ELEC 5709 (0.5 credit)
Lasers
Fall 2020

Instructor: Chris Smelser
Office: 7076 Minto CASE
Office Hours: Thursdays 10:30-2:30 (online)
Lecture: Thursdays/Fridays **(2:30** p.m. – 4:00 p.m.)
Location: Online
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.
- Concept will be reinforced with the use of Matlab.

Textbook/Reference Material:

The recommended text for this course is:

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

Additionally this text may be of use:

Lasers
By Anthony E, Siegman
ISBN: **978-0-935702-11-8**

Grading:

	%
Quizzes	3x10
Mid-Term	30
Final Exam	40
Total	100

Class Schedule, Projects and Assignments.

Week	Due Date	Topics / Assignments	Reading / Assignment
1	Sept. 10,11	Introduction to Laser Operation; Overview of Lasers Atoms, Molecules and Solids: Energy Levels, Insulators, Semiconductors and LED's	Chapter 1
2	Sept. 17, 18	Atoms, Molecules and Solids: Energy Levels, Insulators, Semiconductors and LED's cont'd Absorption and Emission:Spontaneous Emission, Absorption, Broadening.	Chapter 2
3	Sept. 24, 25	Absorption and Emission:Spontaneous Emission, Absorption, Broadening cont'd	Chapter 3 Quiz 1
4	Oct. 1, Oct. 2	Absorption and Emission cont'd; Sodium Vapour Example 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	
5	Oct. 8, Oct. 9	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. 15, Oct. 16	Laser Oscillation: Power and Frequency: Output coupling, single-mode oscillation	Chapter 5
7	Oct. 22	Laser Oscillation: Power and Frequency: Output coupling, single-mode oscillation cont'd	
7	Oct. 23	Midterm	Covers chapters 1-4 and some of chapter 5
8	Oct. 26-30	Reading Week	
9	Nov. 5, Nov. 6	Polarization Laser Resonator, Linewidth and Coherence	
10	Nov. 12, Nov. 13	Laser Resonator, Linewidth and Coherence cont'd	Chapter 6

		Multi-mode and Pulsed Lasing: Q-switching, Mode Locking, Pulse amplifications, Amplified Spontaneous emission	
11	Nov. 19, 20	Multi-mode and Pulsed Lasing cont'd	Quiz 2
12	Nov. 26, 27	Ray Tracing and Resonator Stability Paraxial wave equation, Gaussian, Hermite-Gaussian and Laguerre Gaussian Beams	Chapter 7
13	Dec. 3, 4	ABCD Law for Gaussian Beams Diffraction	
14	Dec. 10, 11	Propagation of Laser Radiation: Wave Equation, group velocity, chirping	Chapter 8 Quiz 3

ACADEMIC ACCOMMODATION

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation:

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website **carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf**.

Religious obligation:

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website **carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf**

Academic Accommodations for Students with Disabilities:

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton website **carleton.ca/pmc**.

Survivors of Sexual Violence:

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit **carleton.ca/sexual-violence-support**.

Accommodation for Student Activities:

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit **https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf**

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.pdf*

COURSE COPYRIGHT

Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).

IMPORTANT DATES TO REMEMBER – Academic Year 2019-2020

WITHDRAWALS

The last day to withdraw from fall term courses with a full fee adjustment is **September 30, 2020**. 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 term courses without academic penalty is **December 11, 2020**.

OFFICIAL FINAL EXAMINATION PERIOD
Fall term: **December 12-23, 2020 –** Examinations are normally held all seven days of the week.

For a complete listing of academic and financial dates and deadlines for the 2019/2020 academic year, please visit https://carleton.ca/registrar/registration/dates-and-deadlines/