ME58700 – Engineering Optics

Fall 2015

Course Syllabus

Course Description

Unlike subjects such as mechanics or heat transfer which are based on applying a limited set of general equations to analyze specific situations, optics is more like electronics where the task is to build a system having specified performance goals using a combination of building-block components, each of which is described by its own equation(s). That is, the basic problem is often one of synthesis rather than analysis. It is therefore important to develop both an analytical understanding and a "physical feel" for how different optical phenomena and optical components behave individually and in combination. Once the fundamentals are learned the best teacher is experience. However, examples discussed in the lectures and home problems are an important starting point.

Learning Objectives

ME58700 provides broad coverage of geometrical and physical optics with an emphasis on topics that often arise in engineering applications. Some subject areas are covered in depth, but others are only treated in a survey fashion due to time limitations. The overall objective of the course is to provide the student with enough of both theory and physical understanding permitting the design and/or use of many optical components and systems, plus the ability to read the literature for further information.

Specific objectives of the course are to provide the student with an understanding of:

1. Basic optical phenomena;
2. Calculation methods for optical design and analysis;
3. Descriptions and applications of important optical elements;
4. The integration of items 1 through 3 in order to design and/or properly use optical systems.

Meeting Time

Tuesday/Thursday 9:00-10:15am, PHYS333

Instructor

Dr. Jun Chen, Associate Professor of Mechanical Engineering

Office: ME 2145

Phone: 765-494-7050 Email: junchen@purdue.edu

Office Hour: Tuesday/Thursday 10:30-11:30am (@ME 2145, or by appointment)

Textbook

- Pedrotti, Pedrotti & Pedrotti, ***Introduction to Optics***, 3rd Edition (Prentice-Hall, 2007)

General Policy

- Attendance: class attendance is required.

- Homework: homework will be assigned periodically and the due date will be given in the assignment sheet.
- Exams: two mid-term exams and one final exam will be scheduled. All exams will be open book (textbook only), open notebook (class notes only) and taken in class (2 hours). Roughly half of the comprehensive final exam will cover material from the last third of the course. The remainder of the Final Exam will be comprehensive and will require you to integrate material from all three sections of the course.
- Group discussion on course materials is permitted, but each student must finish homework and exams INDEPENDENTLY and NO TEAMWORK is allowed. Violations will subject to academic sanctions.

Class Blog

http://www.purdue.edu/mixable

This blog is designed to facilitate the discussion and information exchanges between students, teaching assistant, and instructor. All registered ME587 students can log into this blog using their Purdue career account username and password.

Grade Policy

- Homework:(20%)
- Mid-term exams (20%+20%) and final exam (40%)
- Letter grade (+/-)

Emergency Plan

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant information about changes in this course will be disseminated by course email list and Purdue Blackboard system.

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Progress Schedule *

wk	#	Date	Topic	Reading*
1	1	Aug 25	Introduction, Geometrical Optics	1.1-1.3, 2.1-2.2
	2	Aug 27	Geometrical Optics	2.3-2.9, 2.11-2.12
2	3	Sep 1	Optical Devices	2.3-2.9, 2.11-2.12
	4	Sep 3	Aperture and Field Stops	3.1
3	5	Sep 8	Imaging Elements; Multi-element Systems	3.3-3.7
	6	Sep 10	Matrix Methods	18.1-18.5
4	7	Sep 15	Matrix Methods; Aberrations	18.6-18.11, 20.1-20.2
	8	Sep 17	Aberrations	20.3-20.7
5	9	Sep 22	Radiometry; Photometry	1.4
	10	Sep 24	Fiber Optics	10.1-10.7
6	11	Sep 29	Schlieren and Shadowgraph Systems	Notes
	12	Oct 1	**EXAM 1** (TBD)	
7	13	Oct 6	Introduction to Physical Optics; Electromagnetic Effects in Materials	4, 25.1-25.5
	14	Oct 8	The Fresnel Equations	23.1-23.3
8		Oct 13	—— No Class —— (Fall Break)	
	15	Oct 15	The Fresnel Equations	23.4-23.7
9	16	Oct 20	Light Interference	7.1-7.8, 8.1-8.3
	17	Oct 22	Light Interference, Two Beam Interference	8.4-8.6
10	18	Oct 27	Two Beam Interference	8.4-8.6
	19	Oct 29	Multiple Beam Interference; Multilayer films	7.9, 22.1-22.4
11	20	Nov 3	Matrix Methods in Polarization	14
	21	Nov 5	Production of Polarized Light	15.1-15.5
12	22	Nov 10	**EXAM 2** (TBD)	
	23	Nov 12	Non-linear Optical Devices	
13	24	Nov 17	Fraunhofer Diffraction	11.1-11.2
	25	Nov 19	Fraunhofer Diffraction; Resolution; Gratings	11.3-11.5, 12.1-12.9
14	26	Nov 24	Coherence	9.1-9.6
		Nov 26	—— No Class —— (Thanksgiving)	
15	27	Dec 1	Optical Detectors; Lasers	17.1-17.4, 6.1-6.8
	28	Dec 3	Characteristics of Laser Beams	27.1-27.2
16	29	Dec 8	Characteristics of Laser Beams	27.3-27.6
	30	Dec 10	Holography	16.1-16.6
17			**FINAL EXAM** (TBD)	

* Subject to revise.