PHY 313 – Optics
Syllabus

Credit
4 semester hours
3 hours of lecture per week, 3 hours of lab per week

Prerequisites
PHY 152 or 252 and MAT 122

Course Description
Fundamental concepts of simple optical systems including lenses and mirrors. Physical optics including interference, diffraction, polarization, optical spectra and lasers.

Rationale for Course
This upper division course builds on the introductory background of the physics of light and optics as presented in sophomore level physics. For almost all physics and physics engineering students, this will be their last formal study of physical and geometrical options, including their graduate studies.

Learning Objectives
- The student will understand the velocity of light in various media and the early and later experiments which measured that velocity
- The student will explain how light interacts with transparent and translucent matter
- The student will describe how real and virtual images are formed by lenses and mirrors and how these images depart from the ideal.
- The student will understand the theory behind various optical instruments, including the concept of virtual objects
- The student will demonstrate a mature knowledge of the principles of wave motion, including the Principle of Superposition for both simple and complex waves
- The student will explain the physics of Fresnel and Fraunhoffer Diffraction
- The student will explain double slit diffraction, including why specific orders are missing from the interference pattern
- The student will demonstrate a rudimentary understand of optical scattering and absorption.

Academic Integrity
Students are expected to be honest and to submit their own work on exams. Strict adherence to the Mississippi College "Honesty Policy" (2009-2010 *Mississippi College Undergraduate Bulletin*, pg. 60) will be followed. You may collaborate on homework; however, some exams will be take-home, and you are expected to do your own work on all tests.

Course Outline
- Properties of light – velocity in various media, index of refraction, Fermat's Principle
- Plane Surfaces – prisms, refraction, Snell's law, critical angle, total reflection, image formed by a plane mirror
- Spherical Surfaces – real and virtual images formed by concave and convex surfaces
- Thin Lenses – real and virtual images formed by concave and convex thin lenses, lateral magnification, power of a thin lens, combinations of thin lenses

- Spherical Mirrors – real and virtual images formed by concave and convex mirrors, spherical aberrations and astigmatism
- The effects of optical stops on optical devices
- Optical Instruments – the human eye, cameras, magnifiers, telescopes, microscopes
- Wave Theory – phase and wave velocities, amplitude and intensity, superposition of simple and complex waves
- Interference of two beams – Huygen's Principle, Young's Experiment, double slit sources, Fresnel's biprism, coherent sources, circular fringes, localized fringes, white-light fringes
- Interference due to multiple reflections, thin films, Newton's Rings
- Fresnel and Fraunhofer Diffraction by a single slit, resolving power
- The Double Slit, missing orders
- Absorption and Scattering

Method of Instruction

This is primarily a lecture class with a limited number of assigned homework problems from the text. Classroom discussion is strongly encouraged. The laboratory experiments will supplement the lecture materials and will be performed by teams of two or three students per team, depending upon enrollment.

Required Text and Materials

Fundamentals of Optics by Jenkins and White, 4th Edition. Also, a scientific pocket calculator will be needed. The unit lecture materials will be handed out prior to the start of each unit. These materials consist almost entirely of locally-written lectures which complement the text. Other materials will be distributed as appropriate. Homework will be assigned from the text and it will be graded.

Grading

There will be four unit tests; two on Geometrical Optics and two on Physical Optics. All four tests will be weighted equally, and their average will comprise 75% of the course grade. The homework will be taken up and graded and will comprise 10% of the final course average. The average of all lab reports will count the remaining 15%.

Scale:

Grade	Final Average
A	90-100
B	80-89
C	70-79
D	60-69
F	0-59

Makeup Tests

Makeup tests will be given under the following circumstances:

- A test is missed because of official college activities. When proof of that is provided, special arrangements will be made to give a make-up test.
- A student is ill and has a written excuse from a doctor, medical clinic, or College official

Absences

Mississippi College policies on attendance and academic integrity will be observed. Please see the *2009-2010 Mississippi College Undergraduate Bulletin*, pg. 56-57 for additional details of these policies. Students are responsible for all work missed during absences.

Special Needs

Students who need special accommodations due to learning, physical, psychological, or other disabilities should contact Dr. Buddy Wagner in the Counseling and Career Development Center. He may be reached by phone at 601-925-3354.