Code No: **RT4104A** **R13** **Set No. 1**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B

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PART–A *(22 Marks)*

1. a) Write the expression for refractive index in graded index fibers and step index fiber. [4]
   b) Give the relation between numerical aperture of Skew rays and meridional rays. [4]
   c) What is group delay? [3]
   d) Define and explain about population inversion? [4]
   e) What are the requirements of good connectors? [3]
   f) Explain briefly about link power budget analysis. [4]

PART–B *(3x16 = 48 Marks)*

2. a) With a neat diagram, explain the working principle of analog and digital optical communication systems. [8]
   b) Compute the V-number and number of modes supported by a fiber with $n_1 = 1.48$ and $n_2 = 1.46$; core radius 25 μm and operating wavelength is 1300 nm. [8]

3. a) Write short notes on following
   (i) Mode field diameter (ii) Core-cladding losses. [8]
   b) What are different types of bending losses in optical fiber? [8]

4. a) Draw the structure of edge emitting LEDs and explain. [8]
   b) What is known as quantum limit? A digital fiber optic link operating at 850 nm requires a maximum BER of 10*9. Find the minimum incidental optical power Po to achieve this BER at a data rate of 10 Mb/s for a simple binary level signaling scheme. (ry: 1), [1/r : B/2]. [8]

5. a) Explain the various measures of efficiency in PIN photodiode and briefly explain the working principle of PIN diode. [8]
   b) Draw and explain the output patterns of source to fiber power launching of LED. [8]

6. a) Explain digital signal transmission in optical detectors. [8]
   b) Differentiate between the photo diode parameters, ‘Quantum limit’ and ‘Dark current’. [8]

7. a) Describe the eye pattern analysis for assessing the performance of a digital fiber optical link. [8]
   b) Explain NRZ and RZ line codes in optical link with an example. [8]

Code No: **RT4104A** **R13** **Set No. 2**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
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PART–A *(22 Marks)*

1. a) Define the cut off wave length. [3]
   b) State the Goos-Haenchen effect. [4]
   c) Explain about Rayleigh scattering. [4]
   d) What is the principle of operation of LASER? [3]
   e) What is meant by splicing? And what are the basic requirements of fiber splicing. [4]
   f) What are the connectors? Write different types of connectors. [4]

PART–B *(3x16 = 48 Marks)*

2. a) Define and explain the linear polarized modes in optical fiber. [8]
   b) Define a mode? Explain mode theory in optical fiber? What is Vnumber? Explain. [8]

3. a) Compare Single mode fibers and Graded index fibers. Explain the requirements for fiber materials. [8]
   b) Explain about linear scattering losses in optical fiber. [8]

4. What is meant by ‘fiber splicing’? Explain various types of fiber splicing techniques and fiber connectors [16]

5. a) Explain the working of Avalanche photodiode. [8]
   b) The quantum efficiency of an In GaAs PIN diode is 80% in the wave length range between 1300nm and 1600nm. Compute the range of responsivity of the PIN diode in the specified wavelength range. [8]

6. a) What is link power budget? Discuss with examples. [8]
   b) Explain about the frequency chirping and its effects. [8]

7. a) Explain the method of measurement of chromatic dispersion in optical fibers [8]
   b) Discuss various line codes which are used in optical links. [8]

Code No: **RT4104A** **R13** **Set No. 3**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
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PART–A *(22 Marks)*

1. a) Write and explain about Snell's law. [4]
   b) What are the conditions for total internal reflection? [3]
   c) What are the techniques used in splicing? [4]
   d) What is meant by hetero junction? List out the advantages of hetero junction**.** [4]
   e) Give the advantages of Pindiode. [3]
   f) Define the Model noise and Model partition noise. [4]

PART–B *(3x16 = 48 Marks)*

2. a) Compare Single mode fibers and Graded index fibers. Explain the requirements for fiber materials. [8]
   b) How many types of rays can propagate in a optical fiber? Explain. [8]

3. a) Explain the pulse broadening due to inter model dispersion in different types of optical fibers. [8]
   b) Explain the intra modal dispersion effect in optical fiber. [8]

4. a) Explain the resonant frequencies of a Laser Diode. [8]
   b) Explain the function of quantum efficiency. [8]

5. a) In a 100-ns pulse, 6x 10^6 photons at a wavelength of 1300nm fall on an In GaAsPhoto detector on the average, 5.4 x 10^6 electron-hole (e-h) pairs are generated. Find the quantum efficiency. [8]
   b) Explain why the mechanical Misalignment problem occurs when fibers are joint. [8]

6. a) Discuss about the Point to Point Fiber Optic Link and its characteristics with an example [8]
   b) How the rise-time budget is required in optical communication system? And explain the rise-time-budget. [8]

7. a) What are the advantages and the necessity of WDM? [8]
   b) Explain how the attenuation does and dispersion is measured in optical communication. [8]

Code No: **RT4104A** **R13** **Set No. 4**

IV B.Tech I Semester Regular/Supplementary Examinations, October/November - 2017

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
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PART–A *(22 Marks)*

1. a) Define relative refractive index difference. [3]
   b) What is the necessity of cladding in optical fibers? [3]
   c) A step index fiber has the normalized frequency of 26.6 at 1300nm. If the core radius is 25μm, find the numerical aperture. [4]
   d) Define Internal-Quantum efficiency. And what is the quantum efficiency of photo detector. [4]
   e) Derive the relationship between powers launching versus wavelength. [4]
   f) What are the different error sources in fiber optical receiver? [4]

PART–B *(3x16 = 48 Marks)*

2. a) What are the various elements of Optical communication system? Explain each element in brief? [8]
   b) Derive the Numerical aperture of step index fiber (SIF) by suing Snell's law. [8]

3. Explain all four types of distortion mechanisms in optical communication. [16]

4. a) Write different types of splicing techniques. [8]
   b) Draw the structure of surface emitting LEDs and explain the radiation pattern. [8]

5. a) What is Equilibrium numerical aperture? [8]
   b) A GaAs optical source with a refractive index of 3.6 is coupled to a silica fiber that has a refractive index of 1.48. If the fiber end and the source are in close physical contact, find Fresnel reflection at interface and Power loss (dB). [8]

6. a) Define diffusion length, carrier lifetime and absorption coefficient. [8]
   b) Derive an expression for the total system rise time budget in terms of transmitter fiber and receiver rise time. [8]

7. a) Explain the need of WDM in OC. And explain the function of WDM [8]
   b) Explain the technique of insertion –loss method to measure attenuation. [8]