ECE 463/ PHY 463
Advanced Optics -I

Overview

Course Catalog Description: Electromagnetic theory of geometrical optics, Gaussian ray tracing and matrix methods, finite ray tracing, aberrations, interference and diffraction..
Prerequisites: Physics 302
Textbook: ·Introduction to Optics (Pedrotti, Pedrotti and Pedrotti, 3rd Edition).
Class Goals: To provide the students with a senior level understanding of fundamental optics. The course begins with a review of geometrical optics including image and object formation using ray tracing, cardinal points, matrix methods in an optical system such as a microscope and telescope. The wave nature of light is then discussed with emphasis on superposition, interference, diffraction and diffraction grating. The course ends with a discussion of polarization using Jones matrices.
Course Coordinator: Prof. Sanjay Krishna

Table I: Objectives, Implementation, and Assessment

Objectives		Implementation	Assessment	A	B	C	D	E	F	G	H	I	J	K
O_1	Analyze the formation of images in multiple lens system using paraxial optics equations	3 Lectures, Chapters 1-2	HW 1-2, Exam I Final Exam	X										
O_2	Analyze the working of prisms and the angle of minimum deviation used in the design of double prims and spectrometers	2 Lectures, Chapter 3	HW 3, Exam I Final Exam			X								
O_3	Analyze the operation of optical systems such as microscopes and telescopes using lens equation, matrix methods and determine the cardinal points in a given system.	6 Lectures, Chapter 3, 18	HW 4 Exam I Final Exam	X		X		X						
O_4	Investigate the wave nature of light including the principles of superposition and interference	8 Lectures Chapter 4, 5, 7,8	HW 5 Exam II Final Exam			X		X						
O_5	Investigate the phenomenon of Fraunhofer diffraction and analyze the behavior of diffraction gratings.	6 Lectures, Chapter 8, 9	HW 6 Exam II Final Exam	X		X		X						X
O_6	Investigate the polarization state of light using Jones matrices	2	HW 7 Exam II Final Exam	X		X								X

(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.

Table II: Expectation and Assessment Outcome
Fall 2008, Sanjay Krishna

General expectations:
Homeworks:
These are assigned every two weeks and provides problems for students to solve to implement the concepts learnt in the lectures.

Exams: Expect 70% of the students to score 70% or better on all exams.

Objectives		Outcome Assessment	Evaluation
O_1	Analyze the formation of images in multiple lens system using paraxial optics equations		
O_2	Analyze the working of prisms and the angle of minimum deviation used in the design of double prims and spectrometers		
O_3	Analyze the operation of optical systems such as microscopes and telescopes using lens equation, matrix methods and determine the cardinal points in a given system.		
O_4	Investigate the wave nature of light including the principles of superposition and interference		
O_5	Investigate the phenomenon of Fraunhofer diffraction and analyze the behavior of diffraction gratings.		
O_6	Investigate the polarization state of light using Jones matrices		

COURSE SCHEDULE, Fall 2008

ECE-463/PHY-463 Advanced Optics - I COURSE OUTLINE Fall 2008				
Lec#	Date	Topic	Reading Assignment	HW
1	Aug 26th	**Introduction to Optics and Radiometry**	**Chapter 1**	
2	Aug 28th	**Geometrical Optics: Reflection, Refraction**	**Chapter 2**	
3	Sept 2nd	**Object and Image Formation**	**Chapter 2**	**HW1 Assigned**
4	Sept 4th	**Lens and Mirror Equations**	**Chapter 2**	
5	Sept 9th	**Optical Instrumentation**	**Chapter 3**	
6	Sept 11th	**Prisms**	**Chapter 3**	**HW1 Due**
7	Sept 16th	**Microscopes and Telescope**	**Chapter 3**	
8	Sept 18th	**Cardinal Points**	**Chapter 18**	
9	Sept 23rd	**Matrix Methods**	**Chapter 18**	
10	Sept 25th	**Problem Sessions on Geometrical Optics**	**Chapter 2, 3, 18**	**HW2 Due**
11	Sept 30th	**Problem Sessions on Geometrical Optics**	**Chapter 2, 3, 18**	
12	Oct 2nd	**Problem Sessions on Geometrical Optics**	**Chapter 2, 3, 18**	
13	Oct 7th	**Mid Term I**		
14	Oct 9th	**Wave Equation**	**Chapter 4**	**HW3 Due**
15	Oct 14th	**Superposition**	**Chapter 5**	
16	Oct 16th	**Fall Break**		
17	Oct 21st	**Interference**	**Chapter 7**	
18	Oct 23rd	**Inteference**	**Chapter 7**	**HW4 Due**
19	Oct 28th	**Inteference**	**Chapter 7**	
20	Oct 30th	**Interferometric Instruments**	**Chapter 8**	
21	Nov 4th	**Interferometric Instruments**	**Chapter 8**	
22	Nov 6th	**Interferometric Instruments**	**Chapter 8**	**HW5 Due**
23	Nov 11th	**Mid Term II**		
24	Nov 13th	**Diffraction**	**Chapter 11**	
25	Nov 18th	**Diffraction**	**Chapter 11**	
26	Nov 20th	**Diffraction**	**Chapter 11**	**HW6 Due**
27	Nov 25th	**Diffraction Grating**	**Chapter 12**	
28	Nov 27th	**Thanksgiving**		
29	Dec 2nd	**Diffraction Grating**	**Chapter 12**	
30	Dec 4th	**Polarization**	**Chapter 14**	**HW7 Due**
31	Dec 9th	**Polarization**	**Chapter 14**	
32	Dec 11th	**Review**		
	Dec 16th	**Final Exam**		