

COURSE SYLLABUS

OSE 4470 FIBER OPTIC COMMUNICATIONS, FALL 2020

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Term: Fall 2020
Class Days: Tuesdays and Thursdays
Class Time: 10:30 AM - 11:45 AM
Class Location: Virtual Meeting
Credits: 3 Hours

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

Class Notes: This is a remote, video-delivered course. No in-person classroom attendance is required. Students are expected to attend virtually at designated days and times as specified in the class meeting pattern. Instruction may be supplemented by additional online activity, projects, or exams. Internet access, browser, and e-mail required. Webcams and microphones will be required for class meetings and may be required for exams.

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

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. However, the brief review of Chapter 10 is complementary and will not be part of exams. Also, the following Sections from Chapters 1 through 8 are not covered and will not be part of exams:

Excluded Book Sections: 1.7, 1.8, 2.8, 2.10, 3.4, 4.4, 4.5, 4.6, 4.7, 5.4, 5.6.3, 6.4, 6.6, 7.5, 8.2.4, 8.2.5, 8.2.7, 8.3, 8.4, and 8.5.

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
- You are required to attend class
- Internet access, browser and e-mail
- Webcam and microphone will be required for class meetings and may be required for exams

IX. Course Grading

Course Item	Percent of Final Grade
Homework	15%
Quizzes	15%
Two mid-term exams (20% each): TBD	40%
Comprehensive final exam	30%
	100%

Homework: Assigned on Thursday and collected in class the next Thursday.

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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XIV. Statement Regarding COVID-19

University-Wide Face Covering Policy for Common Spaces and Face-to-Face Classes

To protect members of our community, everyone is required to wear a facial covering inside all common spaces including classrooms (<https://policies.ucf.edu/documents/PolicyEmergencyCOVIDReturnPolicy.pdf>). Students who choose not to wear facial coverings will be asked to leave the classroom by the instructor. If they refuse to leave the classroom or put on a facial covering, they may be considered disruptive (please see the Golden Rule for student behavior expectations). Faculty have the right to cancel class if the safety and well-being of class members are in jeopardy. Students will be responsible for the material that would have been covered in class as provided by the instructor.

Notifications in Case of Changes to Course Modality

Depending on the course of the pandemic during the semester, the university may make changes to the way classes are offered. If that happens, please look for announcements or messages in Webcourses@UCF or Knights email about changes specific to this course.

COVID-19 and Illness Notification

Students who believe they may have a COVID-19 diagnosis should contact UCF Student Health Services (407-823-2509) so proper contact tracing procedures can take place.

Students should not come to campus if they are ill, are experiencing any symptoms of COVID-19, have tested positive for COVID, or if anyone living in their residence has tested positive or is sick with COVID-19 symptoms. CDC guidance for COVID-19 symptoms is located here: (<https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>)

Students should contact their instructor(s) as soon as possible if they miss class for any illness reason to discuss reasonable adjustments that might need to be made. When possible, students should contact their instructor(s) before missing class.

In Case of Faculty Illness

If the instructor falls ill during the semester, there may be changes to this course, including having a backup instructor take over the course. Please look for announcements or mail in Webcourses@UCF or Knights email for any alterations to this course.

Course Accessibility and Disability COVID-19 Supplemental Statement

Accommodations may need to be added or adjusted should this course shift from an on-campus to a remote format. Students with disabilities should speak with their instructor and should contact sas@ucf.edu to discuss specific accommodations for this or other courses.

Because of the continued remote instruction requirement due to the COVID-19 pandemic, this course will use Zoom for some synchronous (“real time”) class meetings. Meeting dates and times will be scheduled through Webcourses@UCF and should appear on your calendar.

Please take the time to familiarize yourself with Zoom by visiting the UCF Zoom Guides at <https://cdl.ucf.edu/support/webcourses/zoom/>. You may choose to use Zoom on your mobile device (phone or tablet).

Things to Know About Zoom:

- You must sign in to my Zoom session using your UCF NID and password.

- The Zoom sessions are recorded.
- Improper classroom behavior is not tolerated within Zoom sessions and may result in a referral to the Office of Student Conduct.
- You can contact Webcourses@UCF Support at <<https://cdl.ucf.edu/support/webcourses/>> if you have any technical issues accessing Zoom.

Class Attendance and Participation

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

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