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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; Dec. - 2019

Optical Communication System

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1	a.	Explain the Refraction and Reflection of a light ray at a material boundary. Also explain the critical angle of incidence ϕ_C	8
	b.	Consider a multimode silica fiber that has a core refractive Index $n_1 = 1.48$ and cladding index $n_2 = 1.46$. Find critical angle, NA and Acceptance angle.	5
	c.	Explain the signal distortion in fibers and discuss Intra modal dispersion and its causes.	7
2	a.	Briefly discuss the power flow in step index fibers with neat diagrams.	7
	b.	Explain the types of photonic crystal fibers with neat diagrams.	6
	c.	Optical powers expressed in dBm, which is the decibel power level referred to 1 mW. Consider a 30 km long optical fiber that has a attenuation of 0.4 dB/km at 1310 nm. Find the optical output power if 200 μW of optical power is launched into fiber.	7

UNIT - II

3	a.	Explain the electron recombination and photon emission for direct band gap and indirect band gap materials.	8
	b.	A double hetero junction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and non radiative recombination times of 30 and 100 ns respectively has drive current of 40 mA. Find bulk recombination lifetime and Internal LED power.	6
	c.	With neat diagrams, explain the fiber splicing techniques in detail.	6
4	a.	Briefly explain the requirements of good connector design and explain the connector types.	7
	b.	With neat diagram, explain the schematic of high radiance surface emitting LED.	6
	c.	Explain the laser diode modes and threshold condition with neat diagrams.	7

UNIT - III

5	a.	Briefly explain the Reach-through avalanche photodiode structure and electric fields.	7
	b.	Derive the expression for the shot Noise by explaining Noise sources.	6
	c.	Explain the digital signal transmission with path through of an optical data link.	7
6	a.	With neat diagram, explain the configuration of an eye diagram showing key performance parameters.	8
	b.	Explain the burst-mode receivers with neat diagram.	6
	c.	Discuss the operation of PIN-photodiode.	6

Contd…2

UNIT - IV

7 a. Discuss the important system requirements to design point-to-point link and their associated characteristics. 6

b. With the help of block diagram explain the overview of analog link. 7

c. A 2×2 biconical tapered fiber couples has an input optical power level of $P_0 = 200\ \mu W$. The output power at 3 ports are $P_1 = 90\ \mu W$, $P_2 = 85\ \mu W$ and $P_3 = 6.3\ \mu W$. Find the coupling ratio, excess loss, insertion loss and return loss. 7

8 a. Explain optical Isolators and optical circulators. 6

b. Explain star couplers and Implement 8×8 star coupler using 2×2 couplers. 8

c. Explain briefly:

i) Generic RF over Fiber link 6

ii) Microwave photonics

UNIT - V

9 a. With the simplified energy level diagram and various transition process of Er^{3+} ions in silica. Explain the amplification mechanism of EDFA. 8

b. Explain the basic optical fiber network topologies with neat diagrams. 8

c. Explain the types of optical amplifiers. 4

10 a. Explain with neat diagrams and transmission rate table, the basic structure of STS-1 SONET frame, STIS-N SONET frame and STM-N SDH frame. 12

b. With an example of an Ultra fast-point to-point transmission system, explain optical TDM links operating at 160 Gbps. 8

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