ELEC ENG 4EM4
Photonic Devices and Systems
Winter 2018
Course Outline

CALENDAR/COURSE DESCRIPTION

Fundamentals of light. Optical fibers and their propagation characteristics. Lasers and photo-diodes. Optical amplifiers and modulators. Photonic networks.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registered in Level III or greater in any Electrical or Computer Engineering Program; ELECENG 3EJ4 or PHYSICS 3BA3 and PHYSICS 3BB3
Antirequisite(s): ELECENG 4EM3, ENGPHYS 4K03

SCHEDULE

Lectures: Monday, Wednesday 11:30 am – 12:20 pm; Friday 1:30 pm – 2:20 pm
Tutorial: Tuesday 8:30 am – 9:20 am
Labs: Every Other Week: L01 Monday 2:30 pm – 5:20 pm ; L02 Monday 2:30 pm – 5:20 pm ; L03 Tuesday 2:30 pm – 5:20 pm ; L04 Tuesday 2:30 pm – 5:20 pm ; L05 Wednesday 2:30 pm – 5:20 pm ; L06 Wednesday 2:30 pm – 5:20 pm ; L07 Thursday 2:30 pm – 5:20 pm ; L08 Thursday 2:30 pm – 5:20 pm ; L09 Friday 2:30 pm – 5:20 pm ; L10 Friday 2:30 pm – 5:20 pm

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Shiva Kumar
ITB-A322
kumars@mail.ece.mcmaster.ca
ext. 26008

Office Hours:
Monday - 9:30 am – 11:30 am
Tuesday - 9:30 am – 11:30 am

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

TA Office Hours are Mondays and Tuesdays from 10:30am-11:30am.

Saber Rahbarfam
ITBA-204
rahbas1@mcmaster.ca
ext.24087

Elham Bidaki
ITBA-201
bidakie@mcmaster.ca
ext. 24087

Mahdi NaghshvarianJahromi
ITBA-201
naghshvm@mcmaster.ca
ext. 24087

Karim Mahmoud
ITB-A208
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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://www.ece.mcmaster.ca/~kumars/Photon_dev.htm

COURSE OBJECTIVES

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

- develop knowledge on operating principles of photonic devices and optical fibers,
- design methodologies and analyzing techniques of lightwave communication systems.
- model simple fiber optic communication systems.
- gain hands-on experience on fiber-splicing and fiber optic systems design.

ASSUMED KNOWLEDGE

Electromagnetics
Signals and systems
Communication systems
Electronic circuits

COURSE MATERIALS

Required Texts:
"Fiber-Optic Communications: Fundamentals and Applications", S. Kumar and M.J. Deen, John Wiley and Sons, 2014.

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

Other Materials:
I-clickers are needed for classroom quizzes.

COURSE OVERVIEW

Week 1	Review of electromagnetics	Lecture Notes
Week 2	Basics of optics	Lecture Notes
Week 3	Optical Fibers - single-mode and multi-mode fibers	Lecture Notes
Week 4	Optical Fibers – fiber dispersion Uniform Plane wave	Lecture Notes
Week 5	Optical Sources – basic concepts	Lecture Notes
Week 6	Optical Sources – semiconductor lasers Phase speed and group speed	Lecture Notes
Week 7	Optical Receivers – Photodetectors	Lecture Notes
Week 8	Optical Receivers – Receiver Design	Lecture Notes

Week 9	Optical Transmission System Design – modulation formats	Lecture Notes
Week 10	Optical Transmission System Design – performance evaluation	Lecture Notes
Week 11	Wavelength division multiplexing	Lecture Notes
Week 12	Review	Lecture Notes

LABORATORY OVERVIEW

Date/Week	Topic	Readings
Week 1	Lab introduction and familiarization with the labkit	Lab volt manual
Week 2	Optical Fibers	Lab volt manual
Week 3	Optical Transmitters	Lab volt manual
Week 4	Optical Transmission Systems	Lab volt manual

LABORATORY OPERATION

The students should work individually and finish a quiz at the end of the experiment. The lab marks are based on the lab performance and quiz.

ASSESSMENT

Component	Weight
Midterm	15%
Quiz	25%
Final Exam	40%
Labs	20%
Total	100%

4 lab assignments - worth 5% each, 1 midterm test - worth 15%, quizzes conducted during the tutorials - worth 15%, iclicker quizzes – 10 %, and final exam - worth 40%. *The final exam will test* cumulative knowledge
Grading Policies: Grade adjustment techniques and info on Missed and Late material such as "No make-up quizzes will be granted; Late assignments will be given Zero; Bell curving will not be applied.

ACCREDITATION LEARNING OUTCOMES

Note: The *Learning Outcomes* defined in this section are measured throughout the course and form part of the Department's continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student's actual grade in the course. For more information on accreditation, please ask your instructor or visit: http://www.engineerscanada.ca .

Outcomes	Indicators	Measurement Methods(s)
Basic understanding of light propagation and interaction in photonic devices (linked to accreditation measurement - knowledge base for engineering).	1.4	Midterm

Hands on experience on optical fiber splicing and optical communication system consisting of transmitter, fiber and receiver.	8.2	Lab safety quiz
Will be capable of selecting appropriate model and methods to model/design fiber optic systems (linked to accreditation measurement - investigation).	3.2	Final Exam

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

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" : http://www.mcmaster.ca/msaf/. "

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.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using webpages. 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.

Electrical and Computer Engineering Lab Safety

Information for Laboratory Safety and Important Contacts

This document is for users of ECE instructional laboratories in the Information Technology Building.

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.
4. Proper and safe use of lab equipment should be known before using it.

5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.

Location of Safety Equipment

Fire Extinguisher
On walls in halls outside of labs

First Aid Kit
ITB A111, or dial "88" after 4:30 p.m.

Telephone
On the wall of every lab near the door

Fire Alarm Pulls
Near all building exit doors on all floors

Who to Contact

Emergency Medical / Security: On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.
Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.
University Security (Enquiries / Non-Emergency): Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.
See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs
Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.
ECE Specific Instructional Laboratory Concerns: For non-emergency questions specific to the ECE

In Case of a Fire (Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C

extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire

Do not use a fire extinguisher on people

1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents.

Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:
1. Immediately discontinue use of the equipment.
2. In Power Lab, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

Protocol for Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you're not sure, ask!

In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

Defined Roles

TA	The first point of contact for lab supervision	
ECE Lab Supervisor	Steve Spencer- ITB 147	steve@mail.ece.mcmaster.ca
ECE Chair	Tim Davidson- ITB A111	davidson@mcmaster.ca
ECE Administrator	Kerri Hastings- ITB A111	hastings@mcmaster.ca
ECE Course Instructor	Please contact your specific course instructor directly	