

EECE 173
Fall 1999

EECE 173 - Optical Fiber Communications

Course Description:

Fundamental principles and theories of optical fiber (Step-Index and Graded-Index, single and multimode fibers) will be introduced and developed. Physical principles of the design and operational characteristics of fiber optic components will be covered. Optical fiber communication systems will be examined and designed.

Prerequisites: Senior Standing in Electrical Engineering and/or Physics.

Course Materials:

Required: Joseph C. Palais, Fiber Optic Communications, 4th Ed., Prentice-Hall, Englewood Cliffs, N.J., 1998.

Gerd Keiser, Optical Fiber Communications, 2nd Ed., McGraw-Hill, New York, 1991.

Optional: None

Course Goals:

To give seniors and first year graduate students fundamental principles on the theory and design of optical fiber systems.

Course Objectives:

By the end of this course, you should...

- Know the basics of electromagnetic theory as related to lightwave signals.
- Know the fundamental principles and theories of optical fibers as dielectric waveguides.
- Know the characteristics of Step-Index, Graded-Index fibers, the design equations and principles of single mode and multimode propagation.
- Know how to analyze signals in optical fibers. This analysis includes:
 - Mode interaction
 - Signal attenuation
 - Signal dispersion and pulse spreading
- Know the basic operating characteristics of semiconductor light sources and photoreceivers. Emphasis is placed on their impact on system performance.
- Know the various couplers and connectors for optical fibers.
- Be able to recognize and assess various distribution systems used in the design of networks (local area network (LAN)).
- Be able to choose and evaluate system components such as fibers, light sources, detectors and couplers.
- Know how to design and analyze basic optical fiber communication networks, including the criteria for system information-handling capability as well as the criteria for future expansion.

Course Topics

Introduction to Optical Communication and
Optical Fiber.
Optical Dielectric Waveguides- Optical Fibers
-Step Index
-Graded Index
-Modes
Signal Analysis in Optical Fibers

Light Sources and Detectors
Coupling to a Fiber; Distribution Systems
Optical Fiber Communication Design

In the Text

Palais: Chap.1, 2, 3
Keiser: Chap. 1
Palais: Chap. 4, 5
Keiser: Chap. 2

Palais: Chap. 4
Keiser: Chap.3
Palais: Chap.6, 7
Palais: Chap.8, 9
Palais: Chap. 12
Keiser: Chap. 8, 11

Class Schedule: 3 Credit course, meeting the equivalent of 3-50 minute class periods per week.

Contribution to Professional Component:	Engineering Science	50 %
	Engineering Design	50 %

Contribution to Program Objectives: partial fulfillment of Criterion 3 objectives: A, C, E, G, K

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Course Coordinator: Fabien Josse

January 11, 2000

Last modified: July 13, 2000

EECE 173: Optical Fiber Communications
ABET Objectives,
Assessment Instruments, and
Assessment Criteria

- (A) **An ability to apply knowledge of mathematics, science, and engineering:**
As listed in the course Goals and Objectives, this ability is needed and is required to learn fundamental principles of lightwave propagation and analysis in optical fibers. Homework and tests will demonstrate such competence.
Minimum competence is defined to be between 70-74% average on all assigned work during the semester.
- (C) **An ability to design a system (sic) to meet desired needs:**
Small design projects are given throughout the semester. A major design project is assigned to each pair of students by the middle of the semester, to be completed by the end of the semester. Each project is discussed with the instructor by first producing a detailed outline.
Minimum competence: 60%-70% average on all design projects including classroom discussion of projects.
- (E) **An ability to identify, formulate, and solve engineering problems.**
Course work including homework and design project is formulated to satisfy this criteria. Also see Course Objectives. Homework and Tests will be demonstrate this ability.
Minimum competence is defined to be between 70-74% average on all assigned work during the semester.
- (G) **An ability to communicate effectively**
Final Design Project work: Students are expected to write a report following a typical scientific paper format. An oral presentation is also scheduled for each pair of students at the end of the semester, followed with questions and answers.
Minimum competence: grade of C on both the written design report and oral presentation. Grade basis include technical quality of the report as well as structure of the report and proper use of the English language (both written and oral).
- (K) **An ability to use the techniques, skills and modern engineering tools necessary for engineering practice**
In addition to the advanced mathematic tools needed to analyze signal propagation in optical fibers, this course also includes an arranged visit to the telephone company technical center. There, students are given demonstrations on the use of technique skills an tools encountered in Optical Fiber Communications. Optical Time Domain Reflectometry (OTDR) is used to locate defects/discontinuities in the fiber. Fiber splicing techniques (fusion/splicing) is performed with state-of-the-art equipments. After a brief demonstration, students are invited to use these tools.
Minimum competence: grade of C on homework and project work showing use of advanced mathematical tools. Also, attendance at and participation in visit activities.

Evaluation of Objective Attainment-Continuing Course Review

Course Specific Evaluation -

At mid-semester, students are asked to write a course assessment. The student's assessment and suggestions are discussed in class. Minor suggestions are immediately incorporated into the class materials to improve the course objectives.

In addition, all course materials use also continuously reviewed.

Department Specific Evaluation -

At the end of each semester, instructors of this course will submit a short written report to the Course Coordinator for EECE 173 which

- discusses their perceptions of student knowledge and ability to apply the listed prerequisites, and
- provides qualitative and quantitative information which discusses the attainment of objectives listed above for EECE 173.

The course coordinator will review these reports with the instructors and in consultation with the instructors recommend modification and/or enhancements to the objectives and criteria as needed. The recommendations will be forwarded to the EECE Undergraduate Committee for approval.

Last modified: July 13, 2000