KUMARAGURU
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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2023
(Regulation 2018)
Seventh Semester
ELECTRONICS AND COMMUNICATION ENGINEERING
U18ECI7203**:** Optical Communication

COURSE OUTCOMES

CO1: Discuss optical fiber communication link structure, characteristics of fiber and fabrication techniques
CO2: Measure and analyze the propagation characteristics of an optical signal in different types of fibers
CO3: Analyze the characteristics of different optical sources
CO4: Inspect the optical receivers and amplifiers of an optical transmission system
CO5: Analyze optical fiber transmission system
CO6: Outline basic optical network concepts and components involved

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1. A silica optical fiber has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine the Numerical Aperture and Acceptance angle for the fiber.	CO1	[K$_3$]
2. Distinguish between optical coupler and isolator.	CO1	[K$_2$]
3. Compare material dispersion and waveguide dispersion.	CO2	[K$_2$]
4. Outline the potential application of EDFA specialty fiber.	CO2	[K$_2$]
5. A double-heterojunction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and non radiative recombination times of 30 and 100 ns respectively. The drive current is 40mA. Determine the Bulk recombination life time .	CO3	[K$_2$]
6. Summarize the transition processes involved in laser action.	CO3	[K$_2$]
7. Determine the Primary photo current (Ip) of an APD, if photons of energy 1.53×10^{-19} J are incident with responsivity of 0.65 A/W and optical power level of 10 μW. If the multiplied photocurrent is 65 μA, Find the Multiplication factor in APD.	CO4	[K$_3$]
8. Recall Receiver Sensitivity.	CO4	[K$_1$]
9. Determine the number of wavelengths supported by WDM technique from 1525-1585nm with a spectral spacing of 0.4nm.	CO5	[K$_3$]
10. Interpret the need for layering in optical network architecture .	CO6	[K$_2$]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Illustrate the essential elements in an optical fiber transmission link with a block diagram. Also discuss the different types of optical fibers based on mode	10	CO1	[K$_2$]

	propagation and refractive index profile with relevant sketches.			
b)	A step index multimode fiber with a numerical aperture of 0.20 supports approximately 1000 modes at 850 nm wavelength. Solve for the following parameters: (i) Diameter of core (ii) Number of modes the fiber supports at 1320 and 1550 nm	6	CO1	[K3]

12. Inspect the cause of signal degradation in the design of an optical communication system. Elaborate on how the following loss mechanisms degrade the optical signals as they propagate in a fiber :   16   CO2   [K3]
  i.   Absorption loss
  ii.   Scattering loss
  iii. Bending loss

Make use of necessary illustrations and mathematical equations to justify the degradation mechanisms.

13.	a)	Justify the need of Double Hetero (DH) structure in a light source and discuss the operation of surfaced emitting – LED and Edge emitting - LED	12	CO3	[K2]
	b)	Compare Single quantum well and Multiple quantum well Laser.	4	CO3	[K3]

14.	a)	Explain the structure and operation of PIN Photodiode with neat diagrams.	8	CO4	[K2]
	b)	Discuss the principle of operation of a fundamental optical receiver with a neat schematic.	8	CO4	[K2]

15. Explain the key system requirements in analyzing a point-to-point OFC link. Examine how the following budgeting schemes are used to analyse the system performance: 16   CO5   [K3]
  i.   Link power budget
  ii.   Rise time budget

Make use of appropriate mathematical models and numerical examples to illustrate the same.

16.	a)	Illustrate how WDM improves the information carrying capacity in an OFC system.	8	CO6	[K2]
	b)	Elaborate on SONET/SDH optical standard with frame format and architecture	8	CO6	[K2]

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