ELEC 5709 (0.5 credit)
Lasers
Fall 2025

Instructor: Chris Smelser
Office: 5144 Mackenzie Bldg.
Office Hours: TBD
Lecture: Mondays/Wednesdays **(2:35** p.m. – 3:55 p.m.)
Location: ME 3165
Tutorial: N/A
Location: **N/A**
Email: Christopher.Smelser@carleton.ca
Phone: **+1 (613) 520-2600 ext 4430**
TA: **N/A**

Course Description: This course is intended to serve as an introduction to Lasers. Topics covered in the course will include absorption, emission, broadening mechanisms, dispersion, gain, population inversion, three and four-level lasing schemes, Q-switching, mode-locking, gaussian beam optics and laser light propagation.

Course Objectives:

- Students will learn a variety of concepts related to lasers including: laser types, gain and rate equations, pulsed lasing, resonators, Gaussian beam optics, and beam propagation.
- Concepts will be reinforced with the use of Matlab.

Textbook/Reference Material:

The recommended texts for this course is:

Laser Physics
By Peter W. Milonni and Joseph H. Eberley
ISBN: **978-0-470-38771-9**
$181.38 on Amazon

Understanding Lasers
By Jeff Hecht
ISBN:**978-1-119-31064-8**
$60 on Amazon

Grading:

	%
Test 1	30
Test 2	30
Final Report	25
Final Presentation	15
Total	100

Final Presentation and Report:

The final presentation and report will be based on a journal article. A list of acceptable journal articles will be provided during the term. The duration of the presentation will be determined by the overall size of the class, however, typical presentations would be 10 minutes with 3 minutes for questions. The final report will be a short 5-page summary of the journal article while exploring some of the background of the topic (through cited papers).

Course Policies:

Late Final Report: Final Reports are expected to be handed in on Brightspace by the end of the exam period. Failure to hand the report in on Brightspace prior to this will result in a 20 % penalty per day up to a maximum of 5 days.

Plagiarism: The reports in this course are expected to be done individually.

AI: Use of generative AI tools (such as ChatGPT) in course work is prohibited unless explicitly authorized by the course instructor for specific elements of the course

Class Schedule, Projects and Assignments.

Week	Due Date	Topics / Assignments	Reading / Assignment
1	Sept. 3	Introduction to Laser Operation; Overview of Lasers	Chapter 1 (Milonni/Eberley) Chapter 1 (Hecht)
2	Sept. 8, 10	Atoms, Molecules and Solids: Energy Levels, Insulators, Semiconductors and LED's Physical Basics	Chapter 2 (Milonni/Eberley) Chapter 2 (Hecht)
3	Sept. 15, 17	Absorption and Emission: Spontaneous Emission, Absorption, Broadening	Chapter 3 (Milonni/Eberley) Chapter 2 (Hecht)
4	Sept. 22, 24	Absorption and Emission cont'd	Chapter 3 (Milonni/Eberley) Chapter 2 (Hecht)
5	Sept. 29, Oct. 1	Laser Oscillation: Gain and Threshold: Feedback, Rate equations, Three and Four-level laser schemes, Small-signal gain and saturation, Spatial Hole burning and Spectral Hole Burning	Chapter 4

6	Oct. 6, Oct.8	Laser Resonators; Longitudinal Modes; Transverse Modes; Single mode operation Multi-mode and Pulsed Lasing: Q-switching, Mode Locking, Amplified Spontaneous emission	Chapter 7 (Milonni/Eberley) Chapter 3 (Hecht) Chapter 6 (Milonni/Eberley)
7	Oct. 15	Test 1	Up until week 6
8	Oct. 20-24	Reading Week	
9	Oct. 27, Oct. 29	Multi-mode and Pulsed Lasing: Q-switching, Mode Locking, Amplified Spontaneous emission (cont'd) Laser Properties: Linewidth, Coherence, Polarization, Propagation, Dispersion.	Laser Properties: Linewidth, Coherence, Polarization, Propagation, Dispersion. Chapter 8 (Milonni/Eberley) Chapter 4-6 (Hecht)
10	Nov. 3, Nov. 5	Laser Types: Gas Lasers, Solid State Lasers, Fiber Lasers, Semiconductor Lasers	Chapter 7-10 (Hecht)
11	Nov. 10, Nov. 12	Applications of Lasers.	Chapter 12-13 (Hecht)
12	Nov. 17	Applications of Lasers (cont'd)	Chapter 12-13 (Hecht)
12	Nov. 19	Test 2	Weeks 9-11
13	Nov. 24, Nov. 26	Presentations	
13	Dec. 1, Dec. 3	Presentations	
13	Dec. 5	Presentations/Lab Tour	

ACADEMIC ACCOMMODATION

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the *Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances*, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

ACADEMIC INTEGRITY

The University Senate defines plagiarism in the regulations on instructional offenses as "to use and pass off as one's own idea or product work of another without expressly giving credit to another."

Borrowing someone else's answers, unauthorized possession of tests or answers to tests, or possession of material designed in answering exam questions, are also subject to university policy regarding instructional offences. Students who post their code online are making themselves a potential party to plagiarism and are subject to the consequences. For more information on Carleton University's Academic Integrity Policy, consult https://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy-2021.pdf

COURSE COPYRIGHT

IMPORTANT DATES TO REMEMBER – Academic Year 2024-2025

WITHDRAWALS

The last day to withdraw from fall term courses with a fee adjustment is **September 30, 2025** (financial withdrawal). Withdrawals after this date will create no financial change to fall term fees and will result in a permanent notation of WDN appearing on your official transcript.

The last day to withdraw from fall courses without academic penalty is **November 15, 2025** (academic withdrawal).

OFFICIAL FINAL EXAMINATION PERIOD

Fall term: **December 8-20, 2025 –** Examinations are normally held all seven days of the week.

For a complete listing of academic and financial dates and deadlines for the 2025/2026 academic year, please visit https://calendar.carleton.ca/academicyear/