ECE 5012: Integrated Optics

Course Description

Fundamentals of planar lightwave circuits and guided wave devices; laser light in anisotropic media; electrooptic and nonlinear optical effects; concepts in telecommunications, RF photonics, nanobiotechnology.

Prior Course Number: 717
Transcript Abbreviation: Integrated Optics
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
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: 3010 (312), or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.
Exclusions: Not open to students with credit for 717.
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

Master the fundamentals of guided wave propagation of laser light in planar rectangular dielectric waveguides
Master concepts for design & synthesis of planar lightwave circuits & guided wave devices (modulators, resonators, switches, filters, couplers, interferometers, multiplexers, bistable devices, waveguide grating arrays, cross connects)
Competency toward to emerging research topics in telecommunications, RF photonics, and nanobiotechnology

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Wave theory of planar optical waveguides	6.0							
Coupled mode theory	6.0							
Electomagnetic wave propagation in anisotropic media	3.0							
Electrooptic effect and devices	3.0							
Nonlinear optical effects and devices	3.0							
Beam propagation method	6.0							
Periodic structures	3.0							
Surface plasmons	2.0							
Microelectromechanical systems (MEMS)	2.0							
Planar lightwave circuits	6.0							

Representative Assignments

Homework problems

Grades

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

Representative Textbooks and Other Course Materials

Title	Author
Fundamentals of Optical Waveguides	Katsunari Okamoto
Supplemental: Photonics	Amnon Yariv and Pochi Yeh
Supplemental: Optical Waves in Crystals	Amnon Yariv and Pochi Yeh
Supplemental: Nonlinear Optics	Robert W. Boyd

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.

Course Contribution		College Outcome
*	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

CpE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
***	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
**	2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
**	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
*	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

EE ABET-EAC Criterion 9 Program Criteria Outcomes

Course Contribution		Program Outcome
***	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
*	2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
	3	an ability to communicate effectively with a range of audiences
	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
**	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Additional Notes or Comments

UPdated prereqs and exclusions to match university version.

Changed ABET c,i,j from *** to **. Reano 4/22/16
Changed ABET h from *** to *. Reano 4/22/216

Update goals, add new AEBT outcomes 6/14/ 2019 BLA

Prepared by: Betty Lise Anderson