OPTICAL FIBER COMMUNICATION

Paper Code: **ECS-802**

Course Credits: 4

Lectures/ Week: 3

Tutorials/ Week: 1

Course description:

UNIT I: INTRODUCTION

Introduction, Elements of Optical fiber link, Ray theory transmission; Total internal reflection, Acceptance angle, Numerical aperture, Skew rays, Mode theory of optical propagation; Electromagnetic waves, Maxwell equations, Modes in Planar guide, Fiber types; Single mode fibers, Multimode fibers, Step index fibers, Graded index fibers.

UNIT II: TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS

Attenuation; Absorption losses, intrinsic absorption, extrinsic absorption, Linear and Non linear Scattering losses, Rayleigh scattering, Mie Scattering, Dispersion; Intra and inter Modal Dispersion, Multipath dispersion, Chromatic dispersion, waveguide dispersion, Over all Fiber Dispersion.

UNIT III: SOURCES AND DETECTORS

Optical sources: Light Emitting Diodes (LED), Laser diode(LD); Absorption and Emission of radiation, Spontaneous emission and stimulated emission, Population inversion, Comparison of LED and LD, Optical Detectors; Photo diode, PIN photodiode, Avalanche photodiode(APD), Responsively, Quantum efficiency , Photo detector noise –Noise sources , Signal to Noise ratio , Detector response time, Optical modulators.

UNIT IV: FIBER LINK DESIGNAND OPTICAL MODULATORS

Fiber Link : System design considerations, Link Design, Link Loss Budget - Power Budget and Time Budget, Loss limits, Dispersion limits, Bandwidth distance product, Modulation of LED and LD, Mach- Zehnder Modulator(MZM), Electro-Absorption Modulator(EAM)

UNIT V: COHERENT LIGHT WAVE SYSTEMS AND OPTICAL NETWORKS

Basic concepts; Local oscillator, Homodyne and Heterodyne detection/demodulation, Signal to noise ratio, Modulation formats; ASK Format, PSK Format, FSK Format, Bit Error Rate, Networks – SONET / SDH, WDM Networks ; Conventional WDM, Course WDM, Dense WDM, EDFA system

Text Book:

1. Optical Fiber Communications Principles and Practice – John M. Senior, Pearson Education – Third Edition. 2009.

2. Optical Fiber Communications – Gerd Keiser – Mc Graw Hill – Fifth Edition. 2013

3. Fiber-optic communication systems - Govind P. Agrawal, Third edition, John Wiley & sons, 2002.

Course Outcomes:

CO1. An ability to understand the general system of optical fiber communication, ray & mode theory and fiber configuration.

CO2. An ability to explain the attenuation, scattering, & bending loss and dispersion of fiber.

CO3. An ability to describe optical sources like LEDs, Laser diodes and Optical detectors like photodiode, PIN photodiode, Avalanche photodiode (APD).

CO4. An ability to analyze and apply link design and understand Mach-Zehnder Modulator (MZM), Electro-Absorption Modulator (EAM) and EDFA system.

CO5. An ability to describe fundamental receiver operation, SONET/SDH and WDM concept.