Hall Ticket No | | | | | | | | | | |

Question Paper Code: AEC018

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-II

Four B.Tech VIII Semester End Examinations, December- 2019

Regulations: IARE-R16

OPTICAL COMMUNICATION

(Only for ECE)

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

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1	a)	Compare the optical link with that of the satellite link .Explain the differences between meridional and skew rays.	7M]
	b)	A step index fiber has the normalized frequency of 26.6 at 1300nm. If the core radius is 25μm, find the numerical aperture.	[7M]
2	a)	What are the uses of optical fibers? Draw the block diagram of an optical communication system.	[7M]
	b)	For a fiber with core refractive index of 1.54 and fractional refractive index difference of 0.01. Calculate its numerical aperture.	[7M]

UNIT – II

3	a)	What are the factors that produce dispersion in optical fibers? What are the methods used to measure fiber dispersion?	[7M]
	b)	When a LED has 2V applied to its terminals, it draws 100 mA and produces 2 mW of optical power. Determine the conversion efficiency of the LED from electrical to optical power.	[7M]
4	a)	What is a DFB Laser? Differentiate DFB LASER from other types of LASER. What is population inversion?	[7M]
	b)	An LED has radiative and nonradioactive recombination times of 30 and 100 ns respectively. Determine the internal quantum efficiency.	[7M]

UNIT – III

5	a)	What are the requirements of a photo detector? Give different types of photo detectors.	[7M]
	b)	Discuss the different noise sources and disturbances in the optical pulse detection mechanism	[7M]
6	a)	Derive the expressions for the SNS of both PIN and APD by incorporating all noise sources.	[7M]
	b)	In a 100ns pulse, 6 × 106 photons at wavelength of 1300 nm fall on an InGaAs photo detector on the average, 5.4 × 106 electron-hole pairs are generated. Find the quantum efficiency.	[7M]

UNIT – IV

7	a)	Explain in detail about source to Fiber power launching.	[7M]
	b)	Draw the block diagram of fundamental optical receiver. Write about each block	
8	a)	Analyze the front end optical amplifiers and explain.	[7M]
	b)	Calculate the number of independent signals that can be sent on a single fiber in the 1525-1565 nm bands. Assume the spectral spacing as per ITU-T recommendation G.692.	[7M]

UNIT – V

9	a)	What is a ‘four-fiber BLSR ring in a SONET? Explain the reconfiguration of the same during node or fiber failure	[7M]
	b)	What are the drawbacks of broadcast and select networks for wide area network applications?	[7M]
10	a)	Draw the frame format of SONET, What are the basic performance criteria of WDM technique?	[7M]
	b)	What are the main parameters used for characterizing the performance of optical amplifiers in a communication system?	[7M]

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COURSE OBJECTIVES

The course should enable the students to:

I	Understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, RI profile and cut-off wave length.
II	Interpret various optical source materials, LED structures, quantum efficiency, Laser diodes and Different fiber amplifiers.
III	Understand fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
IV	Analyze fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

COURSE OUTCOMES:

CO1	Overview Of Optical Fiber Communication, Vector Nature Of light, types of optical fibers, modal analysis.
CO2	Understand Signal Degradation And Optical Sources, Attenuation- Absorption, Material Dispersion, Optical sources, Principles of operation.
CO3	Understand Optical Detectors, Optical Erectors, Sensitivity And Quantum Efficiency, WDM Concepts And Components
CO4	Understand Optical Amplifiers, Basic concepts, semiconductor amplifier, principles of operation, intermediation effects.
CO5	Understand Optical Networks And Dispersion Compensation, Optical networks, soliton based communication system design.

COURSE LEARNING OUTCOMES

Students who complete the course will have demonstrated the ability to do the following

AEC018.01	Understand Basic principles of optical fiber Communications,
AEC018.02	Define light, propagation of light, modes, propagation of light different levels
AEC018.03	Given the propagation of light in a cylindrical dielectric rod; rays and modes types of optical fibers
AEC018.04	Given the Photonic components in optical communication systems ,
AEC018.05	Understand modal analysis of a step index fiber, linearly polarized modes, single mode fibers and graded - index fiber
AEC018.06	Understand Signal Degradation And Optical Sources, Attenuation- Absorption, scattering losses, bending losses, core
AEC018.07	Explain cladding losses, optical waveguides; Material Dispersion, Waveguide Dispersion; Optical sources
AEC018.08	Explain Semiconductor device fabrication, LED and LASER diode; Principles of operation, concepts of line width,
AEC018.09	Understand phase noise, switching and modulation characteristics
AEC018.10	Define Optical detectors: pin detector, avalanche photodiode
AEC018.11	Understand Principles of operation, concepts of responsively, sensitivity and quantum efficiency, noise in detection.
AEC018.12	Explain Multichannel Transmission Technique-Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components
AEC018.13	Understand semiconductor amplifier, erbium-doped fiber amplifier, Raman amplifier, Brillouin amplifier
AEC018.14	Understand principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, gain

AEC018.15	Explain noise dependencies, inter modulation effects, saturation induced crosstalk, wavelength range of operation
AEC018.16	Design Optical networks-SONET/SDH, ATM, IP, wavelength routed networks, soliton communication system,
AEC018.17	Understand Fiber soliton, soliton based communication system design, high Capacity and WDM soliton.

MAPPING OF SEMESTER END EXAMINATION TO COURSE LEARNING OUTCOMES:

SEE Question No.		Course learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AEC018.01	Understand Basic principles of optical fiber Communications.	CO1	Remember
	b	AEC018.02	Define light, propagation of light, modes, propagation of light different levels	CO1	Understand
2	a	AEC018.03	Given the propagation of light in a cylindrical dielectric rod; rays and modes types of optical fibers	CO1	Understand
	b	AEC018.05	Understand Signal Degradation and Optical Sources, Attenuation-Absorption, scattering losses, bending losses, core	CO1	Remember
3	a	AEC018.07	Understand Principles of operation, concepts of responsively, sensitivity and quantum efficiency, noise in detection.	CO2	Remember
	b	AEC018.08	Explain cladding losses, optical waveguides; Material Dispersion,Waveguide Dispersion; Optical sources	CO2	Understand
4	a	AEC018.09	Understand phase noise, switching and modulation characteristics	CO2	Understand
	b	AEC018.09	Understand phase noise, switching and modulation characteristics	CO2	Remember
5	a	AEC018.10	Define Optical detectors: pin detector, avalanche photodiode	CO3	Understand
	b	AEC018.11	Understand principles of operation, amplifier noise, signal to noiseratio, gain, gain bandwidth, gain	CO3	Understand
6	a	AEC018.10	Define Optical detectors: pin detector, avalanche photodiode	CO3	Remember
	b	AEC018.12	Explain Multichannel Transmission Technique-Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components	CO3	Remember
7	a	AEC018.13	Understand semiconductor amplifier, erbium-doped fiber amplifier,Raman amplifier, Brillouin amplifier	CO4	Understand
	b	AEC018.13	Understand semiconductor amplifier, erbium-doped fiber amplifier,Raman amplifier, Brillouin amplifier	CO4	Understand
8	a	AEC018.14	Understand principles of operation, amplifier noise, signal to noiseratio, gain, gain bandwidth, gain	CO4	Remember
	b	AEC018.15	Explain noise dependencies, inter modulation effects, saturation induced crosstalk, wavelength range of operation	CO4	Remember
9	a	AEC018.16	Design Optical networks-SONET/SDH, ATM, IP, wavelength routed networks, soliton communication system,	CO5	Understand
	b	AEC018.17	Understand Fiber soliton, soliton based communication system design, high capacity and WDM soliton.	CO5	Understand
10	a	AEC018.17	Understand Fiber soliton, soliton based communication system design, high capacity and WDM soliton.	CO5	Understand
	b	AEC018.16	Design Optical networks-SONET/SDH, ATM, IP, wavelength routed networks, soliton communication system,	CO5	Remember

Signature of Course Coordinator **HOD, ECE**