ECE4501 Course Syllabus

ECE4501

Fiber Optics (3-4-5)

Prerequisites
ECE 3025 [min C]

Corequisites
None

Catalog Description
Combined lecture-laboratory exporation of the technology of fiber optics, with special emphasis optical fiber communications systems.

Textbook(s)
Agrawal, *Fiber-Optic Communication Systems* (3rd edition), John Wiley, 2003. ISBN 9780471215714 (required)

Topical Outline

- Review of Waveguiding Principles
  - Review of Selected Topics in Optics
  - Wave Equation and General Solutions
  - Wave Propagation in Symmetric Dielectric Slab Waveguides
- Field Solutions for Step-Index Fibers
  - Weakly Guiding Approximation
  - Wave Equation Solution
  - Mode Description and Cutoff Conditions
  - Power Confinement
- Signal Degradation in Step-Index Fibers
  - Absorptive, Radiative, and Scattering Losses
  - Dispersion
    - Dispersion Mechanisms in Single-Mode Fiber
    - Group Delay Distortion in Multimode Fibers
    - Optical Pulse Propagation and Broadening
- Power Launching and Coupling
  - Gaussian Beams; Use of Lenses
  - Basic Considerations for Optimum Coupling
  - Coupling Efficiency Determination
- Sources for Optical Communication Systems
  - Basic p-n Junction Devices
  - Light-Emitting Diodes; Semiconductor Lasers
- Photodetectors
  - PIN Photodiodes; Avalanche Photodiodes
  - Response Time; Photodetector Noise
- Transmission Links
  - Basic System Design; System Budget Considerations
  - Multiplexing Techniques

- Codes for Optical Communication Systems

Optical Networks

- Passive Components; 3 dB Couplers and Stars
- Optical Switching and Switch Architectures
- Network Architectures; Approaches to Optical Management
- Optical Amplifiers; Operation and Impact

Laboratory Characterization of Components

- Gaussian Beams
- Semiconductor Sources
- Detectors
- Fiber Loss and Dispersion

Application of Advanced Measurement Techniques and Equipment

- Optical Spectrum Analyzer
- Optical Time Domain Interferometer
- Bit Error Rate Test Set
- Eye-Diagram Analysis
- Polarization Analysis