Course Syllabus

Physics 360: Optics

Spring Semester 2024

Instructor: Dr. Steven Sahyun
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Phone: Ext. 5113
E-mail: sahyuns@uww.edu
WWW: http://sahyun.net/courses/physcs360
CANVAS: **https://www.uww.edu/canvas**
Class Meetings: M W 11:00 a.m. – 12:15 p.m.
Laboratory: F 9:00 - 11:50 a.m.
Office Hours: M T W 1:00 am – 1:50 am; M 3:30 – 4:30 pm and 3:00 – 4:00 pm
or by appointment.
Exams: See attached schedule
Text: Required: Kenyon: *The Light Fantastic*, **2nd ed.**
Required: OpenStax, *University Physics Vol. 3*. PDF download
from D2L or
https://openstax.org/details/books/university-physics-volume-3

At Library, on Reserve: Poon and Kim, Engineering Optics with MATLAB

Pre-requisite: Physics 324 or consent of instructor.

Other required materials: We will be using LabArchives as an Electronic Laboratory
Notebook (ELN) for recording data and posting laboratory reports. Access to
LabArchives is provided through the course fee so you do not need to purchase a separate
access account.

You are expected to bring an additional laboratory notebook of your choice to lab for
working out calculations and recording notes and then transfer (copy, scan, or photo) the
information into the ELN.

Paper, a scientific calculator (one with trigonometric and logarithmic functions, scientific
notation, etc.), and a data storage device (you may use LabArchives for this but you may
find a separate USB drive helpful). Calculators and USB drives are available for less than
$20).

MATLAB: Because of the prevalent use of MATLAB in industry and research labs, and
because our UWW physics alumni have mentioned that it is something that our majors
should know when graduating, it is the intention that we will be using MATLAB for
several assignments and in-class activities. You have access to MATLAB on the Physics
Department and some UWW computers, and it can be accessed remotely through Citrix
https://gateway.uww.edu/vpn/index.html but you may find it useful to purchase a student
edition of MATLAB ($93) through WISC at
http://wiscsoftware.wisc.edu/wisc/school.asp?institution=1024

or through the www.mathworks.com site (30 day free trial; student edition $50; with Simulink $99). The university is working on obtaining a site license for MATLAB so you may be able to download this for free at some point.

A **FREE** alternative to MATLAB is **GNU Octave:**
https://www.gnu.org/software/octave/download.html

Most MATLAB scripts will work in Octave (and vice versa), though there are some graphing differences. MATLAB assignments or work is to be submitted in working MATLAB scripts, but most development may be in Octave if you do not have access to MATLAB. As long as I can get the scripts to work on my computers for evaluation purposes on MATLAB, you may use either program.

PYTHON: Assignments, in-class activities and laboratory calculations may be completed and submitted using Python programming instead of MATLAB. I will **attempt** to convert existing MATLAB scripts in class activities to Python code where appropriate, but this may not be possible in certain cases. Python is free to download and install on personal computers (https://www.python.org/downloads/) and there are also on-line compilers that may work for some of the activities, for example: Colab: https://colab.research.google.com .

MS Office: Also, as a student, you can get Microsoft Office ProPlus for free at http://www.uww.edu/icit/4u/proplus. This is a great deal. Recommended free alternatives that can open/save most Word, Excel, and PowerPoint files are OpenOffice (http://www.openoffice.org/download/index.html) and LibreOffice (http://www.libreoffice.org/download)

Course Description: This course provides an introductory study of optical phenomena. Geometrical and physical optics beginning with a mathematical treatment of light waves and their interaction with materials. Topics also include interference diffraction, spectroscopy and spectroscopic instruments, polarization, light sources and detectors, lasers, holography, and some topics in modern optics. The laboratory portion of the class will provide hands-on experience for topics discussed.

Class Pedagogy: Much Physics Education research has shown the worth of active learning classroom strategies. This course will attempt to implement these as much as possible through the use of student presentation of material, in-class activities, and discussion sessions. A result is that there will be (hopefully) very little of me deriving equations on the board. There are many excellent sources of notes on the Web relating to material that we will cover (for example I highly recommend http://physics.tamuk.edu/~suson/html/4323/) to satisfy your desire for additional notes.

All personal electronic devices not required for note taking or calculation (e.g., cell phones, pager, iPods, etc.) must be turned off while in class. Texting or using a cell phone during class is NOT PERMITTED. It is distracting and causes other members of your group to be disturbed during the class lecture and activities.

Daily Readings: Read the assigned sections (listed on the course Web site) in the book before coming to class. You will be expected to provide a reading summary (to be graded) at the beginning of class. You may use notes when writing your reading summary or you may bring in a pre-written copy.

Homework: Each class period your will be expected to have completed the homework problem assigned for the day as noted on the class schedule (http://academics.uww.edu/physics/courses/physcs360/schedule.pdf) You will turn your solution at the start of class for credit. Late homework will receive half-credit.

Activities: There will usually be a graded in-class activity. You will turn in your results sheet for the day's activity at the end of the class period. Due to the nature of some of the in-class activities, it may not be possible to offer make-up on these, but when possible, you may make up missed activities at the earliest appropriate time.

Exams: There will be two mid-term exams as well as a comprehensive final. Exams may not be taken late. Questions for the exams will be similar to submitted homework problems and items seen in the in-class activities.

I will provide a TI 30X IIS or similar calculator for use during exams. If you have a similar calculator that you would like to use as an alternate, it must first be checked and approved by me prior to the exam. No other electronic devices are allowed during exams. NO CELL PHONES ARE ALLOWED DURING EXAMS. You will not be allowed to use a cell phone as a calculator during the exams or have your cell phone available.

Laboratory: The laboratory is a required portion of the course. Each lab will be a three-hour session. Plan on attending each session for the laboratory.

We will be using an electronic laboratory notebook (ELN) method at https://mynotebook.labarchives.com to record work in the laboratory.

A video tutorial about LabArchives enotebook is at: https://www.youtube.com/watch?feature=player_embedded&v=DmMd0AA8GG4

It is possible to access your LabArchives notebook from a smart phone or tablet.

You should also have a lab notebook (preferably bound) for recording your experiments and data and then submit a scan or photo of your notes for the day's lab to your ELN. Your ELN will be evaluated (for part of the lab grade) at the end of each lab for good record keeping.

Laboratory Reports:

Each laboratory will have a typed report and follow a grading rubric given below. Laboratory reports are due FRIDAY of the week after lab completion. Reports are to be submitted on LabArchives. There is a LaTeX template on D2L for your reports. LaTeX is recommended but not required for the reports.

Laboratory reports MAY be submitted as team reports from groups of 2 or 3 students. I have found that reports submitted from teams tend to be more complete and correct (and hence receive higher grades) than those submitted individually. **HOWEVER**, Lab notebook submissions will remain as separately graded items for each student. [For example, if a group report is submitted, but there is no lab notebook information on LabArchives, you will not receive notebook credit.] Group reports must contain the names of all students who contributed and each student must make significant contributions to each report. Reports will be reduced by 1 pt. **each** day they are late.

After receiving your laboratory grade, you may rewrite and resubmit your laboratory report for a re-grade. The rewrite is due one week after the original was graded.

To pass the course, you MUST complete 8 of the 10 laboratory experiments (assuming there are no technical problems with the experiments and that there are 10 experiments offered**) as well as** complete the final laboratory project of your own design. If you miss a laboratory, you may use one of the days reserved for your project to work on the lab make-up. If you complete fewer than 8 laboratory experiments (assumption as noted above) you will NOT receive a passing grade.

Please see LabArchives for laboratory notebook and report grading rubrics.

Use of AI on Assignments:

While AI (Artificial Intelligence) text generators are helpful as a starting point to overcome writer's block or to evaluate your work, the purposes of assignments and laboratory reports are **for you to reflect on your learning** of the material and to put **your own** thoughts into words. **Any assignment that *appears*, according to the grader's judgement, *overly reliant* on use of AI text generation in the submitted assignment will be given between no credit up to, at maximum, half-credit.**

Campus Policies and Practices Statement

Course Policy Regarding Video/Audio Recording:

In order to encourage a classroom environment where the free exchange of ideas is possible, video and audio recording must be limited to that done for educational purposes. Prior instructor permission and notification of fellow students is required for any video or audio recording.

Per UW-W policies and practices, if and when certain information is learned, whether in an academic program, residence life or other campus activity, the person (UWW employee) who learns that information is required to report if the information includes any form of sex discrimination, violence, abuse or neglect, past or present. If you share something personal that falls within one of the categories above, thereby requiring the instructor or staff person to report what was shared. If this occurs, the staff person will use discretion, reason and sensitivity to abide by our policies while respecting your privacy. The goal of these requirements is to prevent or avoid further harm to you, as a student, or those who may be exposed to further abuse by others. If you have questions or concerns, you are encouraged to talk with your course instructor or department chair.

The University of Wisconsin-Whitewater is dedicated to a safe, supportive and non-discriminatory learning environment. It is the responsibility of all undergraduate and graduate students to

familiarize themselves with University policies regarding Special Accommodations, Misconduct, Religious Beliefs Accommodation, Discrimination and Absence for University Sponsored Events. (For details please refer to the Undergraduate and Graduate Timetables; the "Rights and Responsibilities" section of the Undergraduate Bulletin; the Academic Requirements and Policies and the Facilities and Services sections of the Graduate Bulletin; and the Student Academic Disciplinary Procedures" [UWS Chapter 14]; and the "Student Nonacademic Disciplinary Procedures " [UWS Chapter 17]).

Grading: Course grades will be determined by the percentage of **total** points assigned for the course. 93% = A, 90% = A-, 87% = B+, 83% = B, 80% = B-, 77% = C+, 73% = C, 70% = C-, 67%=D+, 63% = D, 60% = D-, <60% = F.

The **approximate** assignment of points will be as follows:

Item	Points	%
Exam 1	40	8%
Exam 2	40	8%
Final	80	16%
Participation: in-class activities (18@2pts)	36	7%
Homework Probs (25@2pt)	50	10%
MatLAB projects (3@10 pts.)	30	6%
Lab Reports (11@20pts)	220	44%
Total	496	100%

I reserve the right to adjust grades slightly based on class participation. There may be occasional opportunities for extra credit.

Text: Kenyon, The Light Fantastic, 2nd ed.

Sahyun | **Physics 360 Schedule** | **Spring 2024** | Updated 1/17/2024

Week	Class	Day	Date	Topic/Lab	Book Sections	Assigned Reading Pages	Assignment (Due)
1	1	Mon	22-Jan	Introduction, MatLAB, Pythion, LaTeX and Laser Safety			
	2	Wed	24-Jan	Description of Light	1.4 - 1.5	Kenyon 9-18	H0 Laser Safety Quiz
	L1	Fri	26-Jan	**Lab 0: Lab Introduction and LabArchives**			
2	3	Mon	29-Jan	Light Waves	1.6 - 1.10	18-28	H1 MATLAB Printout of Kenyon 1.1 calculation.
	4	Wed	31-Jan	Ray Optics	2.1 - 2.4	31-45	H2 (1.5, 1.8)
	L2	Fri	2-Feb	**Lab 1: Speed of Light**			
3	5	Mon	5-Feb	Mirrors and Lenses	3.1-3.4	47-57	H3 (2.2)
	6	Wed	7-Feb	Python/MatLAB project 1: Lens equation and ray diagrams			
	L3	Fri	9-Feb	**Lab 2: Cell Phone Optics I**			
4	7	Mon	12-Feb	Lens Matrix	3.5-3.6	57-70	H4 (2.4), MATLAB P1
	8	Wed	14-Feb	Optical Systems	4.1-4.4; 4.6-4.8	75-85; 93-94	H5 (3.10, 4.1)
	L4	Fri	16-Feb	**Lab 3: Optical Coatings**			
5	9	Mon	19-Feb	Midterm 1 (CH 1-4)			
	10	Wed	21-Feb	Wave Optics	5.1-5.3	97-105	
	L5	Fri	23-Feb	**Lab 4: Cell Phone Lens and Microscopes**			
6	11	Mon	26-Feb	Interferometers	5.4, 5.6-5.7.2;	105-107; 115-118	H6 (5.1)
	12	Wed	28-Feb	Interferometers cont.	5.8-5.9	120-128	H7 (5.4)
	L6	Fri	1-Mar	**Lab 5: Holographic Diffraction**			
7	13	Mon	4-Mar	Diffraction - single; multi slit	6.1-6.7	133-143	H8 (5.9) AΩ=2013 Mm^2*str
	14	Wed	6-Mar	Diffraction grating, spectrometer	6.8-6.9	143-150	H9 (6.2) phi = 15°
	L7	Fri	8-Mar	**Lab 6: Interferometers**			
8	15	Mon	11-Mar	Fresnel and Fraunhofer Diffraction	6.10 - 6.14	150-160	H10 (6.5)
	16	Wed	13-Mar	Python/MatLAB project 2: Diffraction graphs			
	L8	Fri	15-Mar	**Lab 7: Single and Multiple Slit Diffraction**			
9	17	Mon	18-Mar	Fourier Optics, linewidth and bandwidth	7.1-7.2, 7.3 -7.3.3	169-173, 177-189	H11 (6.9), MATLAB P2
	18	Wed	20-Mar	Spatial Transforms and Holography	7.4-7.8	189-203	H12 (7.1)
	L9	Fri	22-Mar	**Lab 8: Multiple Slit Diffraction Analysis**			
10				Spring Break			
11	19	Mon	1-Apr	Reflection and Refraction, Fresnel's equations	9.1-9.5; 9.6-9.7	239-240; 251-255;255-266	H13 (7.6)
	20	Wed	3-Apr	Midterm 2 (CH 5-7)			
	L10	Fri	5-Apr	**Lab 9: Cell Phone Spectroscopy**			
12	21	Mon	8-Apr	Solar Eclipse! No Class!			
	22	Wed	10-Apr	Waveguides	9.8-9.9	267-274	H14 (9.3)
	L10	Fri	12-Apr	**Lab 10: Polarization of Cell Phone Display**			
13	23	Mon	15-Apr	Polarization, LCD and optical activity	10.1-10.4; 10.5; 10.5.2-10.8	277-283; 288-289; 290-307	H15 (9.9)
	24	Wed	17-Apr	Python/MatLAB project 3 - Graphing Polarization, Malus' Law			
	LA	Fri	19-Apr	**Lab Assessment Day**			
14	25	Mon	22-Apr	Scattering, Absorption and dispersion, Group Velocity	11.1-11.5; 11.6-11.6.2	309-331	H16 (10.5, 10.8)
	26	Wed	24-Apr	Lasers	14.1-14.4	397-412	H17 (11.5, 11.7), MATLAB P3
	L11	Fri	26-Apr	**Lab 11: Digital Holography**			
15	27	Mon	29-Apr	Lasers (cont.)	14.7-14.8.1	423-434	H18 (14.6), MATLAB P4
	28	Wed	1-May	Fiber Optics	16.1-16.2; 16.4-16.5	493-506	H19 (14.14)
	L11	Fri	3-May	**Lab 11: Digital Holography (cont.)**			H21 (16.2, 16.10)
16		Wed	11-May	Final 10:00 am - 12:00 noon (CH 1-7, 9-11, 14, 16)			

FINAL EXAM SCHEDULE

All instructional staff of on- and off-campus classes are expected to meet during their scheduled final exam times. All comprehensive final exams shall be administered at the prescribed time during the final exam times. For those classes where there is no final exam, the time prescribed during the final exam times shall be used as a regular class meeting. Exception to meeting classes during the exam times requires specific written approval in advance from the college dean.

The general schedule will be available via PDF around the beginning of the given term. Due to the amount of department requested changes, the specific final exam schedule in WINS will not be available to view until after the tenth day of classes for the term.

For classes that have set meeting times, the final exam shall be administered at the prescribed time during finals week. For classes with set meeting times that do not have a final exam, the time prescribed during finals week shall be used as a regular class meeting.

For classes without set meeting times (ie. online classes), the timing of the final exam or final assignment is at the discretion of the instructor within finals week.

No undergraduate student shall be required to take more than two comprehensive final exams on the same day. Any student with more than two comprehensive final exams scheduled for the same day may elect to reschedule the additional examination(s). These alternative arrangements are available only when the exams are comprehensive.

- Final exams for web-based and arranged classes are to be held during final exam week at the discretion of the instructor.
- Final exams for off-campus classes are to be held at the regular class meeting time that falls during the final exam week.
- Classes offered at times not listed below do not have designated final exam times. Instructors are to make arrangements by the end of week 11 to administer these exams during the standard final exam times*.
- Instructors needing an alternative time or location, different than the one assigned, must work with their department associate to request an alternative.
- 0.5 - 1 unit courses will not be assigned a final exam time. However, if instructors would like to host a final exam, please contact the Registrar's Office by the tenth day of classes to ensure proper time and room assignments occur.

Monday
Time	Classes
7:45-9:45 am	MW, MWR, MWF, MTWR, MF or WF classes beginning between 7:00-8:50 am
10:00-12 Noon	MW, MWR, MWF, MTWR, MF or WF classes beginning between 10:00-10:50 am
12:15-2:15 pm	MW, MWR, MWF, MTWR, MF or WF classes beginning between 12:00-12:50 pm
2:30-4:30 pm	MW, MWR, MWF, MTWR, MF or WF classes beginning between 2:00-2:50 pm
4:45-6:45 pm	M, MW, MWR, MWF, MTWR or MF classes beginning between 4:00-6:25 pm
7:00-9:00 pm	M, MW, MWR, MWF, MTWR or MF classes beginning 6:30 pm or later

Tuesday
Time	Classes
7:45-9:45 am	TR, MTR, MTWRF or TWR classes beginning between 7:00-8:50 am
10:00-12 Noon	TR, MTR, MTWRF or TWR classes beginning between 10:00-10:50 am
12:15-2:15 pm	TR, MTR, MTWRF or TWR classes beginning between 12:00-12:50 pm
2:30-4:30 pm	TR, MTR, MTWRF or TWR classes beginning between 2:00-2:50 pm
4:45-6:45 pm	T, TR, MTR or MTWRF classes beginning between 4:00-6:25 pm
7:00-9:00 pm	T, TR, MTR or MTWRF classes beginning 6:30 pm or later and Common Exam 1

Wednesday
Time	Classes
7:45-9:45 am	MW, MWR, MWF, MTWR, MF or WF classes beginning between 7:00-8:50 am
10:00-12 Noon	MW, MWR, MWF, MTWR, MF or WF classes beginning between 11:00-11:50 am
12:15-2:15 pm	MW, MWR, MWF, MTWR, MF or WF classes beginning between 1:00-1:50 pm
2:30-4:30 pm	MW, MWR, MWF, MTWR, MF or WF classes beginning between 3:00-3:50 pm
4:45-6:45 pm	W or WF classes beginning between 4:00-6:25 pm
7:00-9:00 pm	W or WF classes beginning 6:30 pm or later

Thursday
Time	Classes
7:45-9:45 am	TR, MTR, MTWRF or TWR classes beginning between 9:00-9:50 am
10:00-12 Noon	TR, MTR, MTWRF or TWR classes beginning between 11:00-11:50 am
12:15-2:15 pm	TR, MTR, MTWRF or TWR classes beginning between 1:00-1:50 pm
2:30-4:30 pm	TR, MTR, MTWRF or TWR classes beginning between 3:00-3:50 pm
4:45-6:45 pm	R or TWR classes beginning between 4:00-6:25 pm
7:00-9:00 pm	R or TWR classes beginning 6:30 pm or later and Common Exam 2

Friday*
Time	Classes
7:45-9:45 am	F only classes beginning between 7:00-9:55 am
10:00-12 Noon	F only classes beginning between 10:00-11:55 am
12:15-2:15 pm	F only classes beginning between 12:00-1:55 pm
2:30-4:30 pm	F only classes beginning between 2:00-3:55 pm
4:45-6:45 pm	F only classes beginning between 4:00 pm or later

*Friday will also include courses offered at a non-standard start time and special makeup exams for on-campus students if authorized by the instructor.

Saturday
Saturday classes should hold exams during the meeting time that falls during exam week.

Sunday
Sunday classes should hold exams during the meeting time that falls during exam week.