PHYS333: Physical Optics
Fall 2015

Teacher: Dr. Kelly Krieble Office: Room 109, Collier Hall of Science Phone: 610-861-1437 (ext. 1437 on-campus) e-mail: krieblek@moravian.edu	Classroom: CHS 123 MWF 10:20-11:30am
	Office Hours: MWF 9-10am

Course Description:

Physical optics entails a theoretical and experimental study of the interaction of electromagnetic radiation and matter. Subject areas include wave and photon representations of light, geometrical optics, polarization, interference, and diffraction phenomena. Modern optics experiments using lasers and interferometers will also be explored.

Goals of the course:

The primary aim of this course is to introduce students to experimental and theoretical techniques in optics. At the end of this course, students will be able to:

- Articulate an understanding of the wave-particle duality of light as it applies to various experiments,
- Explain various geometrical and physical properties of electromagnetic radiation for a variety of different wavelengths,
- Describe and follow various experimental optical laboratory techniques for measuring light phenomena,
- Demonstrate competency in writing and presenting experimental findings,
- Employ a variety of mathematical techniques, including matrix methods, for solving complex problems in optics.

Course Text:

Optics. 4th ed., Hecht

Grading Policy:

A = 90%-100%
B = 80%-89%
C = 70%-79%
D = 60%-69%
F = below 60%

Note: It is within the instructor's purview to apply qualitative judgment in determining grades for an assignment or for the course.

Assessment:	**% Weight**
Homework problems	20
Laboratory Notebook	30
Exams	20
Presentation/Poster	10
Final Exam	20

Academic Honesty Policy:

Moravian College expects its students to perform their academic work honestly and fairly. A Moravian student, moreover, should neither hinder nor unfairly assist the efforts of other students to

complete their work successfully. This policy of academic integrity is the foundation on which learning at Moravian is built.

The College's expectations and the consequences of failure to meet these expectations are outlined below. If at any point in your academic work at Moravian you are uncertain about your responsibility as a scholar or about the propriety of a particular action, consult your instructor.

Your work in this course will be bound by the Moravian College Policy on Academic Honesty (found in the Student Handbook), so please review and study that document.

Guidelines for Honesty:

All work that you submit or present as part of course assignments or requirements must be your original work unless otherwise expressly permitted by the instructor. This includes any work presented, be it in written, oral, or electronic form or in any other technical or artistic medium. When you use the specific thoughts, ideas, writings, or expressions of another person, you must accompany each instance of use with some form of attribution to the source. Direct quotes from any source (including the Internet) must be placed in quotation marks (or otherwise marked appropriately) and accompanied by proper citation, following the preferred bibliographic conventions of your department or instructor. It is the instructor's responsibility to make clear to all students in his or her class the preferred or required citation style for student work. Student ignorance of bibliographic convention and citation procedures is not a valid excuse for having committed plagiarism.

You may not collaborate during an in-class examination, test, or quiz. You may not work with others on out-of-class assignments, exams, or projects unless expressly allowed or instructed to do so by the course instructor. If you have any reservations about your role in working on any out-of-class assignments, you must consult with your course instructor.

You may not use writing or research that is obtained from a "paper service" or that is purchased from any person or entity, unless you fully disclose such activity to the instructor and are given express permission. You may not use writing or research obtained from any other student previously or currently enrolled at Moravian or elsewhere or from the files of any student organization, such as fraternity or sorority files, unless you are expressly permitted to do so by the instructor.

You must keep all notes, drafts, and materials used in preparing assignments until a final course grade is given. In the case of work in electronic form, you may be asked to maintain all intermediate drafts and notes electronically or in hard copy until final grades are given. All these materials must be available for inspection by the instructor at any time.

Tardy Assignment Policy

The due dates for each assignment will be stated when the assignment is handed out. Grades for tardy assignments will be reduced by 10% for each day that the assignment is past due.

Final semester exam:

A comprehensive exam will be administered on all material covered during the semester.

Attendance Policy:

Attendance is strongly encouraged since new material, problem solutions, different approaches from that of the text and computer instructions will be presented during this time. Students work at their own pace in the laboratory and must complete all experiments. Laboratory attendance is required since explanations and procedures will be presented at the beginning of the laboratory period. Please see the instructor about any work that may have been missed, and collect any notes from your colleagues.

Academic Support Center:

The Academic Support Center houses Disability Support and Greyhound Tutoring on the first floor of Monocacy Hall and can be reached at 610-861-1401. Greyhound Tutoring provides course-specific tutors to Moravian students, free of charge. If you would like to work with a Greyhound Tutor

to boost your academic success, please request a tutor through http://bit.ly/NeedTutorMC (case-sensitive). Plan ahead! It takes 2-3 business days to connect you with a tutor. Please email Dana Wilson (wilsond@moravian.edu), Tutor Coordinator, for more information about tutoring. Please email Laurie Roth (rothl@moravian.edu), Director of Academic and Disability Support, for more information about disability support.

Students who wish to request accommodations in this class for a disability should contact Ms. Laurie Roth, Director of Academic & Disability Support, located on the first floor of Monocacy Hall (extension 1401). Accommodations cannot be provided until authorization is received from the Academic & Disability Support office.

Students are also encouraged, yet not required, to inform course faculty of those situations that can affect academic performance. Resources may be available to aid students who are experiencing academic difficulty.

It is important to contact the office as soon as possible to enhance the likelihood that such accommodations are implemented in a timely fashion. Any student who wishes to disclose a disability and request accommodations under the Americans with Disabilities Act (ADA) for this course first MUST meet with Ms. Laurie Roth.

Good luck in the coming year. Should you have any comments about the class during the semester, please feel free to discuss them with me; I will welcome any suggestions for improving the course. Since I am looking for you to do your best work, you should demand excellence from me as well.

Subject to revision

Date		Scheduled Topic	Chapter Readings
Monday	8/31	Course Introduction LAB: Experiments on E & M radiation, Microwaves and sound, wavelength determination. Lecher Wire experiment. (Problem set #1 handout)	1 2.1 - 2.4
Wednesday	9/2	Complex representation of waves, Phasors	2.5 - 2.7
Friday	9/4	Plane, spherical, and cylindrical waves	2.8 - 2.10
Monday	9/7	E&M theory LAB: Doppler effect with ultrasonic waves, Intensity variation for spherical and cylindrical waves. (problems 3.2, 3.5, 3.6)	3.1 - 3.3.2
Wednesday	9/9	Irradiance, Intensity, Radiation (problems 3.23, 3.29, 3.31, 3.32)	3.3.3 - 3.4.3
Friday	9/11	Atomic Emission, the EM spectrum (problems 3.38, 3.40, 3.36, 3.57)	3.4.4 – 3.7
Monday	9/14	Light Scattering, Transmission, Reflection, Refraction LAB: Experiments on ray optics (problems 4.2, 4.3, 4.4, 4.7, 4.15)	4.1 - 4.4.1
Wednesday	9/16	Huygens's and Fermat's principles (problems 4.24, 4.26**, 4.32, 4.35) ** - error in answer	4.4.2 - 4.5
Friday	9/18	Waves at interfaces (problems 4.37, 4.39, 4.40)	4.6.1 - 4.6.2
Monday	9/21	Fresnel Equations LAB: Experimental investigation of Fresnel's equations (problems 4.41, 4.45, 4.46, 4.50, 4.66)	4.63
Wednesday	9/23	Total internal reflection, evanescent waves, dispersion (problems 4.52, 4.57, 4.60)	4.7 – 4.8
Friday	9/25	Colors, QED (problems 4.61, 4.77, 4.78)	*4.9 – 4.11*
Monday	9/28	Geometric Optics LAB: Speed of light with pulsing laser. Evanescent wave with microwaves. (problems 4.52, 4.68, 4.69)	5.1 – 5.2.2
Wednesday	9/30	Thin lenses (problems 5.1, 5.7, 5.8)	
Friday	10/2	Apertures and mirrors (problems 5.10, 5.20, 5.22, 5.43)	5.2.3
Monday	10/5	EXAM #1 – chapters 2 to 4 LAB: Geometrical Optics, beam expander, Gaussian profile (problems 5.44, 5.47, 5.68, 5.76)	5.3 – 5.4

Wednesday	10/7	Prisms (problems 5.71, 5.79, 5.86)	5.5
Friday	10/9	Optical systems	
Monday	10/12	No Classes	
Wednesday	10/14	Matrix methods (problems 7.3, 7.4, 7.6, 7.11)	7.1 – 7.2
Friday	10/16	Matrix methods (problems 7.22, 7.29)	
Monday	10/19	Waves LAB: Continue previous experiments and do experiments with prisms, the spectrometer (problems 8.3, 8.10, 8.13, 8.16)	8.1 – 8.6
Wednesday	10/21	Fourier methods (problems 8.18, 8.20, 8.21, 8.25)	8.7 – 8.9
Friday	10/23	Polarization (problems 8.60, 8.69, 8.70, 8.72)	
Monday	10/26	Jones vectors, Optical activity LAB: Aberrations, Coma and Astigmatism. See p.253-263. Start lab on polarization (handout problem on Jones vectors) (problems 8.57, 8.58, 8.59, 8.61)	
Wednesday	10/28	Wave plates (problems 9.2, 9.3, 9.4, 9.8, 9.10)	9.1 – 9.3
Friday	10/30	Interference (problems 9.12, 9.24, 9.25, 9.27)	9.4 – 9.5
Monday	11/2	Fabry-Perot Interferometer LAB: Elliptical polarization of microwaves, half and quarter wave retarders (problems 9.34, 9.35, 9.37, 9.40)	9.6
Wednesday	11/4	Thin films (problems 9.41, 9.46, 9.31)	9.7 – 9.8
Friday	11/6	Single and double slit (problems 10.2, 10.3, 10.6, 10.7)	10.1 – 10.2.2
Monday	11/9	Exam #2 – chapters 5 to 9 LAB: Continue polarization experiments. Interference: Young's double slit, Michelson interferometer	10.2.3–10.2.5
Wednesday	11/11	Circular aperture, resolution (problems 10.9, 10.10, 10.12)	10.2.8
Friday	11/13	Diffraction Gratings	10.3 – 10.3.4
Monday	11/16	Fraunhofer diffraction LAB: Interference: single slit, double and multiple slits. Fabry Perot interferometers (scanning Fabry Perot with laser beams) (problems 10.33, 10.34, 10.38)	10.3.5-10.3.6

Wednesday	11/18	Fresnel Diffraction (problems 10.39, 10.41)	10.3.7-10.3.8
Friday	11/20	Cornu Spiral (problems 10.43, 10.46)	10.3.9- 10.3.10
Monday	11/23	Lasers LAB: Babinet compensator, Scanning interferometer, single slit intensity distribution. (problems 10.45**, 10.47, 10.49) ** - use the Web	
		THANKSGIVING RECESS	
Monday	11/30	Laser modes LAB: Diffraction grating (problems 10.48, 10.52)	
Wednesday	12/2	Open cavity laser	
Friday	12/4	Laser systems	
Monday	12/7	Finish lab work LAB: Zone plates with microwaves and light. Turn in laboratory experiments, Laser stability	
Wednesday	12/9	Presentations	
Friday	12/11	Review	