

COURSE SYLLABUS

OSE 4470 FIBER OPTIC COMMUNICATIONS, FALL 2023

Instructor: Dr. Rodrigo Amezcua Correa
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Term: Fall 2023
Class Days: Mondays and Fridays
Class Time: 10:30 AM - 11:45 AM
Class Location: NSC 0147
Credits: 3

Office Hours: Tuesday, Thursday: 12:00 PM – 1:00 PM.
I will be happy to discuss the material with you anytime by appointment.

I. University Course Catalog Description

Introduction to the principles and design of optical fiber communication systems including the optoelectronic devices used in transmitters and receivers.

II. Course Overview

This course is an introduction to the principles of optical fiber communication systems. The course covers three topics: 1) The optical fiber as a transmission channel. 2) Optoelectronic devices used in transmitters, receivers, and multiplexers. 3) Design of the overall communication system and assessment of its performance. In part 1, step-index and graded-index multimode and single-mode optical fibers are described and their attenuation and dispersion characteristics are determined. The transfer function of the fiber system is determined. Part 2 introduces the basic principles of interaction of light with semiconductor materials, including absorption and electroluminescence. Light emitting diodes, laser diodes, and photodiodes are introduced as the basic components of optical transmitters and receivers. Semiconductor and fiber optical amplifiers are also introduced. Part 3 deals with the design of the digital fiber communication system, including derivation of the bit error rates for attenuation- and dispersion-limited systems and determination of the maximum data rates possible for a given length. Introductions to wavelength-division multiplexing (WDM) and optical fiber networks are also provided.

III. List of Topics

1. The fiber as a communication link:
 - Planar optical waveguides. Waveguide modes.
 - Step- and graded-index optical fibers. Multimode and single mode fibers.
 - Attenuation. Material and modal dispersion
 - Broadening of optical pulses in fibers
2. Optoelectronics of transmitters and receivers:
 - Interaction of light with semiconductor materials. Absorption and electroluminescence.
 - Optoelectronics: Semiconductor light sources (Light emitting diodes and laser diodes) and photodetectors (PIN photodiodes and avalanche photodiodes)
 - Semiconductor and fiber optical amplifiers
3. The communication system
 - Digital fiber communication systems. Bit error rates for attenuation- and dispersion-limited systems.
 - Maximum data rates achievable for a given fiber length.
 - Wavelength-division multiplexing (WDM).
 - Optical fiber networks

IV. Course Learning Objectives

Upon completing this course, the students will:

- Understand how optical fibers guide light, including the concepts of guided modes and group velocity.
- Know how to compute the attenuation and pulse broadening encountered when optical pulses at a given wavelength travel in long fibers.
- Know the operational principles of light emitting diodes and laser diodes and their distinction
- Know the operational principles and the limitations of photodiodes and avalanche photodiodes
- Understand the basics of optical modulation and multiplexing
- Be able to design a fiber link of given length operating at a given wavelength, and at a prescribed bit error rate by use of optical repeaters
- Acquire an integrated view of engineering by seeing the fundamental analogies between electrical and optical communication systems

V. Course Prerequisites

OSE 3052 Introduction to Photonics

EEL 355C, Signal Analysis and Analog Communications

VI. Credits

3

VII. Course Textbook

Optical Fiber Communications, 4th Edition G. Keiser, McGraw-Hill.

Reference (suggested) Books

Introduction to Optical Fiber Communication Systems, W. Jones, Jr., Oxford University Press.

Fiber-Optic Communication Systems, G. Agrawal, Wiley.

Fundamentals of Photonics, 2nd edition B. Saleh and M. Teich, Wiley, 2007

Chapters Covered from the Required Textbook

Chapters 1- 8 and 10 of Keiser's textbook are covered.

VIII. Course Requirements

- The student is expected to review the textbook, notes, and other materials before class. Materials used for class will be available on UCF Webcourses.
- Internet access, browser and e-mail.

Class Attendance and Participation

- Regular class attendance is mandatory.
- Please be on time to class.
- Come to class prepared.

IX. Course Grading

<u>Course Item</u>	<u>Percent of Final Grade</u>
Homework	5%
Quizzes	20%
Guest lectures attendance and discussion	5%
Two mid-term exams (20% each): TBD	40%
Comprehensive final exam	30%
	100%

Grading Scale (%)	Rubric Description
100 ≥ A > 93 ≥ A ⁻ > 90	Excellent, has a strong understanding of all concepts and is able to apply the concepts in all and novel situations. Has full mastery of the content of the course.
90 ≥ B ⁺ > 87 ≥ B > 83 ≥ B ⁻	Good, has a strong understanding of most or all of the concepts and is able to apply them to stated and defined situations.
80 ≥ C ⁺ > 77 ≥ C > 73 ≥ C ⁻	Average, has a basic understanding of the major concepts of the course and is able to apply to basic situations.
70 ≥ D ⁺ > 67 ≥ D > 63 ≥ D ⁻	Below average, has a basic understanding of only the simple concepts and is able to apply to only a limited number of the most basic situations.
60 ≥ F	Demonstrates little to no understanding of the course content.

X. Grading Objections

All objections to grades should be made IN WRITING WITHIN ONE WEEK of the work in question. Objections made after this period has elapsed will NOT be considered – NO EXCEPTIONS.

XI. Professionalism and Ethics

Academic dishonesty in any form will not be tolerated. If you are uncertain as to what constitutes academic dishonesty, please consult The Golden Rule, the University of Central Florida's Student Handbook (<http://www.goldenrule.sdes.ucf.edu/>) for further details. As in all University courses, The Golden Rule Rules of Conduct will be applied. Violations of these rules will result in a record of the infraction being placed in your file and the student receiving a zero on the work in question AT A MINIMUM. At the instructor's discretion, you may also receive a failing grade for the course. Confirmation of such incidents can also result in expulsion from the University.

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XII. Students with Special Testing/Learning Needs

Students with special needs and require special accommodations must be registered with UCF Student Disability Services prior to receiving those accommodations. Students must have documented disabilities requiring the special accommodations and must meet with the instructor to discuss the special needs as early as possible in the first week of classes. UCF Student Disability Services can be contacted at <http://www.sds.sdes.ucf.edu/>, or at (407) 823-2371.

XIII. Excusal from Course Assignments and Course Examinations

If an emergency arises and a student cannot submit assigned work on or before the scheduled due date or cannot take an exam on the scheduled date, the student MUST give notification to the instructor NO LESS THAN 24 HOURS BEFORE the scheduled date and NO MORE THAN 48 HOURS AFTER the scheduled date.

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Note: The dates of the topics will be posted on Webcourses and are subject to change depending upon how things progress during the course of the semester