KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Seventh Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U18ECI7203: Optical Communication

COURSE OUTCOMES

CO1: Discuss optical fiber communication link structure, characteristics of fiber & fabrication techniques (K2)
CO2: Measure and analyze the propagation characteristics of an optical signal in different types of fibers (K4).
CO3: Analyze the characteristics of different optical sources (K3).
CO4: Inspect the optical receivers and amplifiers of an optical transmission system (K3).
CO5: Analyze optical fiber transmission system (K4).
CO6: Outline basic optical network concepts and components involved (K2).

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

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

1.	Classify different types of optical fiber based on RI profile and mode configuration.	CO1	[K_2]
2.	For an optical fiber with core refractive index of 1.45 and cladding refractive index of 1.43, Find numerical aperture and critical angle.	CO1	[K_1]
3.	Explain how dispersion degrades the optical signal.	CO2	[K_3]
4.	Compare and contrast dispersion shifted and dispersion flattened fibers.	CO2	[K_2]
5.	Contrast between direct band gap and indirect band gap materials.	CO3	[K_2]
6.	Define BER in a digital receiver.	CO4	[K_2]
7.	Why are the SONET / SDH architectures self healing?	CO5	[K_1]
8.	Define quantum limit.	CO5	[K_1]
9.	How does an EDFA work?	CO6	[K_1]
10.	Compare coarse and dense WDM.	CO6	[K_2]

Answer any FIVE Questions:-
PART B (5 x 4 = 20 Marks)
(Answer not more than 80 words)

11.	A step index multimode fiber with a numerical aperture of 0.20 supports approximately 1000 modes at 850 nm wavelength. Solve for the following: (i) What is the diameter of its core? (ii) How many modes do the fiber supports at 1320 and 1550 nm?	CO1	[K_3]

12.		List any two potential applications of Specialty fibers		CO2	[K_4]
13.		Compare and contrast LED and Laser source.		CO3	[K_2]
14.		List the noise sources and disturbances in an optical pulse detection mechanism.		CO4	[K_2]
15.		Determine the Quantum efficiency and the responsivity of the photodiode at 1300 nm when $6x10^6$ photons with 1300 nm wavelength incident on photodiode, on average 5.4x 10^6 electron-hole pairs are generated at the terminals of the device?		CO5	[K_3]
16.		Outline the key system features of wavelength-division multiplexing.		CO6	[K_1]

Answer any FIVE Questions:-
PART C (5 x 12 = 60 Marks)
(Answer not more than 300 words)

17.	a)	Explain any one of the methods to fabricate a silica optical fiber using vapor phase oxidation process.	6	CO1	[K_2]
	b)	List the major advantages of optical fiber communication system and explain key components of an Optical Fiber Transmission link with a neat schematic.	6	CO1	[K_4]
18.		Inspect the importance of signal attenuation in the design of optical communication system. Elaborate on three basic attenuation mechanisms that degrade the optical signals as they propagate in a fiber.	12	CO2	[K_4]
19.	a)	Discuss the principle of operation of Fabry-Perot Semiconductor Laser diode with neat diagram and derive the threshold condition for laser oscillation.	6	CO3	[K_3]
	b)	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 following performance characteristics: (i) Bulk recombination lifetime and Internal quantum efficiency. (iii) Optical power generated internally.	6	CO3	[K_3]
20.	a)	Explain the operation of photodiode that internally multiplies the photocurrent with avalanche gain using appropriate diagram	8	CO4	[K_2]
	b)	Compare the characteristics of PIN Photodiode with APD	4	CO4	[K_2]
21.	a)	A pin photo detector has the following parameters at a wavelength of 1300nm: I_D = 4nA, η= 0.90, R_L = 1k ohm & the surface leakage current is negligible. The incident optical power is 300nW and the receiver bandwidth is 20MHz. Determine the following noise terms of the receiver: (i) Mean square shot noise current. (ii) Mean square thermal noise current.	6	CO5	[K_3]
	b)	Explain the structure and operation of reach-through Avalanche Photodiode with neat diagrams. Also specify the relation between quantum efficiency and responsivity.	6	CO5	[K_2]
22.		Illustrate how link power budget and rise time budget is done for an optical link with an example	12	CO6	[K_2]

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