PHYS408/609, Optics, Spring 2015

INSTRUCTOR: Dr. Pengwang Zhai
Office: Phys. 427
Ph.:410-455-3682

DATES AND LOCATION: MoWeFr 9:00AM-9:50AM Janet & Walter Sondheim 107
First Day of Class: Monday, January 26
Last Day of Class: Monday, May 11
Final Exam: TBD.

OFFICE HOURS: Tuesday and Thursday 2:00AM-2:50AM
or Through Email

TEXTS: Eugene Hecht: Optics (4^{th} Edition)

Reference (not required): Robert Guenther, Modern Optics, (Wiley, 1990).

Prerequisites: Basic electromagnetic theory, basic theory of ordinary differential equation, vector analysis.

GRADING:
Homework (Undergraduates: 30%; and Graduates 20%),
Presentation/Discussion: (10%),
Term Paper: (Undergraduates: not required; Graduates: 10%),
Midterm Exam: (30%),
Final Exam: (30%).

Course Strategy:

There will be an in-class midterm exam and an in-class final exam. There will be no exam make-up except for University-policy accepted absence.

Each student will be required to give a 15-minute oral presentation on a topic on OPTICS. Students in the class will judge the presentation based on clearness, content, and student's understanding of the topic. The topic has to be determined before March 1st.

Graduate students will have to write a 15-page term paper on a topic on Optics. The topic could be the same as the presentation. A good paper has to be standalone and include all necessary components, which typically includes literature review and theory/experiments outline, applications, and summary.

To promote active learning, students are strongly encouraged to read the corresponding textbook chapters before each lecture. Pre-lecture homework and discussion assignments are given routinely before lectures.

Reading the sections of the textbook corresponding to the assigned homework exercises is considered part of the homework assignment; you are responsible for material in the assigned reading *whether or not it is discussed in the lecture.* Homework will be due weekly in Monday's lecture. There will be a 30% penalty on late homework submissions.

Course Outline

1. Maxwell's Equations and EM Wave theory
   1.1. Basic Laws of E&M Theory
   1.2. EM wave equations, Energy and Momentum, Phase speed and dispersion.
   1.3. Radiation
   1.4. EM wave spectrum
2. The Propagation of Light
   2.1. E&M wave at an Interface
      2.1.1. Total Internal Reflection
      2.1.2. Brewster's angle
   2.2. Wave superposition
      2.2.1. Addition of waves
      2.2.2. Anharmonic waves
      2.2.3. Nonperiodic waves
3. Geometric Optics
   3.1. Lenses and Mirrors
   3.2. Prisms
   3.3. Fiber optics
4. Polarization
   4.1. Nature of polarization
   4.2. Dichroism and Birefringence
   4.3. Polarization by Scattering and reflection
   4.4. Retarders
   4.5. Optical Modulators
5. Interference and Diffraction
   5.1. Basic Concepts
   5.2. Interferometers
   5.3. Frauhofer Diffraction
   5.4. Babinet's Principle
   5.5. Applications of Interferometry
6. Fourier Optics
   6.1. Fourier Transforms
   6.2. Optical Applications
7. Coherence Theory
8. Lasers and Nonlinear Optics (Time permits)

Academic Honesty Policy

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community, in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism,

and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory. [Statement adopted by UMBC's Undergraduate Council and Provost's Office.]