

Department of Electrical and Computer Engineering
New Jersey Institute of Technology

ECE 462: RF/ Fiber Optic Systems (3 credits, 3 contact hours, elective course)

Instructor: Oksana Manzhura; email: om22@njit.edu; Tel.: 908 542-9868

Text books W.B. Jones, Jr., Introduction to Optical Fiber Communication Systems, Holt, Rinehart and Winston, Inc., 1988.[ISBN 0-19-510726-8] (main text)
D.K. Cheng, Field and Wave Electromagnetics, The Addison-Wesley Series in Electrical Engineering, 1990. [ISBN 0-201-12819-5] (supporting text)

Course Description:

This course deals with waveguide properties of dielectric structures as applied to optical fibers. Provides understanding of operation principles of semiconductor optical sources and detectors, rf/microwave modulation and demodulation of an optical carrier. Introduces design concepts in optical links and systems, transmitters and receivers. Provides introduction to usage of CAD software tools for rf/microwave simulations.

Prerequisite: ECE students - ECE 362 **Corequisite:** ECE 469 or instructor permission

Specific course learning outcomes (CLO): The student will be able to

1. Develop firm understanding of major properties of dielectric waveguide propagation;
2. understand and utilize the basic governing equations to analyze optical fibers, sources and detectors; design optical basic optical fibers and links and calculate fiber optic link characteristics;
3. understand limitations in design of systems and links based on specific fiber optic and semiconductor devices;
4. understand major principles of fiber optic system applications and industry trends.

Relevant student outcomes (ABET criterion 3):

- (a) an ability to apply knowledge of mathematics, science, and engineering (CLO 1, 2, 3)
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data (CLO 1, 2, 3)
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (CLO 3, 4)
- (f) an understanding of professional and ethical responsibility (CLO 3, 4)
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (CLO 4)
- (i) a recognition of the need for, and an ability to engage in life-long learning (CLO 3, 4)
- (j) a knowledge of contemporary issues (CO 4)
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (CLO 3, 4).

Computer assisted design and course specific software:

PSpice, Microwave Office (AWR), Matlab, other pertinent RF/Microwave calculators.

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.

| Tentative Course Schedule | Weeks |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Introduction to fiber optic systems and technology, system structure, modulation types, bandwidth, light and electromagnetic waves. | 1-2 |
| Waveguide propagation and optical fibers, introduction to waveguides, parallel, rectangular, cylindrical waveguides | 3-5 |
| Dielectric waveguides, step and graded (exponential) index fiber | 6-7 |
| Dispersion and losses in fibers | 8-9 |
| Review of semiconductors and LED | 10 |
| Semiconductor lasers | 11 |
| Photodetectors | 12 |
| Optical amplifiers (EDFA and Raman), optical receivers and noise considerations | 13 |
| System considerations, and WDM | 14 |

Grading policy: Homework, quizzes class, participation: 5%
Project presentation: 10%
Two class examinations: 25%, 25%
Final examination: 35%

Homeworks and projects

Homeworks assigned in class weekly and a course project chosen by consultation with the instructor.

Updates and Assignments to be distributed via e-mail/ printed form.

Office hours, recitations and group studies: Friday 11:30am-1pm and by appointment, 24/7 by e-mail.

Honor Code: The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.

Office: MIC Bldg., Room 403

Prepared by: O. Manzhura

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.