

ECE 6511: Nonlinear Optics

Course Description

Nonlinear optics for the generation, propagation, amplification, and control of laser light; all-optical switching and solitons; modern applications in high speed lightwave devices and systems.

Prior Course Number: 5511

Transcript Abbreviation: Nonlinear Optics

Grading Plan: Letter Grade

Course Deliveries: Classroom

Course Levels: Graduate

Student Ranks: Masters, Doctoral

Course Offerings: Autumn

Flex Scheduled Course: Never

Course Frequency: Odd Years

Course Length: 14 Week

Credits: 3.0

Repeatable: No

Time Distribution: 3.0 hr Lec

Expected out-of-class hours per week: 6.0

Graded Component: Lecture

Credit by Examination: No

Admission Condition: No

Off Campus: Never

Campus Locations: Columbus

Prerequisites and Co-requisites: Prereq: 5012, or Grad standing.

Exclusions:

Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No

The course is a GEC: No

The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001

Subsidy Level: Doctoral Course

Programs

| Abbreviation | Description |
|--------------|------------------------|
| CpE | Computer Engineering |
| EE | Electrical Engineering |

Course Goals

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| Learn the fundamentals of the variety of nonlinear optical phenomena |
| Learn concepts for design and synthesis of lightwave devices and systems |
| Exposed to emerging research topics involving laser light |

Course Topics

| Topic | Lec | Rec | Lab | Cli | IS | Sem | FE | Wor |
|---|-----|-----|-----|-----|----|-----|----|-----|
| Nonlinear polarization of material media | 5.0 | | | | | | | |
| Wave equation description of nonlinear optical interactions | 5.0 | | | | | | | |
| Harmonic, sum, and difference frequency generation | 3.0 | | | | | | | |
| Parametric amplification and oscillation | 3.0 | | | | | | | |
| Field and intensity dependent refractive index | 6.0 | | | | | | | |
| Stimulated Raman and Brillouin scattering | 3.0 | | | | | | | |
| All-optical switching and solitons | 6.0 | | | | | | | |
| Wavelength conversion and phase conjugation | 3.0 | | | | | | | |
| Modern applications | 3.0 | | | | | | | |

Representative Assignments

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|-------------------|
| Homework problems |
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Grades

| Aspect | Percent |
|------------|---------|
| Homework | 30% |
| Midterm | 30% |
| Final exam | 40% |

Representative Textbooks and Other Course Materials

| Title | Author |
|---|---------------------------|
| <i>Nonlinear Optics</i> | Robert W. Boyd |
| <i>Supplemental: Nonlinear Fiber Optics</i> | Govind P. Agrawal |
| <i>Supplemental: Optical Waves in Crystals</i> | Amnon Yariv and Pochi Yeh |
| <i>Supplemental: Photonics</i> | Amnon Yariv and Pochi Yeh |
| <i>Supplemental: Fundamentals of Optical Waveguides</i> | Katsunari Okamoto |

ABET-EAC Criterion 3 Outcomes

| Course Contribution | | College Outcome |
|---------------------|---|---|
| *** | a | An ability to apply knowledge of mathematics, science, and engineering. |
| | b | An ability to design and conduct experiments, as well as to analyze and interpret data. |
| * | c | An ability to design a system, component, or process to meet desired needs. |
| | d | An ability to function on multi-disciplinary teams. |
| *** | e | An ability to identify, formulate, and solve engineering problems. |
| | f | An understanding of professional and ethical responsibility. |
| | g | An ability to communicate effectively. |
| *** | h | The broad education necessary to understand the impact of engineering solutions in a global and societal context. |
| *** | i | A recognition of the need for, and an ability to engage in life-long learning. |
| *** | j | A knowledge of contemporary issues. |

| Course Contribution | | College Outcome |
|---------------------|---|--|
| *** | k | An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. |

Additional Notes or Comments

updated course description and prereqs to match university format.

Change prereqs to allow any grad students 4/14/13.

Change course number from 5511 to 6511 (4/22/16). RMR

Change ABET-EAC Criterion c from *** to *.

Prepared by: Ronald Reano