EE 530 Fall 2011 – Optical Materials, Instruments & Devices

PREREQUISITE WILL BE WAIVED1 See below.

Instructor:	Professor Robert W. Hellwarth
Office Hours:	1:30-4:00 MW
	SSC 329
E-mail:	hellwart@usc.edu
Telephone:	(213)740-4380
Class Time:	11-12:20 a.m. MW
Course URL:	TBA

Course Description:

This is one of five courses in the optics program core sequence. The primary aim of this course is to give the student 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 optical 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 analyze 1) plane wave solutions of Maxwell's equations in a homogeneous medium having arbitrary complex dielectric tensor, 2) teraherz optical modulators, 3) propagation in magnetic media, 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 at metal and dielectric surfaces (plasmonics). We will demonstrate a number of mathematical tricks that greatly simplify the above analyses and that 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 EEB 100, 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 7, 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 books familiar to the students from other courses and sources.

Calendar

First Class:	Monday, August 22
Last Class:	Wednesday, November30
Class Holidays:	Monday, September 5; Wednesday, Nov.23.
Midterm Exam:	Monday, October 13 (during class period)
Final Exam:	Monday, December 7 (11:00 - 1:00pm)