Engineering Physics
ENG PHYS 3E04/Physics 3N04
Fundamentals of Physical Optics
Undergraduate Studies
Winter 2027
Course Outline

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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Office Hours:
by email appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn is the official course website for course communication, submission of work and grading, http://avenue.mcmaster.ca/. It is the students' responsibility to regularly check the course webpage for updates and announcements.

McMaster email addresses will be used in the communications.

CLASS FORMAT

Course Dates: 01/04/2027 - 04/07/2027
Units: 4
Course Delivery Mode: All classes are in-person.
Course Description: Geometrical optics, electromagnetic waves, interference of light, Fraunhofer and Fresnel diffraction, polarized light, Fresnel equations, optical properties of materials, introduction to optical systems and precision optics experiments, selected topics in modern optics.
Prerequisite(s): Registration in the final level of an Engineering Physics program
Antirequisite(s): PHYSICS 3N03, ENGPHYS 3E03

The course is scheduled as follows:

• C01: lecture	Tuesday	11:30 – 12:20 pm	see Mosaic or Avenue for location
• C01: lecture	Thursday	11:30 – 12:20 pm	see Mosaic or Avenue for location
• C01: lecture	Friday	11:30 – 12:20 pm	see Mosaic or Avenue for location
• T01: tutorial	Tuesday	1:30 – 2:20 pm	see Mosaic or Avenue for location
• L01: lab	Wednesday	2:30 – 5:20 pm	see Mosaic or Avenue for location
• L01: lab	Thursday	2:30 – 5:20 pm	see Mosaic or Avenue for location
• L01: lab	Friday	2:30 – 5:20 pm	see Mosaic or Avenue for location

The course is organized as follows:

- 4 classes (3 lectures and 1 tutorial) per week
- 4 in-person labs
- Practice questions (for each Chapter)
    - Self-marking (answers to the practice questions can be found at the end of the textbook, solutions of the selected questions will be provided at tutorials)
- Tutorial Presentations
    - Each team will present solutions of the selected practice questions and important concepts/phenomena learnt in the course
    - Need to select a team and preferred date of presentation by the end of **Friday Jan.8th, 2027** (First come, first take). After the deadline, it will be randomly assigned by TAs.
    - Presentation schedule will be posted to Avenue to Learn
- 5 Quizzes (in-class, in-person)
    - 50 min.
- Final exam (in-person)

COURSE INTENDED LEARNING OUTCOMES

By the end of this course, students should be able to:

- Solve a range of problems in the domain of geometrical optics
- Demonstrate a good understanding of the wave nature of light
- Demonstrate a good understanding of the principle of superposition – leading to the interference of light in a wide range of situations, including diffraction phenomena.
- Be able to solve problems connected with the operation of optical instruments which directly exploit light wave interference.
- Explain the relation of the optical properties of materials and selected mechanisms for the generation of polarized light.
- Solve problems involving simple waveguides and the propagation of light in modulated media
- Understand the application of boundary conditions in electromagnetic problems, and in particular the development and implications of Fresnel's equations
- Be capable of solving problems connected with the domain of light-matter interactions

ENGINEERING ACCREDITATION: GRADUATE ATTRIBUTES AND LEARNING OUTCOMES

The Canadian Engineering Accreditation Board (CEAB) is a division of Engineers Canada and is responsible for accrediting undergraduate engineering programs across Canada. Accreditation by the CEAB ensures that the engineering programs meet a national standard of quality and cover essential educational requirements. Graduate Attributes are a set of qualities and skills that the CEAB expects engineering graduates to possess. These attributes are a benchmark for the learning outcomes of accredited engineering programs. This section lists the Graduate Attribute Indicators associated with some of the Learning Outcomes in this course.

The Graduate Attributes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's grade in the course.

Outcomes	Indicators
Be able to propose and evaluate solutions to problems in geometrical optics, interference-based optical instruments, and light–matter interactions using substantiated physical and quantitative reasoning, while recognizing the assumptions and limitations of the solutions.	2.2
Be able to select appropriate principles of wave optics and electromagnetics to plan experiments, determine suitable data collection methods, and develop analysis strategies for investigating interference, diffraction, Fresnel effects, and other optical phenomena.	3.1
Be able to organize and deliver an effective oral presentation on selected topics in optics, using appropriate technical content, terminology, and explanations for the intended audience.	7.3

For more information on Engineering Accreditation, please visit: https://www.engineerscanada.ca

LAB INFORMATION

4 in-person labs

- Labs will be done in-person (lab schedule will be posted on Avenue to Learn)
- Lab group selection: **Due Friday, Jan. 15th, 2027**
  - Lab group will be randomly assigned by TAs after the due date.
- Submission deadline of lab report will be posted on Avenue to Learn
- Late submission of lab reports will not be marked and a grade of ZERO will be assigned.

LAB SAFETY

- Students must pass the laser safety training before the start of lab sessions.

COURSE SCHEDULE

A weekly breakdown of the course schedule

Date/Week	Topic	Readings (textbook)
Week 1	Overview and nature of light	Chapter 1
Week 2	Geometrical Optics and ZEMAX	Chapter 2
Week 3	Wave Equations	Chapter 4
Week 4	Superposition of Waves	Chapter 5
Week 5	Interference of Light	Chapter 7
Week 6	No class	
Week 7	Interference of Light	Chapter 7
Week 8	Optical Interferometry, Coherence	Chapters 8, 9
Week 9	Matrix Treatment of Polarization	Chapter 14

Week 10	Production of Polarized Light	Chapter 15
Week 11	Fresnel Equations	Chapter 23
Week 12	Fraunhofer Diffraction	Chapter 11
Week 13	Fresnel Diffraction	Chapter 13
Week 14	Fresnel Diffraction	Chapter 13

This lecture schedule is based upon current university and public health guidelines and may be subject to changes during the term. Any changes to the schedule or course delivery will be communicated on the course announcements section on Avenue to Learn. Please check the announcements prior to attending class.

REQUIRED/OPTIONAL MATERIALS AND FEES

Required Texts:

- "Introduction to Optics", 3rd edition, by Pedrotti, Pedrotti, Pedrotti (Cambridge 2017).

Lecture notes:

- To be posted on Avenue to Learn

Lab manuals:

- To be posted on Avenue to Learn

Calculator:

- Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

Other Materials:

- The course will make significant use of ZEMAX.
- Instruction on installation of the free student version of ZEMAX will be posted to Avenue to Learn.

COURSE ASSESSMENT DETAILS

Component	Due Date	Weight
Quizzes		25%
Labs		20%
Presentations		5%
Final Exam		50%
Total		100%

GRADING SCALE

The McMaster 12 Point Grading Scale

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76

B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

MSAF policy will be followed. For examples:

- An MSAF for a missed quiz will automatically allocate the missed grade to the total quiz grade component.
- An MSAF for a missed assignment will automatically lead to a 1-week extension for that assignment, but it still needs to be submitted.

GENERATIVE AI

Students may freely use generative AI in this course so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. Use of generative AI outside assessment guidelines or without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the expectations for citation and reference and to do so appropriately.

APPROVED ADVISORY STATEMENTS

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics and the Faculty of Engineering are committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of

credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:
1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a

positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

ACADEMIC ADVISING

Academic Advisors are available to assist you with any problems or questions you may have. This includes course selections, changes to your enrolment, McMaster Student Absence Form (MSAF), Religious, Indigenous, or Spiritual Observances (RISO) forms, exams, taking courses at another university (for credit at McMaster), Petitions for Special Consideration, and much more. Below is the contact information for the Office of the Associate Dean (Academic) in the Faculty of Engineering:

JHE-Hatch 301
https://www.eng.mcmaster.ca/programs/academic-advising
(905) 525-9140 ext. 24646

PHYSICAL AND MENTAL HEALTH

For a list of McMaster University's resources, please refer to the Student Wellness Centre.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work". An abbreviated version is provided below.

The University recognizes that students periodically require relief from academic work due to extenuating circumstances. Students seeking relief for missed academic term work are expected to read the ***McMaster Student Absence Form Policy***. The Policy aims to manage these requests by taking into account the needs and obligations of students, instructors and administrators. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in their course. Any concerns regarding the granting of relief should be directed to the Faculty Office.

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three (3) calendar days:**

    - Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
    - Students may submit requests for relief using the MSAF once per term.

- An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
- The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
- The MSAF cannot be used for academic work that has already been completed or attempted.
- An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
- The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three (3) calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**

    - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
    - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.