

EE 530 Fall 2007 – Optical Materials, Instruments & Devices

Instructor:	Professor Robert W. Hellwarth
Office Hours:	1:30-4:00 MW SSC 329
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Telephone:	(213)740-4380
Class Time:	11-12:20 a.m. MW
Course URL:	TBA
Classroom:	OHE 120 and DEN

Course Description:

This is one of five courses in the optics program core sequence. The primary aim of this course is to give the students the skills necessary to analyze and design both present and future devices for fiberoptic and free space communications, liquid-crystal flat-panel and projective displays, scanning optical microscopes, optics-on-a-chip, and for read/write optical disc memories. Although we assume the student is familiar with Maxwell's equations, with elementary integral calculus and with vector analysis, we will devote the first two weeks to a review of a) the wave equation for optics, b) complex-number representations for monochromatic vector field amplitudes, and c) optical energy flows written in terms of these complex-vector amplitudes. We then proceed to use the known optical properties of various materials to analyze 1) plane wave solutions of Maxwell's equations in a homogeneous medium having arbitrary complex dielectric tensor, 2) terahertz optical modulators, 3) propagation in magnetic media: optical hard discs, 4) propagation in optical fibers, fiber lenses, fiber gratings, fiber junctions and fiber resonators, 5) propagation in twisted birefringent media: liquid crystal displays, 6) the focusing of a Gaussian beam to deliver maximum intensity on a near or distant target, and 7) the optical waves that can exist on metal and dielectric surfaces (plasmonics). We will demonstrate a number of mathematical tricks that greatly simplify the above analyses, and which have not yet found their way into published texts.

Prerequisites: None. The prerequisite "EE529" listed in the catalogue is in the process of being removed; EE529 and EE530 are now complimentary and can be taken together. Student wishing to enroll in EE530 can get this prerequisite waved in PHE 606, the office of Jaime Zelada.

Homework and Grading

Homework papers are assigned each Monday and due the next Monday in class (exception: Homework #2 due Wednesday, September 3, because of the Holiday). Each assignment will be graded and returned promptly with solutions. The lowest grades will be omitted from calculating the overall homework grade, which will be assigned on the basis of the class curve (from 0 to 4.3).

Midterm and final exam grades from 0 to 4.3 will also be assigned using the class curve. The final course grade G will be computed using the formula:

$$G = \frac{[\text{homework}]}{4} + \frac{[\text{midterm}]}{4} + \frac{[\text{final}]}{2} .$$

The University grade sheet requires a letter grade, which will be calculated using the usual number-to-letter conversion.

Textbook:

There will be no required text. Class notes will be supplied by the lecturer. The book “Optical Waves in Crystals”, by A. Yariv and P.Yeh, (Wiley 1984), will be kept on reserve in Seaver Library; it contains much useful data on materials. The lecturer will attempt to relate his lectures and class notes to material in the books familiar to the students from other courses and sources.

Calendar 2007

First Class:	Monday, August 25
Last Class:	Wednesday, December 3
Class Holidays:	Monday, September 1
Midterm Exam:	Monday, October 13 (during class period)
Final Exam:	Wednesday, December 10 (11:00- 1:00pm)