propagate through the core by total internal reflection? [CO1,K2]   1

   (a)   Refraction

   (b)   Reflection

   (c)   Absorption

   (d)   Dispersion

1-c.   What is attenuation in the context of optical fibers? [CO2,K1]   1

   (a)   The increase in signal power

   (b)   The decrease in signal power

   (c)   The dispersion of light

   (d)   The amplification of light

1-d.   Rayleigh scattering is a type of:(CO2,K2)   1

   (a)   Linear scattering

(b) Non-linear scattering

(c) Refraction

(d) Absorption

1-e. A planar LED is fabricated from GaAs is having a optical power emitted is 0.018% of optical power generated internally which is 0.018% of optical power generated internally which is 0.6 P. Determine external power efficiency.(CO3,K2,K3)   1

(a) 0.18%

(b) 0.32%

(c) 0.65%

(d) 0.009

1-f. 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-g. What is the primary purpose of optical amplifiers in optical networks? [CO4,K1]   1

(a) To convert optical signals into electrical signals

(b) To increase the intensity of optical signals

(c) To reduce the speed of data transmission

(d) To encode data into optical signals

1-h. Which technology allows the integration of electronic and optical switching in a network?(CO2,K1)   1

(a) Electro-optic switching

(b) Opto-electric switching

(c) Hybrid switching

(d) Fiber-optic switching

1-i. SONET/SDH operates at which layer of the OSI model? [CO5,K2]   1

(a) Physical Layer

(b) Data Link Layer

(c) Network Layer

(d) Transport Layer

1-j. What is the purpose of the Scrambling Overhead (SOH) in the SONET frame structure?(CO5,K2)   1

(a) Error detection

(b) Payload transport

(c) Frame synchronization

(d) Scrambling/descrambling synchronization

2. Attempt all parts:-

2.a.	How does total internal reflection play a role in optical fibers?(CO1,K2)	2
2.b.	How is attenuation measured in optical fibers?(CO2,K2)	2
2.c.	How is LED efficiency calculated?(CO3,K2)	2
2.d.	What is the significance of Wavelength Division Multiplexing (WDM) in optical networks?(CO4,K1)	2
2.e.	Discuss the concept of optical transport network (OTN) and its relationship with SONET/SDH.(CO5,K2)	2

SECTION-B   30

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

3-a.	Explain the relationship between numerical aperture and the angle of the cone of light in an optical fiber.(CO1,K2)	6
3-b.	How does the Goos-Hänchen shift affect the position of reflected light?(CO1,K2)	6
3-c.	How do impurities in the fiber material contribute to absorption losses?(CO2,K2)	6
3-d.	What causes chromatic dispersion to occur in optical communication systems?(CO2,K2)	6
3-e.	Discuss the advantages of using laser diodes in various applications.(CO3,K2)	6
3-f.	Define optical Switches in optical networks with examples.(CO4,K1)	6
3-g.	What is the primary function of Asynchronous Transfer Mode (ATM) in networking? [CO5,K1]	6

SECTION-C   50

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

4-a.	What is the fundamental difference between step-index and graded-index optical fibers? [CO1,K1]	10
4-b.	How does the MFD affect the efficiency of coupling light into and out of a single-mode fiber?(CO1,K2)	10

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

5-a.	How does chromatic dispersion differ from other types of dispersion in optical fibers? [CO2,K2]	10
5-b.	Explain how multimode step-index (MSI) fibers exhibit intermodal dispersion.(CO2,K2)	10

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

6-a.	Compare the performance characteristics of PIN photodiodes and avalanche photodiodes. [CO3,K3]	10
6-b.	How can the thermal management of photodiodes be optimized to enhance their overall performance?(CO3,K3)	10

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

7-a.	Explain the concept of Dense Wavelength Division Multiplexing (DWDM) in second-generation optical networks. How does DWDM improve the network's	10

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data transmission capacity? [CO4,K2]

7-b.   Describe the relationship between wavelength, frequency, and energy in the electromagnetic spectrum. How does the energy of a photon relate to its wavelength or frequency?(CO4,K2)   10

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

8-a.   Discuss the role of erbium-doped fiber amplifiers (EDFAs) in optical line amplifiers.(CO5,K2)   10

8-b.   How do OADMs support the scalability of optical networks as traffic demands evolve?(CO5,K2)   10

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