Short Syllabus

BECE308L Optical Fiber Communications (2-0-0-2)

OpticalFiber: Structures, Waveguides - Ray optics, Mode theory, Fiber Types; Signal Degradation - Nonlinear Optical Effects, SRS, SBS, SPM, CPM, FWM; Optical Transmitters - Power and Modulation Bandwidth, Modulators, Transmitter Design; Optical Receivers – Photodetector, PIN, APD, Receiver Design; Digital links and Measurements – Point to Point Links, Attenuation, OTDR; WDM Concepts and Components - Filters, Multiplexers, WDM System Performance Issues; Optical Amplifiers - Semiconductor Optical Amplifiers;

Course Code	Course Title	L	T	P	C
BECE308L	Optical Fiber Communications	2	0	0	2
Pre-requisite	BECE306L, BECE306P	Syllabus version			
		1.0			

Course Objectives

1. To understand the principles of optical fibers and their signal degradation.
2. To familiarize with the fundamentals of optical sources and detectors used in communications.
3. To learn WDM techniques and its components in contemporary optical communication systems.

Course Outcomes

At the end of the course, the students will be able to:

1. List the fundamental optical laws, structures and waveguides.
2. Comprehend the various signal degradation in the fiber optical communication.
3. Design the optical transmitters and receivers and evaluate their performances.
4. Estimate the system requirements for point to point communication.
5. Examine the significance of WDM techniques and their applications.
6. Comprehend and analyse the performance of the various optical amplifiers.

Module:1	Optical Fiber: Structures, Waveguides	3 hours

Key elements of optical fiber system-Ray optics, Mode theory, Geometrical-Optics Description, Fiber Types - specialty fibers.

Module:2	Signal Degradation	5 hours

Attenuation-Absorption, Scattering, Bending losses, Dispersion-Material, Waveguide Dispersion, Polarization Mode Dispersion, Intermodal dispersion, Mode Transit time, Dispersion-Induced Limitations, Nonlinear Optical Effects- SRS, SBS, SPM, CPM, FWM.

Module:3	Optical Transmitters	4 hours

Sources: LED-Structures-Quantum Efficiency, Power and Modulation Bandwidth- LASER-DFB, DBR, VCSEL, Quantum Efficiency, Modulators - Direct and external modulators, Transmitter Design.

Module:4	Optical Receivers	5 hours

Photodetector-PIN, APD, Receiver Design, Receiver Noise-CNR&SNR), Receiver Sensitivity, Quantum limit, Sensitivity Degradation, Receiver Performance-Probability of error, Bit Error rate, Eye-Diagram.

Module:5	Digital links and Measurements	4 hours

Digital links: Point-to-Point Links-System Consideration-Link power budget-Rise time budget, System performance- Attenuation, Dispersion measurements-OTDR.

Module:6	WDM Concepts and Components	5 hours

Overview of WDM, Fiber Coupler-Wave guide coupler-Star couplers, Isolators and Circulators - Fiber Bragg Grating, Filters, Multiplexers, WDM System Performance Issues-Compensation techniques.

Module:7	Optical Amplifiers	2 hours

Semiconductor Optical Amplifiers, Raman Amplifiers, Erbium-Doped Fiber Amplifiers.

Module:8	Contemporary Issues	2 hours

	Total Lecture hours:	**30 hours**
Text Book(s)		
1.	Gerd Keiser, Optical Fiber Communications, 2017, 5th Edition, McGraw Hill Education, India.	
Reference Books		
1.	Conway, E., Optical Fiber Communications Principles and Practice, 2018, 1st Edition, ED-TECH Press, United Kingdom.	
2.	Singal, T. L. Optical Fiber Communications: Principles and Applications, 2017, Cambridge University Press, India.	
3.	Keiser, G., Fiber Optic Communications, 2021, 1st Edition, Springer, Singapore	
Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test		
Recommended by Board of Studies	14-05-2022	
Approved by Academic Council	No. 66	Date 16-06-2022