

**Approval: 5<sup>th</sup> Senate Meeting**

<b>Course Name</b>	: Optical Communication Systems
<b>Course Number</b>	: EE-614
<b>Credits</b>	: 3-0-0-3
<b>Prerequisites</b>	: EE-304: Communication Theory and the instructor's consent
<b>Intended for</b>	: UG/MS/PhD
<b>Core or Elective</b>	: Elective
<b>Semester</b>	: Odd/Even

**Preamble:** This course is intended to bring to the students the information necessary to understand the design, operation and capabilities of fiber systems. Students will be introduced to the fundamental concepts of various optical components subsystems and systems. Latest topics are included to keep in touch with the recent trends.

**Course Outline:**

1. INTRODUCTION TO OPTICAL COMMUNICATION AND FIBER CHARACTERISTICS (8 Contact Hours)  
Evolution of Light wave systems, System components, Optical fibers, Step Index & Graded index Mode theory, Fiber modes, Dispersion in fibers, Limitations due to dispersion, Dispersion shifted and dispersion flattened fibers, Fiber Losses and Non-linear effects
2. OPTICAL TRANSMITTERS (4 Contact Hours)  
Basic concepts, LED's structures, Spectral Distribution, Semiconductor lasers, Structures, Threshold Conditions, and Transmitter design.
3. OPTICAL DETECTORS AND AMPLIFIERS (8 Contact Hours)  
Basic Concepts, PIN and APD diodes structures, Photo detector Noise, Signal impairments, Receiver design. Amplifiers: Basic concepts, Semiconductor optical amplifiers, Raman, Brillouin amplifiers, Erbium doped fiber amplifiers, pumping requirements, cascaded in-line amplifiers.
4. COHERENT LIGHTWAVE SYSTEMS (4 Contact Hours)  
Basic coherent systems, Coherent detection principles, Homodyne and heterodyne detection, Modulation formats, BER in synchronous receivers, Equalization, carrier phase and frequency synchronization, timing synchronization
5. MULTICHANNEL SYSTEMS (6 Contact Hours)  
WDM Light wave Systems, WDM Components, WDM System Performance Issues, Time-Division Multiplexing, Subcarrier Multiplexing, Orthogonal Frequency Division Multiplexing (OFDM) and Code-Division Multiplexing
6. OPTICAL TRANSMISSION LINK LIMITS (6 Contact Hours)  
Power budget and bandwidth limited point-to-point light wave system, OSNR evaluation in high speed optical transmission systems, Dispersion Management, Nonlinearity management.
7. OPTICAL NETWORKS (6 Contact Hours)  
LANs, MANs, Long-Haul Networks, Design Guidelines

**Reference Books:**

1. John M. Senior, "Optical Fiber Communications: Principles and Practice" (second edition) Prentice Hall of India
2. G. P. Agrawal, "Fiber Optic Communication Systems", 3rd Edition, John Wiley & Sons, New York, 2002.
3. G. Keiser, "Optical Fiber Communication Systems", McGraw Hill, New York 2000.
4. M. Cvijetic and Ivan Djordjevic, "Advanced Optical Communication Systems and Networks" ArtechHouse, 2013
5. Ramaswami, Sivarajan, and Sasaki's "Optical networks: A practical perspective," Morgan-Kauffman, 3/e, 2009.