

Total No. of Questions: 6

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Enrollment No.....



Faculty of Engineering
End Sem (Even) Examination May-2019
EC3CO14 / EI3CO14 Fiber Optic Communications
Programme: B.Tech. Branch/Specialisation: EC/EI

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. In an optical fibre, the concept of Numerical aperture is applicable in describing the ability of 1
(a) Light Collection (b) Light Scattering
(c) Light Dispersion (d) Light Polarization
- ii. Which among the following do/does not support/s the soot formation process? 1
(a) OVPO (b) MCVD (c) PCVD (d) All of these
- iii. In single-mode fibers, how does the fraction of energy traveling through bound mode appear in the cladding? 1
(a) As a crescent wave (b) As a gibbous wave
(c) As an evanescent wave (d) All of these
- iv. Which splicing technique involves the alignment and locking of broken fiber edges by means of positioning devices & optical cement? 1
(a) Fusion (b) Mechanical
(c) Both (a) and (b) (d) None of these
- v. The lower energy level contains more atoms than upper level under the conditions of _____ 1
(a) Isothermal packaging (b) Population inversion
(c) Thermal equilibrium (d) Pumping
- vi. Which of the following materials is not suitable for making an LED 1
(a) GaAs (b) Silicon (c) InGaAsP (d) GaAlAs

P.T.O.

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- vii. Which of the following detectors give amplified output? **1**
 (a) p-n Photodiode (b) p-i-n Photodiode
 (c) Avalanche photodiode (d) Photovoltaic detector
- viii. Which of the following is an inherent property of an optical signal and cannot be eliminated even in principle? **1**
 (a) Thermal noise (b) Shot noise
 (c) Environmental noise (d) Background noise
- ix. Which of the following is an example of an intensity-modulated sensor? **1**
 (a) A sensor based on the relative displacement of two fibers.
 (b) A fiber-optic gyroscope
 (c) A Mach-Zehnder interferometer
 (d) All of these
- x. The function of wavelength-division multiplexer is to **1**
 (a) Separate signals at different wavelengths and couple them to different detectors.
 (b) Combine signals at different wavelengths to pass through a single fiber.
 (c) Tap off part of the energy of the incoming signal.
 (d) Change the transmission speed of the input signal.
- Q.2 i. What are meridional rays and screw rays? **2**
 ii. What is NA? Derive its expression. **3**
 iii. Explain different modes in optical communication system. Discuss the mode theory in step index fibre. **5**
- OR iv. What are the different methods of fibre fabrication. Explain any one method in detail with diagram. **5**
- Q.3 i. Define Intramodal & intermodal dispersion. **2**
 ii. What is dispersion? Derive the expression for Waveguide & material dispersion. **8**
- OR iii. Discuss different types of signal degradation factors in optical communication (with respect to optical windows). Also discuss the design of dispersion shifted and dispersion flattened fibers. **8**

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- Q.4 i. Write about LED modulation bandwidth. **3**
 ii. What is LED? Explain the types of LEDs. **7**
- OR iii. Explain the terms in Laser-Optical cavity, laser oscillations and threshold condition of laser. **7**
- Q.5 i. What is quantum efficiency and responsivity of a photo detector and derive the expression also. **3**
 ii. Name the different types of photodetectors. Explain any two in detail. **7**
- OR iii. Explain different types of optical amplifiers. Also discuss the role and working of EDFA in optical communication system. **7**
- Q.6 Attempt any two:
 i. What are optical sensors? Explain any one. **5**
 ii. Write a short note on optical isolators and optical circulators. **5**
 iii. What is wavelength division multiplexing and how it is used in optical communication? **5**

Marking Scheme

EC3CO14 / EI3CO14 Fiber Optic Communications

Q.1	i.	In an optical fibre, the concept of Numerical aperture is applicable in describing the ability of	1
		(a) Light Collection	
	ii.	Which among the following do/does not support/s the soot formation process?	1
		(c) PCVD	
	iii.	In single-mode fibers, how does the fraction of energy traveling through bound mode appear in the cladding?	1
		(c) As an evanescent wave	
	iv.	Which splicing technique involves the alignment and locking of broken fiber edges by means of positioning devices & optical cement?	1
		(b) Mechanical	
	v.	The lower energy level contains more atoms than upper level under the conditions of _____	1
		(c) Thermal equilibrium	
Q.2	vi.	Which of the following materials is not suitable for making an LED	1
		(b) Silicon	
	vii.	Which of the following detectors give amplified output?	1
		(c) Avalanche photodiode	
	viii.	Which of the following is an inherent property of an optical signal and cannot be eliminated even in principle?	1
		(b) Shot noise	
	ix.	Which of the following is an example of an intensity-modulated sensor?	1
		(a) A sensor based on the relative displacement of two fibers.	
	x.	The function of wavelength-division multiplexer is to	1
		(b) Combine signals at different wavelengths to pass through a single fiber.	
Q.2	i.	Meridional rays	1 mark
		Screw rays	1 mark
	ii.	Definition of Numerical Aperture	1 mark
		Diagram	1 mark
		Derivation	1 mark

OR	iii.	Modes in optical communication system	2 marks	5
		Mode theory in step index fibre.	3 marks	
	iv.	Names of different methods of fibre fabrication	1 mark	5
		Any one method	2 marks	
		Diagram	2 marks	
Q.3	i.	Definition of Intramodal	1 mark	2
		Definition of intermodal dispersion.	1 mark	
	ii.	Dispersion	1 mark	8
		Expression for Waveguide	3.5 marks	
OR		Expression for Material dispersion.	3.5 marks	8
	iii.	Types of signal degradation factors	2 marks	
		Window Attenuation diagram	2 marks	
		Design of dispersion shifted	2 marks	
		Dispersion flattened fibers.	2 marks	
Q.4	i.	LED modulation bandwidth.		3
		For Optical	1.5 marks	
		For electrical	1.5 marks	7
	ii.	LED	1 mark	
OR		SLED	2 marks	
		Diagram	1 mark	
		ELED	2 marks	
		Diagram	1 mark	
Q.5	iii.	Laser-Optical cavity	2 marks	7
		Laser oscillations	2 marks	
		Threshold condition of laser.	3 marks	
Q.5	i.	Quantum efficiency	1 mark	3
		Responsivity of a photo detector	1 mark	
		Derive the expression	1 mark	
OR	ii.	Name the different types of photodetectors	1 mark	7
		Two Photodetectors explanation		
		2 marks each (2 mark * 2)	4 marks.	
		Diagram 1 mark for each (1 mark * 2)	2 marks	
Q.5	iii.	Name of different types of optical amplifiers	2 marks	7
		Diagram	2 marks	
		Theory	3 marks	

Q.6	Attempt any two:		
i.	Optical sensors	1 mark	5
	Explanation of any one	3 marks	
	Diagram	1 mark	
ii.	Optical isolators	1.5 marks	5
	Diagram	1 mark	
	Optical circulators.	1.5 marks	
	Diagram	1 mark	
iii.	Wavelength division multiplexing	2 marks	5
	Diagram	1 mark	
	Applications of optical communication	2 marks	
