

ECE4502 Course Syllabus

ECE4502

Optical Fiber Communications (3-0-3-4)

CMPE Degree

This course is Elective for the CMPE degree.

EE Degree

This course is Selected Elective for the EE degree. * (Selected Elective means this course is one of a few choices that are required for the degree.)

Lab Hours

3 supervised lab hours and 0 unsupervised lab hours

Course Coordinator

Ralph, Stephen E

Prerequisites

ECE 3025 [min C]

Corequisites

None

Catalog Description

Combined lecture-laboratory exploration of the technology of fiber optics, with emphasis on optical fiber communication systems.

Textbook(s)

Kumar & Deen, *Fiber Optic Communications: Fundamentals and Applications* (1st edition), 2014. (required)

Course Outcomes

Upon successful completion of this course, students should be able to:

1. Be conversant on optical waveguide components, including single and multimode fiber, fiber couplers, connectors, and fiber amplifiers.
2. Demonstrate basic fiber handling skills, including cleaving and splicing.
3. Identify and measure fundamental system impairments and know the mitigation methods.
4. Operate instrumentation for measuring fiber and optical system properties,.
5. Measure noise and its effects on system performance.
6. Describe signal processing methods and their impact on fiber communication links.
7. Design, construct, and test a basic fiber communication link.
8. Demonstrate sophistication in experimental data processing, interpretation, and presentation.
9. Write a good technical report.
10. Give a clear and informative team presentation.

Student Outcomes

In the parentheses for each Student Outcome:

"P" for primary indicates the outcome is a major focus of the entire course.

"M" for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.

"LN" for "little to none" indicates that the course does not contribute significantly to this outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (LN) An ability to communicate effectively with a range of audiences
4. (LN) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (P) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (P) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (M) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

Laboratory I: Fiber loss and dispersion measurements

Laboratory II: Receivers and eye diagrams

Laboratory III: Basic OOK optical links

Laboratory IV: Advanced optical links, noise and impairment assessment

Laboratory V: Final Project

1) Optical Fiber Transmission

Basic elements of optical fiber links, Fiber structure and the ray

2) Lasers

Basic concepts and conditions for laser oscillations, Semiconductor

3) Optical Modulators and Modulation Schemes

Signaling basics, Digital modulation schemes, Optical modulator typ

4) Optical Receivers

Photodetector types and performance characteristics, PIN photodiode

5) Optical Amplifiers

Optical amplifier architectures, Semiconductor optical amplifiers,

6) Transmission Systems and Performance Analysis

Eye diagrams and bit error rates, Direct detection links, DWDM syst

7) Nonlinear Effects in Fibers

Origin of linear and nonlinear refractive indices, Nonlinear Schrod

8) Digital Signal Processing

IF estimation and compensation, Phase estimation and compensation,