09910PHYS332000 Optics I

Lecture Hours: 11:10 – 12:00, Tuesdays, 10:10 – 12:00, Thursdays
Location: Room Phys 313
Instructor: Prof. Ci-Ling Pan (潘犀靈教授)
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Office Hours: by appointment
Teaching Assistant: to be assigned.

Course Objective:

This course is intended to provide broad, introductory to intermediate-level coverage of the field of classical optics, establishing a solid foundation for further work or study. It covers geometric optics and its application to basic optical system, polarization of light and its properties, interference and its applications in interferometers and thin films, and simplified treatment of diffraction and its implication in imaging.

Text Book:

Eugene Hecht, Optics, fourth edition, Addison Wesley, 2002.

We use heavily slides adapted from those of Prof. Trebino's course website (Georgia Tech): http://www.physics.gatech.edu/gcuo/UltrafastOptics/

***Approximate* Course topics and lectures in order of presentation**:

1. Electromagnetic Theory, Maxwell's equations, E-M waves, Energy, Momentum, Poynting vector, light in bulk matter, index of refraction, dispersion relation $n(\omega)$.
2. Propagation of light, Rayleigh scattering, reflection, refraction, Fermat's principle, the Fresnel equations, total internal reflection, optical properties of metals.
3. Geometric optics, lenses, mirrors, fiberoptics, optical systems, thick lenses, analytical ray tracing, aberrations, GRIN systems.
4. Superposition of waves, same and different frequencies, anharmonic periodic waves.
5. Polarization, polarizers, dichroism, birefringence, polarization by reflection, circular polarizers, optical modulation, liquid crystals.
6. Interference, interferometers, multiple beam approaches.

7. Diffraction, Fraunhofer diffraction, Fresnel Diffraction

Pre-requisites:

Familiarity with optics and electromagnetism is expected, at the level of an introductory electromagnetism course. Facility with basic vector calculus and matrix operations is required. Also, we will be using complex numbers and Fourier transform techniques.

Grading

Grades will be determined by problem sets, midterm quizzes and a final exm. The formula that will be used to calculate your final grade is:

Problem Sets and Midterms: 50%
Final Exam: 50%

Resources on the Web:

http://www.lightandmatter.com/area1book5.html#contents
http://acept.la.asu.edu/PiN/rdg/readings.shtml
http://www.physics.gatech.edu/gcuo/UltrafastOptics/index.html