April 2013

Physics 423 – Advanced Optics (4)
Course Outline

Current Catalog Description
Advanced topics of modern optics. May include: fiber optics, Fourier optics, quantum optics, lasers, holography, non-linear optics. 3 lectures, 1 laboratory. **Prerequisite:** PHYS 323.

Learning Objectives and Criteria:
Upon completion of the course the student is expected to have the following theoretical skills:

- understand and apply the principles of optical wave propagation
- calculate amplitudes, phases, intensities, and interference of optical waves
- understand and apply the principles of guided-wave optics.
- calculate reflectance and transmittance of polarized light waves at the dielectric interface between two media
- have a familiarity with fields of research and/or industrial applications of physical optics

Upon completion of the course the student is also expected to have the following laboratory skills:

- assemble, align, troubleshoot, and optimize experimental optical equipment beyond an introductory level
- understand and be able to use detection equipment such as CCD cameras and power meters
- understand and be able to use computer software programs for data collection and analysis
- clearly present, discuss, analyze, and explain data and results in written form

Text and References:
Textbook: Pedrotti et al, *Introduction to Optics, 3rd edition*, Pearson Prentice Hall
References:
Brooker, *Modern Classical Optics*, Oxford U. P.
Hecht, *Optics*, Addison Wesley
Goodman, *Introduction to Fourier Optics*, 3rd edition, Roberts and Company Publishers

Activities, Content, and Method:
Course Activities: Physics 423 is offered in a traditional lecture and laboratory format.

Content: The exact topical content of the course can vary year to year depending upon the instructor and current topics of interest in the field of optics. Topics covered in the course may include:

- Lens aberrations
- Laser light generation
- Laser cavities and their components
- Propagation of Gaussian beams
- Light polarization and polarization control systems
- Holography

- Fiber optics
- Optical waveguides
- Fresnel diffraction
- Fresnel equations
- Fourier Optics
- Image formation and spatial filtering
- Non-linear optics

Methods of Assessment:
The bulk of the student's course grade is determined by performance on mid-term examination(s), laboratory work, and a final exam. Additional factors may include homework assignments, and possibly a paper and/or presentation on an individually chosen research topic.