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 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.

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 70% 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 20%.

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

Dropping the Course

Refer to the Mississippi College Academic Calendar for the final drop date for the course. Drops after this date will only be permitted for extreme circumstances and will require approval from the course instructor, department chair, Dean of the School of Science and Mathematics, and the Vice-President for Academic Affairs.

Academic Integrity

Mississippi College students are expected to be scrupulously honest. Dishonesty, such as cheating or plagiarism, or furnishing false information, including forgery, alteration or misuse of University

documents, records or identification, will be regarded as a serious offense subject to severe penalty, including, but not limited to, loss of credit and possible dismissal. See the *Mississippi College Student Handbook* or University Policy 2.19 for specific information regarding penalties associated with dishonest behavior at Mississippi College. Copies of the *Mississippi College Student Handbook* are available in the Office of the Vice President for Enrollment Management and Student Affairs, Nelson 313. Copies of University policies are available on the Mississippi College web site.

Attendance Policy

Class attendance/participation is an essential part of university education, and students are expected to attend/participate regularly and punctually in all classes and laboratories. The responsibility for any work missed as the result of an absence rests entirely with the student. Cumulative absences/nonparticipation may result in a lowered grade or loss of credit for the course. Tardiness is also subject to penalty, as is any failure to complete required class work on time. A student will receive a grade of F immediately upon accumulating the following number of absences, whether excused or unexcused:

- 12 in semester classes meeting three times per week
- 8 in semester classes meeting two times per week

If a student misses more than the number of class periods specified in university policy and believes that there are reasonable explanations for the absences, he/she may appeal the absences to the Dean of the School of Science and Mathematics.

Early Alert System

Mississippi College has adopted the practice of finding students early in the semester who may be exhibiting behaviors that could ultimately have a negative impact on their academic progress. These behaviors are often called "red flag" behaviors and include, but are not limited to, excessive absences, poor test grades, and lack of class participation or evidence of non-engagement. Identifying these behaviors early gives the instructor the opportunity to raise the "red flag" on behalf of a particular student so that the student can take the appropriate action to redirect his/her progress. The system alerts the student, the student's advisor, and the Office of Student Success.

These messages are intended to help a student recognize an area of concern and to encourage him/her to make some choices to improve the situation. When a student receives an Early Alert message, the student should quickly make an appointment to talk with his/her professor about the situation. Also, students can make full use of the Office of Student Success to set academic goals and connect to campus resources.

Students with Disabilities

In order for a student to receive disability accommodations under Section 504 of the Americans with Disabilities Act, he or she must schedule an individual meeting with the Director of Student Counseling Services immediately upon recognition of their disability (if their disability is known they must come in before the semester begins or make an appointment immediately upon receipt of their syllabi for the new semester). The student must bring with them written documentation from a medical physician and/or licensed clinician that verifies their disability. If the student has received prior accommodations, they must bring written documentation of those accommodations (example Individualized Education Plan from the school system). Documentation must be current (within 3 years).

The student must meet with SCS face-to face and also attend two (2) additional follow up meetings (one mid semester before or after midterm examinations and the last one at the end of the semester). Please

note that the student may also schedule additional meetings as needed for support through SCS as they work with their professor throughout the semester. Note: Students must come in each semester to complete their Individualized Accommodation Plan (example: MC student completes fall semester IAP plan and even if student is a continuing student for the spring semester they must come in again to complete their spring semester IAP plan).

Student Counseling Services is located on the 4th floor of Alumni Hall) or they may be contacted via email at mbryant@mc.edu . You may also reach them by phone at 601-925-7790. Dr. Morgan Bryant is director of MC Student Counseling Services.