ENG PHYS 4SO3
The Introduction to Lasers and Electro-Optics
Fall/Winter 2016/17
Course Outline

CALENDAR/COURSE DESCRIPTION

The material covered in this course includes the basic description of light in terms of electro-magnetic fields. Relevant aspects of geometric and physical optics as well as physics of radiation will be reviewed. The propagation of light through materials and the optical response of materials are used to introduce non-linear optical phenomena, including optical amplification. The properties of resonators and the basic operation of lasers are discussed and the unique properties of laser radiation are described. These topics are described in the context of representative laser systems and their industrial applications as well as optical mirrors, detectors, modulators, optical fibers, etc.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): EP3E03, and Registration in the final level of an Engineering Physics program
Antirequisite(s): NA

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Chang-qing Xu
JHE A417
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ext. 24314

Office Hours:
Wednesday – 2:30 pm – 4:00 pm
Or by appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Qianli Ma maq5@mcmaster.ca
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ABB 137

TA OFFICE HOURS: SEE COURSE WEBSITE

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://avenue.mcmaster.ca/

COURSE OBJECTIVES

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

- Understand optical processes and physics behind lasing phenomenon;
- Understand the concept, properties, and physics of optical resonators, and their linkage with laser performance;
- Understand laser oscillation mathematically and physically, and its impact on laser performance;
- Understand physics and applications of lasers and other electro-optic devices;
- Be able to understand engineering design process, and follow engineering design process.

MATERIALS AND FEES

Required Textbook:

- Kelin J. Kuhn, “laser engineering”, Prentice-Hall, 1998.

References:

- Richard Syms and John Cozens, "Optical Guided Waves and Devices", McGraw Hill, 1993;
- Frank L. Pedrotti, S. J. Leno S. Pedrotti, "Introduction to Optics", Pretice Hall, 1993;
- Amnon Yariv, "Optical Electronics in Modern Communications", New York, Oxford, Oxford University Press, 1997.

Calculator:

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

COURSE OVERVIEW

Date/Week	Topic	Readings (lecture notes – sections; textbook – chapters)
Week 1	Overview and optical process	Section 1, 2; Chapter 1, 2, 5
Week 2	Laser oscillation and optical resonator	Section 3, 4; Chapter 3, 4, 5
Week 3	Optical resonator	Section 4; Chapter 4
Week 4	Laser cavity	Section 4; Chapter 4
Week 5	Laser performance and types of lasers	Section 4, 6; Chapter 5, 9, 10
Week 6	No class	
Week 7	Types of lasers, amplifiers, and plane wave	Section 5, 6, 7; Chapter 12; Chapter 12 - Syms
Week 8	Plane wave, refractive index, AR coating	Section 7, 8, 10, 11; Chapter 3 – Syms, Chapter 8
Week 9	Index ellipsoid, Pockel's effect	Section 9; Chapter 7 – 12; Chapter 2, 3 - Syms
Week 10	Nonlinear effect, optical waveguide	Section 9, 11
Week 11	Optical waveguide, Guest lecture	
Week 12	Applications (laser display, telecom, etc.)	
Week 13	Applications (presentation)	
Week 14	Applications (presentation)	

ASSESSMENT

Component	Weight
Quizzes (2)	15%
Assignment	35%
Final Exam	50%
Total	100%

ACCREDITATION LEARNING OUTCOMES

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

Outcomes	Indicators
Able to describe optical processes and explain physics behind laser operation; Able to describe optical resonators and apply to laser principles; Understanding of laser oscillation and application to operation; Understanding of optical modulators and ability to apply to engineering example; Demonstrate knowledge of widely used lasers and ability to apply taught theory to real device; Understanding of plane waves and ability to apply mathematics; Knowledge of the interaction between light and materials	1.4
Demonstrates an ability to identify reasonable assumptions (including identification of uncertainties and imprecise information) that could or should be made before a solution path is proposed; Demonstrates an ability to identify a range of suitable engineering fundamentals (including mathematical techniques) that would be potentially useful for analyzing a technical problem; Obtains substantiated conclusions as a result of a problem solution including recognizing the limitations of the solutions	2.1, 2.2, 2.3
Recognizes and discusses applicable theory knowledge base; Selects appropriate model and methods and identifies assumptions and constraints; Estimates outcomes, uncertainties and determines appropriate data to collect	3.1, 3.2, 3.3
Recognizes and follows an engineering design process. (This means an iterative activity that might include recognizing the goal, specifying the constraints and desired outcomes, proposing solutions, evaluating alternatives, deciding on a solution, and implementing); Recognizes and follows engineering design principles including appropriate consideration of environmental, social and economic aspects as well as health and safety issues; Proposes solutions to open-ended problems; Includes appropriate health and safety considerations	4.1, 4.2, 4.3, 4.5
Demonstrates an ability to respond to technical and non-technical instructions and questions; Presents instructions and information clearly and concisely as appropriate to the audience; Constructs effective oral or written arguments as appropriate to the circumstances	7.1, 7.2, 7.3
Critically evaluates and applies knowledge, methods and skills procured through self	12.1, 12.2

directed and self identified sources, including those that lie outside the nominal course curriculum; Shows an awareness of the wide range of engineering societies, literature, conferences, and other information sources

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

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.

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.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity

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.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

1. The McMaster Student Absence Form is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.

2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/A214). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. You should expect to have academic commitments Monday through Saturday but not on Sunday or statutory holidays. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed here: http://www.eng.mcmaster.ca/current/documents.html

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their wok to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to http://www.mcmaster.ca/academicintegrity/.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using X*. Students should be aware that, when they access the electronic components of this course, 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 this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

X = e-mail, LearnLink, Avenue to Learn

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf.