IV Year-I Semester		L	T	P	C
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OPTICAL COMMUNICATION (RT4104A)

Prerequisite Course:

Engineering Physics, Analog communication

Course Description and Objectives:

This course investigates the basic aspects of fiber-optic communication systems. Topics include sources and receivers, optical fibers and their propagation characteristics, and optical fiber systems. The principles of operation and properties of optoelectronic components, as well as the signal guiding characteristics of glass fibers, are discussed.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes.

Cos	Course Outcomes	POs
1	Choose necessary components required in modern optical communications systems	3
2	Design and build optical fiber experiments in the laboratory and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers	3
3	Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems	2
4	Choose the optical cables for better communication with minimum losses	2
5	design build and demonstrate optical fiber experiments in the laboratory	3

Syllabus:

UNIT I:

Objective: To learn fundamentals of optical communication and optical fiber working principles

Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT II:

Objective: To learn about various materials used in the fabrication of optical fibers.

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

UNIT III:

Objective: To study various types of connectors and splicing techniques and also various misalignment losses.

Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing-Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints.

UNIT IV:

Objective: To gain knowledge on various LED ,LASER sources and their charateristics.

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD, Optical detectors-Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

UNIT V:

Objective: To understand the concepts of power launching, power coupling and also receiver operation.

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers.

UNIT VI:

Objective: To calculate link power budget and attenuation and dispersion measurement.

Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

TEXT BOOKS

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition,2002

REFERENCE BOOKS:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.