Rutgers University, Department of Electrical and Computer Engineering
ABET COURSE SYLLABUS
COURSE: 14:332:466

Course Catalog Description: 14:332:466 Optoelectronic Devices (3)

Pre-Requisite Courses: 14:332:361, 382

Co-Requisite Courses: None

Pre-Requisite by Topic:

1. Electromagnetic Fields and Waves
2. Ordinary Differential Equations
3. Integral Calculus
4. Vector Analysis

Textbook & Materials: B. E. A. Saleh & M. C. Teich, Fundamentals of Photonics, Wiley-Interscience, 2nd edition (2007), ISBN 0471358320.

References: Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall; 2nd edition (1996), ISBN 0134956567.

Overall Educational Objective: 1. To introduce the student to the concepts, physical operations, and design criteria of state-of-the art optoelectronic devices and systems used in research, technology, medicine communication, etc.

Course Learning Outcomes: A student who successfully fulfills the course requirements will have demonstrated:

1. An understanding of state-of-the art optoelectronic technology.
2. An introduction to quantum mechanics and its role in the design and operation of optoelectronic devices.
3. An understanding of semiconductor material properties and semiconductor opto-electronic device physics
4. An overview of the current state and design of light emitting diodes and the related issues in the color vision of human being.
5. An in depth analysis of laser theory and rate equations in the design of lasers; and an overview of laser resonators and laser types.
6. An in depth analysis of optical fibers and the working principles of optical communications devices, including modulators, switches, and detectors.

How Course Outcomes are Assessed:
HW Problems (30%)
Two Mid-Term Exams (40 %)

Final Exam (30 %)

N = none S = Supportive H = highly related

Outcome	Level	Proficiency assessed by
(a) an ability to apply knowledge of Mathematics, science, and engineering	H	HW Problems, Exams
(b) an ability to design and conduct experiments and interpret data	N	
(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	N	
(d) an ability to function as part of a multi-disciplinary team	N	
(e) an ability to identify, formulate, and solve ECE problems	H	HW Problems, Exams
(f) an understanding of professional and ethical responsibility	S	Lectures
(g) an ability to communicate in written and oral form	S	HW Problems
(h) the broad education necessary to understand the impact of electrical and computer engineering solutions in a global, economic, environmental, and societal context	S	Lectures
(i) a recognition of the need for, and an ability to engage in life-long learning	S	Lectures, subsequent courses
(j) a knowledge of contemporary issues	S	Lectures
(k) an ability to use the techniques, skills, and modern engineering tools necessary for electrical and computer engineering practice	H	HW
Basic disciplines in Electrical Engineering	H	HW, Exams
Depth in Electrical Engineering	S	HW, Exams
Basic disciplines in Computer Engineering	N	
Depth in Computer Engineering	N	
Laboratory equipment and software tools	S	MATLAB
Variety of instruction formats	S	Lectures, Problem sessions, Office hour discussions

Topics Covered week by week:

Week 1: Introduction and Applications; Optics Review
Week 2: Optical waveguides
Week 3: Optical fibers
Week 4: Basics of quantum mechanics
Week 5: Basics of semiconductor physics and materials
Week 6: Optical Amplifiers
Week 7: Optical Resonators and optical gain
Week 8: Lasers: Threshold conditions & fundamental device characteristics
Week 9: Light emitting devices
Week 10: Semiconductor lasers
Week 11: Specialized semiconductor lasers and laser applications
Week 12: Optical modulation: internal modulation; external modulators (Mach-Zehnder etc)
Week 13: Electroabsorption modulators; optical switches
Week 14: Photo-detectors: basic physics, noise; various types (PIN, MSM, APD)
Week 15: Solar cells
Week 16: Final examination

Computer Usage: Simulations using MATLAB.

Design Experiences: ~20% Homework problems are design-oriented problems.

Independent Learning Experiences: 1. Home-Work, 2.Testing (Exams)

Contribution to the Professional Component:
(a) College-level mathematics and basic sciences: 0.25 credit hours
(b) Engineering Topics (Science and/or Design): 2.75 credit hours
(c) General Education: 0 credit hours
Total credits: 3

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