FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **V**

Course Code: **202060507**

Course Title: **Optical Fiber Communication**

Course Group: **Professional Elective Course**

Course Objectives: To introduce the students with fiber optic communication technology, modes, configurations, and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system, optical amplifiers, fiber network elements, basic optical components and techniques of fiber optic measurement.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction of Optical fiber Communications:** Electromagnetic spectrum, Optical Spectral bands, Evolution of fiber optic system, Multiplexing Techniques, Elements of an optical fiber transmission link with the functional description of each block, transmission widows, advantages of optical fiber link over conventional copper systems, applications of fiber optic transmission systems.	03
2	**Optical Sources:** Semiconductor Physics background, Light emitting diode (LEDs)structures, materials, Figure of merits, characteristics & Modulation. Laser Diodes Modes & threshold conditions, Diode Rate equations, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, Spectral width, temperature effects, and Light source linearity.	07

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3	**Optical fibers - Structures, Wave guiding and Fabrication:** Optical laws and definitions, optical fiber modes and configurations, Mode theory, step Index and Graded Index (GI) fibers, single mode and graded index fibers, Derivation for numerical aperture, V number and modes supported by step index fiber, mode field, Numerical aperture and modes supported by GI fibers, fiber materials, linearly Polarized modes fiber fabrication techniques, and mechanical properties of fibers, fiber optic cables.	**08**
4	**Coupling and Signal Degradation in Optical Fibers:** Source to fiber power launching, Lensing schemes, fiber-to-fiber joints, LED coupling to single mode fibers, fiber splicing, Optical fiber connectors, Attenuation, signal distortion in optical waveguides, pulse broadening in graded index fiber, Characteristics of Single Mode Fibers, mode coupling, international standards for optical transmission fibers.	**10**
5	**Optical Receivers:** Principles of operation of photodetectors, types, characteristics, figure of merits of detectors photodiode materials, photodetector noise, detector response time, temperature effects on gain, comparison of photodetectors. Receiver operation, Preamplifier types, receiver performance and sensitivity, Eye diagrams, Coherent detection, Specification of receivers.	**10**
6	**Advances in Fiber Optic Systems:** Optical Amplifiers – types & principles of operation, WDM Concepts – DWDM, Optical Networks – SONET/SDH, Optical Switching, Optical Couplers, Optical Add & Drop MUX (OADM), Circulators, attenuators, wavelength converters, Test and measurements of attenuation, dispersion, Eye patterns, Use of OTDR, Dispersion Compensation in fiber optics.	**07**
		45

List of Practicals / Tutorials:

1	Setting -up of Analog/ Digital Optical Communication Link.
2	Measurement of attenuation characteristics of an optical fiber.
3	Measurement of NA of a multimode fiber.
4	Measurement of Dispersion of optical fiber.
5	Measurement of emission wavelength of LED/LASER source.
6	To measure the Propagation Delay in a fiber optic digital link for different optical power input, R_{in} and threshold settings.
7	To study different encoding methods for fiber optic digital transmission.
8	Setting -up of voice link on Optical communication Link.
9	Performing Experiments on the VI characteristics of the optical Sources.
10	Performing Experiments on the characteristics of the optical detectors.
11	Simulation based Experiments and Design using MATLAB / SCILAB.
12	Calculate Mode Field Diameter, V number, Propagation constant & its graphical representation using MATLAB/SCILAB simulation.

Reference Books:

1	Gerd Keiser, **Optical Fiber Communications**, 4th Edition, Mc Graw Hill.
2	John M. Senior, **Optical Fiber Communication**, PHI/Pearson,
3	Djafar Mymbaev and Lowell L, Scheiner, **Fiber optical communication Technology**, Pearson
4	G. Agrawal, **Fiber optic Communication Systems**, John Wiley and sons.

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5	S C Gupta, **Optical Fiber Communication and Its Applications**, PHI/Pearson,

Supplementary learning Material:	
1	https://vlab.amrita.edu/index.php?sub=59&brch=269
2	https://vlab.amrita.edu/index.php?sub=1&brch=189
3	NPTEL & Coursera Video Lectures

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	20	20	15	15	10	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To understand the principles and operation of fiber optic communication system	**40**
CO-2	To be familiar with use of various optical components constituting optical fiber links and to calculate different kind of losses and signal distortion	**25**
CO-3	Design an optical fiber link with encapsulation of different system components.	**25**
CO-4	Understand the measurement techniques for performance parameters of optical fiber.	**10**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June -2022

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Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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