Code No: **R204104A** **R20** **Set No. 1**

IV B.Tech I Semester Regular Examinations, January – 2024

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

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

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Define Graded Index fiber (GIF). Explain the ray transmission mechanism in GIF. [7]

b) A multimode step index fiber with a core diameter of 100μm and relative index difference of 1.5% is operating at a wave length of 0.85μm. If the core refractive index is 1.50, estimate (i) The normalized frequency for the fiber, (ii) The number of guided modes. [7]

(OR)

2 a) Draw the structure of an Optical fiber. Explain mode coupling effects due to bends in fiber. [7]

b) A silica OF has a core refractive index of 1.45 and a cladding refractive index of 1.42. Determine (i) Critical angle at the core-cladding interface (ii) Numerical Aperture of the fiber. [7]

UNIT - II

3 a) Discuss about the properties and applications of Active glass fibers. [7]

b) Define the term dispersion in fibers. Discuss about Material dispersion. [7]

(OR)

4 a) Elucidate micro and macro bending losses. [7]

b) Explain about Information capacity determination. [7]

UNIT - III

5 a) Discuss about single mode fiber joints. [7]

b) List out intrinsic coupling losses and explain any 2-losses with suitable diagrams. [7]

(OR)

6 a) Explain about self alignment types existing during fusion splicing. [7]

b) What parameters to be considered while selecting good OF connector design? Explain. [7]

Code No: **R204104A** **R20** **Set No. 1**

UNIT – IV

7	a)	Design a surface emitting LED and explain their radiation property.	[7]
	b)	How the Temperature effects APD avalanche gain? Explain.	[7]
		(OR)	
8	a)	How can be estimated resonant frequencies of a Laser diode? Explain.	[7]
	b)	Classify detector response time and explain any one of the method.	[7]

UNIT - V

9	a)	Write a note on Equilibrium Numerical Aperture and discuss the applications.	[7]
	b)	What is WDM? Explain the basic principle of WDM?	[7]
		(OR)	
10	a)	Explain the how the power is coupling from source to fiber. Discuss an importance of acceptance angle during power coupling.	[7]
	b)	List out the types of error sources and explain about any two sources.	[7]

Code No: **R204104A** **R20** **Set No. 2**

IV B.Tech I Semester Regular Examinations, January – 2024

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

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

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Draw the structure of an optical fiber and explain each part. Why the cladding refractive index is less than core refractive index? Explain. [7]

b) Calculate the cut-off wavelength for a SIF to exhibit single-mode-operation when the core refractive index and radius are 1.48 and 5μm respectively, with the relative index difference being 0.25%. [7]

(OR)

2 a) Draw the block diagram of an optical fiber communication system and explain each part. [7]

b) Define refractive index and explain the concept of Effective refractive index. [7]

UNIT - II

3 a) Explain the designing and applications of Chalgenide glass fibers. [7]

b) Explain the effect of dispersion on digital pulse transmitted in fiber with suitable diagrams. [7]

(OR)

4 a) Discuss in detail about losses due to fiber bend. [7]

b) Write a short note on Pulse broadening in Graded index fiber. [7]

UNIT - III

5 a) Explain about V-groove splicing technique with suitable diagrams. [7]

b) Discuss about alignment Losses. [7]

(OR)

6 a) Explain the designing and working of Expanded beam connectors. [7]

b) Discuss about core-diameter mismatch and numerical aperture mismatch. [7]

Code No: **R204104A** **R20** **Set No. 2**

UNIT - IV

7 a) In a 100ns pulse, $6x10^6$ photons at a wavelength of 1330nm fall on an InGaAs photo detector. On the average $5X10^6$ electron-hole pairs are generated. Find the Quantum efficiency. [7]

b) Explain the working principle of a surface emitting LED. [7]

(OR)

8 a) Discuss about threshold conditions in Laser diode. [7]

b) List out the performances of different photo detectors. [7]

UNIT - V

9 a) Define Lambertian Pattern? Draw the radiation patterns radiated by different optical sources. [7]

b) Explain Attenuation measurement using cutback technique with suitable diagrams. [7]

(OR)

10 a) Explain about time-domain intermodal dispersion measurement. [7]

b) Classify and explain Line coding techniques used in Optical links. [7]

Code No: **R204104A** **R20** **Set No. 3**

IV B.Tech I Semester Regular Examinations, January – 2024

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

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

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Draw the curve of Field amplitude distribution of a fundamental mode and explain about Mode field diameter. [7]

b) Discuss about Acceptance angle with supporting diagrams. [7]

(OR)

2 a) Explain the designing of Step Index fibers and Graded Index fibers. [7]

b) A silica OF has a core refractive index of 1.47 and a cladding refractive index of 1.45. Determine Acceptance angle of the fiber. [7]

UNIT - II

3 a) Explain about Halide material fibers. [7]

b) Two polarization maintaining fibers operating at a wavelength of 1µm have beat lengths of 0.7mm and 80m. Determine the modal birefringence in each case. [7]

(OR)

4 a) When the mean optical power launched into an 8km length of fiber is 100µW, the mean optical power at the fiber output is 4µW. Determine
(i) Overall signal attenuation (ii) Signal attenuation /km [7]

b) Discuss about Intrinsic absorption. [7]

UNIT - III

5 a) Explain about electric arc fusion Splicing techniques with neat diagrams. [7]

b) Discuss about Longitudinal and Lateral misalignments. [7]

(OR)

6 a) Draw the suitable diagrams for tube splicing and explain it. [7]

b) Explain about Butt-joint connector technique. [7]

Code No: **R204104A** **R20** **Set No. 3**

UNIT - IV

7 a) Define the terms homo- junctions, single hetero junctions and double hetero junctions and explain with suitable diagrams. [7]

b) Explain the working principle of a PIN detector with supporting drawings. [7]

(OR)

8 a) A double hetero junction InGaAsP LED emitting at a peak wavelength of 1310nm has radiative and non radiative recombination times of 25 and 90ns respectively. The drive current is 35mA. Find the internal quantum efficiency and the internal power level. [7]

b) Define LASER? Explain the design principles of a LASER diode. [7]

UNIT - V

9 a) Define coupling efficiency. Derive an equation of power coupling from LED to step index fiber. [7]

b) Draw the point –to-point link and explain each component choice. [7]

(OR)

10 a) Define attenuation Loss. Explain any one of the technique to measure attenuation. [7]

b) Explain the differences between analog receivers and digital receiver systems. [7]

Code No: **R204104A** **R20** **Set No. 4**

IV B.Tech I Semester Regular Examinations, January – 2024

OPTICAL COMMUNICATION

(Electronics and Communication Engineering)

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

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

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UNIT - I

1 a) Define Maridional ray and Skew ray. Explain path transmission along fiber with suitable diagrams. [7]

b) A multi mode SIF has a relative refractive index difference of 1% and a core refractive index of 1.50. The number of modes propagating at a wave length of 1.3µm is 1100. Estimate the diameter of the core. [7]

(OR)

2 a) Describe with the aid of simple ray diagrams: (i) Multimode SIF and single mode SIF (ii) Multimode GIF. Compare the advantages and disadvantages of these two types for use as an optical channel. [7]

b) Derive the Numerical Aperture equation of an optical fiber. [7]

UNIT - II

3 a) Explain the designing of Glass fibers based on doping concentrations. [7]

b) A 6km OF link consists of multimode SIF with a core refractive index of 1.5 and a relative refractive index difference of 1%. Estimate (i) Delay difference between slowest and fastest modes at the fiber outputs and (ii) $B_{T(max)}$ [7]

(OR)

4 a) Write a notes on designing of Plastic optical fibers. [7]

b) Classify the scattering Losses and explain any one type of loss. [7]

UNIT - III

5 a) Explain about straight–sleeve and tapered- sleeve alignment technique. [7]

b) Discuss the return loss (RL) due to index-matched connection with perpendicular fiber end faces. [7]

(OR)

6 a) Define reflection coefficient and discuss all possible conditions. [7]

b) Discuss about Multimode fiber joints. [7]

Code No: **R204104A** **R20** **Set No. 4**

UNIT - IV

7 a) Explain the working principle of an Edge emitting LED source with supporting diagrams. [7]

b) Define and derive an equation of External Quantum Efficiency of a Laser diode? [7]

(OR)

8 a) Discuss about the term Power bandwidth product. [7]

b) Explain the function of APD device in optical detector. [7]

UNIT - V

9 a) Discuss the radiation pattern of Laser diode and explain coupling mechanism. [7]

b) Explain Frequency-domain Intermodal dispersion technique. [7]

(OR)

10 a) Draw the basic diagram of optical data link and explain the function of each block. [7]

b) Which parameter can measure by using Eye pattern technique? Explain. [7]