CONTACT INFORMATION:

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- **Office Hours:** **MONDAYS, THURSDAYS 1:30-2:30** Phy 353

- **Contact preferences**
  
  I encourage you to use the Discussion Forums on LEARN to discuss problems you have with the assignments or to ask questions about the course - if you are having problems, others likely are too. I will monitor the forums via an email forward, normally at least once per day and will respond to correct concepts, answer questions, etc.

  Feel free to contact Prof. Campbell by email, **including PHYS 256 in the subject line.** Emails will normally be responded to within 24 hours. Visit me in office hours or if needed make an appointment to see me.

  Please make sure that your WatIAM ID is up to date with the email address that you use so that you receive notifications from me via Learn.

COURSE DESCRIPTION:

Optics is a very active field today and it is a field with many applications in physics, chemistry, engineering and the life sciences. There is a bright future for jobs and research for those trained in optics, both in the short term for imaging, visualization and displays, and biophotonics and in the longer term for quantum optics and telecommunications. Students at Waterloo have an opportunity to take two additional optics courses in 3rd year, PHYS 393 Physical Optics and PHYS 394 Light-Matter Interactions, both require PHYS 256 and PHYS 364 or AMATH 353. Optics overlaps with electromagnetism but Phys 256 will be taught without assuming knowledge of E &M. **Properties of waves, energy, momentum, force and pressure, learnt in first year Physics, will be BRIEFLY reviewed and then applied in describing the properties of light.**

- **Calendar course description:** Electromagnetic waves and the nature of light. Geometrical optics, aberrations. Physical Optics: interference, Fraunhofer and Fresnel diffraction, polarization. Optical instruments.

- We will not cover Fresnel diffraction.

- **Course Prerequisite Requirements:**
Prereq: PHYS 112 or 122 (ECE 106); One of MATH 108, 128, 138, 148 (ECE 206).
Antireq: PHYS 226, 246

If you have failed a prerequisite or have withdrawn from a corequisite, you must inform Dr. Campbell

- **Course topics:** I will give more detailed summaries of course topics covered prior to the midterm and the final exam.
- **Course delivery:** Most lectures will be delivered using Powerpoint. Sample problems will be solved in tutorial. There will be many demonstrations, in class and in tutorial as well as web based demonstrations. Lecture notes, additional review materials and web based demonstrations will be posted on LEARN. Assignments and solutions will be posted on LEARN. **Problems solved in tutorial will not be posted.** There will be a project for bonus marks.

**LEARNING OBJECTIVES:**

- understand the particle/ wave nature of light
- understand the meaning of equations describing light propagation and the interaction of light and matter
- understand the design of simple optical instruments
- be able to visualize and draw diagrams demonstrating the optical properties of light and materials
- be able to solve optical problems
- appreciate the breadth of applications of optics
- an extra assignment will allow you to clearly communicate optics concepts

**RESOURCES:**

- **Required Text:** OPTICS by E. Hecht, 4th edition. Older editions are satisfactory but references and problem numbers may be wrong. This is a useful text for 3rd year courses and as a general optics reference. EDITIONS ORDERED FROM OVERSEAS OFTEN HAVE DIFFERENT PROBLEMS THAN IN THE NORTH AMERICAN EDITION. The text is on reserve in the Davis Centre Library.
- **Suggested Reference Texts:**
  - Optics, Schaum’s Outlines by E. Hecht. An inexpensive book with many solved problems. The material parallels the primary text. *On reserve in the Davis Centre Library*
  - Introduction to Optics, any edition, by Pedrotti and Pedrotti. This has sometimes been used as the text for this course. There are a large number of other texts on optics at an appropriate level. *On reserve in the Davis Centre Library*
  - Physics for Scientists and Engineers by Serway or other first/second year text covering optics.
- Learn materials
  - See powerpoint notes, online demos, sample exams, problem solution sets, URL’s and other materials
- Reserves: The required text and two suggested texts have been placed on reserve.

**TOPICS:** Planned Topics with Section numbers from Hecht:

Ch. 2  Wave Motion: Mostly review, 2.5, 2.6 are new, 2.8-2.9 is for later math, but we do the physics.
Ch. 3  EM Theory: Omit most except some of 3.2.1 3.3, 3.4.4, 3.5 (concept of dispersion only). Physics 224 OR 252/253 will teach this properly.

Ch. 4  Propagation of Light: Qualitative treatment in early sections, not 4.5 some of 4.6 and on for concepts, including Fresnel equations, total internal reflection, reflecting prisms, evanescent wave concept only, not 4.8, 4.9 concept, not 4.10, 4.11 except 4.11.2 concept.

Ch. 5  Geometrical Optics: Very important material. not 5.6.1, 5.7.1, 5.72-5.75, 5.8, 5.9. *** The rest of the chapter is the core of the course, together with Ch.6, 9.

Ch. 6  More Geometrical Optics: Mostly 6.1, no 6.2-6.5.

Ch. 7  Superposition: 7.1, not 7.1.4, not 7.2, not 7.3, not 7.4 except concept of sum of frequencies, will do briefly 7.4.3 but not responsible

Ch. 8  Polarization: Only 8.1.1 linear polarization. And 8.6 Brewster’s angle.

Ch. 9  Interference: Important material. 9.1, 9.2-only concept of temporal and spatial coherence, Not 9.2.2, 9.3 to end of equations, 9.4 no interferometers except Michelson, not 9.5, not 9.6, simplified 9.7.2 single film, not 9.8. *** The core of the course, together with Ch.5, 6.

Ch.10  Diffraction: Only 10.1, 10.2.1, 10.2.5, 10.2.6- We omit some of the heavier general theory, not 10.2.7, not 10.3-10.5.

TUTORIAL EXPECTATIONS AND PRIVACY:

- Tutorial Attendance and Privacy statement: In order to protect their privacy, students may choose to hand in their assignments with their ID number as identifier or with a blank page with only their name on the front of the assignment.
  - In order to have your assignments and term test returned in person, please attend tutorials. After the tutorial at which an assignment is returned, Campbell will bring assignments to lectures and tutorials and students can pick them up from a pile.
  - Tutorials are not mandatory but you are responsible for the concepts demonstrated and the types of problems that will be solved in tutorial. Please send emails to Dr. Campbell in advance of tutorials describing concepts that you would like clarified or types of questions that are giving difficulty.
  - Dr. Campbell will not normally give one on one mini tutorials to students who miss lectures or tutorials. In that situation, students should photocopy the notes of a classmate or consult online materials.

ASSESSMENT:

- Grading Policy: Final Mark is the best of: 25% assignments + 25% test + 50% final OR 25% assignments + 10% test + 65% final. Completing Introduce Yourself online by the deadline will result in one bonus mark. There will be another bonus written assignment for 5% credit. See details on Learn. However, any student with less than 40% on the final exam will fail the course.
  - PLAGIARISM DETECTION SOFTWARE (TURNITIN) WILL BE USED TO SCREEN THIS EXTRA ASSIGNMENT. THIS IS BEING DONE TO VERIFY THAT USE OF ALL MATERIAL AND SOURCES IN THIS ASSIGNMENT ARE DOCUMENTED. Turnitin can also be used by
students to encourage proper citation and referencing. *Students will be given the option of a complete an annotated bibliography if they do not want to have their assignment screened by Turnitin. Please email me if you wish to discuss further alternatives.*

The ‘Notification’ feature of LEARN can be helpful for both instructors and students so that they can receive course alerts regarding new and changed Dropbox, ePortf, and quiz deadlines, grade updates and releases and news updates. Instructors may want to encourage students to use this feature. Information on subscribing to ‘Notifications’ can be found at the following URLs for: Students: https://uwaterloo.ca/learn-help/students/news Click on your name in the upper right and then on Notifications

- **There will be a term test** Tuesday Oct 20th 11:30 ROOM TBA
  - **Equation sheets:** You will be allowed a sheet of equations in the midterm and 2 sheets in the final examination. **SEE THE RULES AND TEMPLATES on LEARN.** **FAILURE TO FOLLOW THE EQUATION SHEET RULES MAY BE DEALT WITH UNDER POLICY 71 STUDENT DISCIPLINE AS AN UNAUTHORIZED EXAM AID.** *If the equation sheet has minor violations, a mark penalty of 5% will be assessed. If the sheet does not follow the guidelines and gives the student an unfair advantage, it may be taken from the student near the beginning of the exam.*
  - **You will only be allowed to use a ‘blue goggle’ calculator, a ‘pink-tie’ calculator or Engineering’s new ‘yellow hardhat’ calculator, WITH AN APPROVED STICKER** during the midterm and final exam. Calculators purchased on campus will be approved with a sticker at the time of purchase. **Those pink tie calculators purchased elsewhere can get approved by seeing an advisor in MC 4023.** Senior Science students may purchase ‘blue goggle’ calculators from the Book Store (the cost is under $20; supplies are limited).
  - **Calculators without approved stickers will also be confiscated at the beginning of the exam AND THIS MAY BE DEALT WITH UNDER POLICY 71 STUDENT DISCIPLINE AS AN UNAUTHORIZED EXAM AID.**

- **Assignments:** There will be 9-10 weekly assignments during the term (~2 to be forgiven), to be handed in online OR in the P256 slot just outside room P211 by 4PM on the due date. **0.5% WILL BE DEDUCTED FOR EACH ASSIGNMENT OR MIDTERM NOT PICKED UP BY THE LAST DAY OF CLASSES**
  - Any changes in assignment due dates or test dates will be discussed and announced in class and posted on the course webpage. However, the grading scheme will remain the same.
  - Copies of solutions will be available on LEARN after you have handed in your assignments.
  - These assignments should take a maximum of a few hours.
  - **CHECK LEARN FOR DUE DATES.**
  - **THE ONLINE DROPBOX WILL CLOSE 24 HOURS AFTER THE DUE DATE. Please email me if you intend to hand in an assignment late. All late assignments must be handed in online (within 24 hours) or under Prof. Campbell’s office door (PHY 353). (The door to the corridor locks at 10pm and for the weekend).** **The physical dropbox in Physics will not be checked for late assignments.**
  - Late assignments will incur a penalty of 10% a day, including the day that the assignment is due. **No assignments will be accepted after the solution set has been posted online.**
• If you wish an EXTENSION ON AN ASSIGNMENT, provide reasons to Dr. Campbell in person or by email before the due date of the assignment.

• I will retain assignments for pickup up to the final exam but beyond that date as per FIPPA rules, assignments and midterms will be securely destroyed.
  o Deadline impacts of online learning environment service disruptions can be seen here:
    Service Interruptions in the Online Learning Environment: Guidelines for Instructors

• Missed Exams, Term tests and Assignments: A student who misses a final exam, assignment, etc. and who provides a Verification of Illness (VIF) or other similar form (please see the information that will be needed) with a valid reason may be accommodated, at Prof. Campbell’s discretion, dependent on the severity of the situation and the student’s standing in the course. PROVIDE THE VIF AS SOON AS POSSIBLE. For legitimate reasons with adequate documentation, an alternative exam may be written during the Faculty of Science make up exam dates. BUT, FOR EXAMPLE, IF A STUDENT IS FAILING THE COURSE PRIOR TO MISSING THE FINAL EXAM OR PRESENTS WEAK DOCUMENTATION, THE STUDENT WILL BE ADVISED TO RETAKE THE EXAM THE NEXT TIME THAT THE COURSE IS OFFERED TO ALLOW NEEDED REMEDIAL WORK.
  o If the midterm or an assignment is missed for a valid reason, the grading system will normally be modified, placing more weight on the final exam.
  o Please feel free to discuss such situations or any other extraordinary circumstances with me, preferably in advance of the assignment, term test or exam, but definitely within 48 hours by email if necessary.

• Reminder: Only VIFs, issued from Waterloo’s Health Services (https://uwaterloo.ca/health-services/), are acceptable documentation when the service is available (https://uwaterloo.ca/health-services/student-medical-clinic/services). Students who are sick on a weekend, during off-hours, while out of town or receiving ongoing care from a family physician or specialist may have to provide valid and suitably informative VIFs from other health service providers. Information should include
  1) the date of the physician assessment
  2) the dates of illness
  3) the level of incapacitation, and
  4) whether the diagnosis was made based on the physician’s assessment or strictly on the student’s description.
  o Students should bring their VIFs to the Science (or their faculty) Undergraduate Office for verification and filing and then to Dr. Campbell.

DROP AND ADD DATES

PLEASE check appropriate UWaterloo websites (Important Dates on Learn for example) for details concerning various dates (e.g., final examination, drop deadlines)

ACADEMIC INTEGRITY:

• Office of Academic Integrity provides relevant information for students, faculty and staff, including a fact sheet and an academic integrity tutorial.
  o Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.
  o Although students can learn a great deal by discussing the approach to problem assignments in group situations, it is not acceptable to copy each other’s solutions nor
is it acceptable to make a detailed verbal solution or a written solution to an assigned problem available to another student.

- The Faculty of Arts has an excellent website on “Avoiding Academic Offences” or see Academic Integrity for Students.

- The following are not acceptable:
  - Re-creating test questions and answers without the express permission of the course instructor
  - Obtaining, distributing or receiving unauthorized academic material without the express consent of the course instructor
  - Sharing unauthorized course-related materials via hard-copy, email, social media or LEARN
  - Using LEARN email lists to sell or distribute unauthorized academic material.

- **Discipline:** Students are expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions. Completion of the Orientation to Academic Integrity Tutorial is encouraged and familiarity with Policy #71, (Student Discipline) is expected. Students who are unsure whether an action constitutes an offense, or who need help in learning how to avoid offenses (e.g., plagiarism, cheating) or about ‘rules’ for group work/collaboration should seek guidance from the course instructor, academic advisor, or the Associate Dean of Science for Undergraduate Studies. For information on typical Policy 71 penalties, students should check Guidelines for the Assessment of Penalties.

- **Grievance:** Students, who believe that a decision affecting some aspect of their university life has been unfair or unreasonable, may have grounds for initiating a grievance. Students should read Policy #70, Student Petitions and Grievances, Section 4. When in doubt, students must contact the department’s/school’s administrative assistant who will provide further assistance.

- **Appeals:** A decision or penalty imposed under Policy 33 (Ethical Behavior), grievances under Policy #70 (Student Petitions and Grievances) or Policy #71 (Student Discipline) may be appealed, if there is a ground. Petitions may not be appealed. Students who believe they have a ground for an appeal should refer to Policy #72 (Student Appeals).

**COURSE RULES/CONSIDERATIONS:**

- **Exam Period:** Dec. 8-22nd, 2015
  - Students should start checking for posted exam dates toward the middle of October.
  - Student travel plans are not considered acceptable grounds for granting an alternative examination time.
  - More information about UW’s Final Examination policies is available here.

- **Students with Disabilities:**
  - AccessAbility Services, located in Needles Hall extension in room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If students require academic accommodations to lessen the impact of their disability, they should register with AccessAbility Services at the beginning of each academic term.

- **Changes to Course Outlines**
  - Revised course outlines will be posted/provided, if course details change (e.g., topics covered, emphasis on certain topics, etc.)
Course elements that will not change are the:
   - Grading scheme
   - Course elements related to evaluation

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