R13

Code No: 117GA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, November/December - 2016
OPTICAL COMMUNICATIONS
(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) List out the advantages of Optical Communication. [2]
b) What are Skew Rays? [3]
c) Define dispersion in multimode fibers. What are its effects? [2]
d) What is meant by Pulse broadening? [3]
e) List the factors that cause intrinsic joint losses in a fiber [2]
f) What are the differences between Laser diode and an LED? [3]
g) Describe the Quantum limit. [2]
h) What are the receiver error sources? [3]
i) Illustrate interchannel crosstalk that occurs in WDM networks [2]
j) Define Jitter [3]

PART-B

(50 Marks)

2.a) Explain about Numerical Aperture in the fiber with a neat diagram.
b) A typical refractive index difference for an optical fiber designed for long distance transmission is 1%. Estimate the Numerical aperture and the solid acceptance angle in air for the fiber when the core index is 1.49. Also calculate the critical angle at the core-cladding interface within the fiber. [6+4]

OR

3.a) A multimode step index fiber with a core diameter of 80μm and a relative index difference of 1.5% is operating at a wavelength of 0.85μm. If the core refractive index is 1.48, estimate:
i) The normalized frequency for the fiber
ii) The number of guided modes.
b) Explain in detail the Graded index fibers with neat diagrams. [4+6]

4.a) Explain material dispersion, wave guide dispersion and find an expression for both using electromagnetic field theory.
b) An optical signal at a specific wavelength has lost 55% of its power traversing 7.0km of fiber. What is the attenuation in dB/km of this fiber? [7+3]

OR

5.a) Discuss the connection losses with a neat diagram.
b) Consider a standard G.652 non-dispersion shifted single mode optical fiber that has a zero-dispersion wavelength at 1310nm with a dispersion slope of S_o=0.0970 ps/(nm^2.km). Plot the dispersion in the wavelength range of 1270nm $\leq \lambda \leq$ 1340nm. [6+4]

6.a) Draw and explain the various fiber alignments and joint losses.
b) Describe various fiber splicing techniques with their diagrams. [5+5]

OR

7.a) Describe the various types of fiber connectors and couplers.
b) Explain the working of hetero structure LED. [5+5]

8.a) Draw the structure of PIN and APD photo detectors and explain their operation.
b) What is meant by detector response time? Explain. [5+5]

OR

9.a) With a neat diagram explain the operation of each block in fundamental optical receiver.
b) With a neat diagram discuss the Analog Receivers. [5+5]

10.a) Discuss the different Line coding used in Optical Links.
b) A transmitter has an output power of 0.1 mW. It is used with a fiber having NA = 0.25, attenuation of 6 dB/km and length 0.5 km. The link contains two connectors of 2 dB average loss. The receiver has a minimum acceptable power (sensitivity) of – 35 dBm. The designer has allowed a 4 dB margin. Calculate the link power budget. [6+4]

OR

11.a) Discuss the following:
i) WDM networks
ii) Ultra high capacity networks.
b) Describe the measurement of attenuation and dispersion in Optical Fibers. [5+5]

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