

R16

Code No: 138DY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year II Semester Examinations, July - 2023

OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) Define acceptance angle and numerical aperture. [2]
- b) Explain the concept of skew rays. [3]
- c) Define group delay in optical fibers. [2]
- d) Describe the concept of pulse broadening in optical fibers. [3]
- e) Define the power bandwidth product for LEDs. [2]
- f) Discuss the factors that affect the quantum efficiency of LEDs. [3]
- g) Define quantum limit. [2]
- h) What is the role of analog receivers in optical communication? [3]
- i) What is Link Power Budget? [2]
- j) What are the types of dispersion and their impact on signal transmission in optical fiber systems? [3]

PART – B

(50 Marks)

- 2.a) Explain the concept of cut-off wavelength in single-mode fibers and its significance in signal transmission.
- b) Define mode field diameter and effective refractive index in single-mode fibers and discuss their importance. [5+5]

OR

- 3.a) Explain how the refractive index profile affects the transmission characteristics in ray theory transmission.
- b) Discuss the concept of bandwidth in graded index fibers and how it is influenced by the refractive index profile. [5+5]

- 4.a) Explain waveguide dispersion and discuss its impact on signal distortion in optical fibers.
- b) Explain the concept of attenuation in optical fibers. Discuss the different types of losses contributing to attenuation, including absorption, scattering, bending, core, and cladding losses. [5+5]

OR

- 5.a) Explain the different types of optical fiber connectors used in optical communication systems. Discuss their characteristics, advantages, and applications.
- b) Explain the concept of splicing in optical fiber connections. Discuss the different techniques used for fiber splicing and their advantages and limitations. [5+5]

QA QA QA QA QA QA QA G

- 6.a) Describe the factors that affect the quality and reliability of fiber splices. Discuss the methods used for testing and evaluating the performance of fiber splices.
- b) Discuss the challenges and considerations specific to splicing multimode fibers. Explain the techniques used for achieving low joint loss in multimode fiber joints. [5+5]

QA QA QA QA QA QA QA G

OR

- 7.a) Explain the concept of equilibrium Numerical Aperture (NA) in power launching. Discuss its significance and the techniques used for achieving optimal NA matching between the source and the fiber.
- b) Describe the output patterns and power coupling in source-to-fiber power launching. [5+5]

QA QA QA QA QA QA QA G

- 8.a) Discuss the temperature effect on avalanche gain in APD optical detectors. Explain how temperature variations can impact the performance of APD devices?
- b) Explain the fundamental operation of an optical receiver. Discuss the key components and their roles in converting optical signals to electrical signals. [5+5]

OR

- 9.a) Describe the process of digital signal transmission in optical receivers. Discuss the error sources and the techniques used for error detection and correction.
- b) Explain the concept of the probability of error in optical receivers. Discuss the factors that influence the probability of error and the methods used to minimize it. [5+5]

QA QA QA QA QA QA QA G

10. Explain the concept of link power budget in optical communication. Provide examples and discuss how link power budget calculations are performed? [10]

OR

11. Explain the concept of line coding in optical links. Discuss the different line coding techniques used for encoding and decoding digital signals in optical communication systems. [10]

QA QA QA QA QA QA QA G

---ooOoo---

QA QA QA QA QA QA QA G

QA QA QA QA QA QA QA G

QA QA QA QA QA QA QA G