ECE 5131: Lasers

Course Description

Atomic interaction with radiation, cavities with gain, Gaussian beams, light-emitting diodes, and semiconductor lasers.

Prior Course Number: 732
Transcript Abbreviation: Lasers
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: Even 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: 3010 (312) and 3030 (432), or Grad standing in Engineering, Biological Sciences, or Math and Physical Sciences.
Exclusions: Not open to students with credit for 732.
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 physics of emission, absorption, and optical gain
Master physics of optical resonators, with and without gain
Master dynamics of lasing
Be competent in understanding gain and lasing in semiconductor lasers

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Review of electromagnetics	1.0							
Coherence	1.0							
Gaussian beams	2.0							
Guided optical beams	3.0							
Dispersion and attenuation	2.0							
Resonant cavities	3.0							
Einstein coefficients, lineshape	2.0							
Optical amplification and lineshape broadening	3.0							
Lasing dynamics, gain saturation	2.0							
Inhomogeneous systems	1.0							
Amplified spontaneous emission	1.0							
Efficiency, output coupling	1.0							
Laser modulation	2.0							
Mode-locking	2.0							
Saturable absorbers	1.0							
Erbium-doped fiber amplifiers	1.0							
Review of density of states, quasi-Fermi levels	2.0							
Absorption and gain in semiconductors	2.0							
Spontaneous emission proflies	1.0							
Homojunction and heterojunction lasers	1.0							
Quantum well lasers	2.0							
Vertical cavity lasers	1.0							
Distributed feedback and other lasers	1.0							
Selected topics in modern lasers	2.0							

Representative Assignments

Homework

Grades

Aspect	Percent
Homework	20%
Midterms (two)	50%
Final examination	30%

Representative Textbooks and Other Course Materials

Title	Author
Laser Electronics	Joseph Verdeyen

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.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Update prereqs, exclusions, and course goals to match university version.

Changed wording of goals to reflect mastery levels. RMR 4/22/16.

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