ECE 493/593 – Optics
ABET Syllabus

Catalog Data: ECE 493/593: Optics. Three hours. Electromagnetic wave theory, propagation, superposition, photons and light. Geometrical optics, lenses, mirrors, and other optical instruments. Polarization, interference, diffraction, coherence, matrix method, transfer function. Lasers, optical fibers and holography.

Prerequisites: PH 253 or consent of instructor.
ECE 340 (for ECE students) or equivalent recommended.

Textbook: Eugene Hecht, *Optics*, 4th ed., Pearson, 2002.

Relationship of Course toward Meeting ABET Program Outcomes:

The course supports instruction for Program Outcomes A, B, and M, as required by ABET Criterion 3 of EC 2000 and ABET Program Criteria. The relationships are indicated in the Course Learning Objectives.

The course does not include direct assessment for Program Outcomes.

Course Learning Objectives:

The overall course objective is to study the concepts of electromagnetic waves in the optical regime, including photons and light, to describe components that can affect their propagation in a medium, to study phenomena such as interference, diffraction, and to explain their application in lasers, including laser optoelectronic devices. At the end of this course, students are expected to be able to:

1. Apply knowledge of mathematics to analyze optical systems, including: (Outcome A)
   a. Geometrical determination of light propagation through lenses, mirrors, prisms, and other optical systems.
   b. Geometrical formulation of reflection and refraction.
   c. Gemoetrical determination of polarization of light.
2. Design and conduct experiments, analyze and interpret data using optical systems. (Outcome B)
3. Apply complex algebra and variables, linear algebra and matrix to the propagation of optical electromagnetic waves. (Outcome M)
   a. Determination of reflection and transmission coefficients.
   b. Formulation and analysis of their propagation characteristics in linear media.
   c. Formulation and analysis of interference and diffraction patterns.

Program Outcome Measure Assessments:

The course does not include direct assessment for Program Outcomes.

Contribution of Course to Meeting the ABET Professional Component:

- Skills required, used, and developed include advanced mathematics and descriptive geometry.
- Estimated Content: Engineering Science: 3.0 credits

Relationship of Course to Program Objectives:

The course supports Program Educational Objective 1, by developing a fundamental knowledge of and an ability to apply mathematics and descriptive geometry to analyze the propagation of electromagnetic waves –under the form of photons and light– in a number of optical systems, as well as their application in lasers.

Topics Covered During Class:

1.	Electromagnetic theory, photons, light	(3.0 hrs)
2.	Propagation of light	(6.0 hrs)
3.	Geometrical optics	(7.5 hrs)
4.	Polarization	(4.5 hrs)
5.	Interference	(4.5 hrs)
6.	Diffraction	(4.5 hrs)
7.	Modern optics: lasers, fiber optics, holography	(3.0 hrs)
8.	Midterm Examinations (2)	(3.0 hrs)
		36.0 hrs
		plus 2.5 hrs final exam

Laboratory: Six (6) laboratory experiments related to the course material are performed throughout the semester, as follows:

1.	Introduction to optics and components	(1.5 hrs)
2.	Refractive index	(1.5 hrs)
3.	Interferometry	(1.5 hrs)
4.	Diffraction	(1.5 hrs)
5.	Spectral composition of light	(1.5 hrs)
6.	Optical devices	(1.5 hrs)
		9.0 hrs

Prepared by: Patrick Kung Date: 1 November 2010