Carleton University
Department of Electronics

Engineering ELEC4702 Fiber Optic Communications

Course Outline ---------- January, 2019

Instructor

Professor B.A. Syrett Room ME4150
Email: bas@doe.carleton.ca
Course web page: www.doe.carleton.ca/courses/ELEC4702

Introduction

In this course you will learn about the fundamental components of a fiber optic communications system, and basic optical link /network design. You will also become familiar with important optical measurements through four or five formal laboratories.

Textbook

The textbook (recommended to purchase) is "Optoelectronics and Photonics" (2nd edition, Prentice-Hall, 2013) by S.O. Kasap. Class notes and lab materials will be handed out in class.

Lecture Outline (Tuesday and Thursday 4-5:30 pm, Room 3190 Mackenzie)

The prerequisites for this course are basic semiconductor physics as covered in ELEC3908 and basic electromagnetic waves as covered in ELEC3909. The student is expected to have a good knowledge of these subjects. It is also beneficial to have some knowledge of communication systems as would be obtained in SYSC3501. The lecture material covers most of Chapters 1-5 of the textbook and some additional material on optics and optical networks not in the textbook. The planned lecture outline is as follows.

Lecture	Topic
1	Introduction
2-7	Basic Optics: ray optics, wave optics, beam optics, EM optics
8-12	Optical Waveguides dielectric slab waveguides, optical fibers: step-index, graded-index, multimode, single-mode, attenuation, distortion, fabrication, mechanical properties, cables
13-17	Optical Sources review of PN junctions, LEDs, laser diodes, noise
18-23	Optical Detectors and Receivers PIN diode, APD, noise, response time, digital receiver, analog receiver
24-26	Passive Optical Components power launching and coupling, connectors, couplers, gratings
27-28	Optical Amplifiers Erbium-doped fiber amplifier
29-36	Optical Communications Systems digital link design, analog link design, WDM, basic optical network concepts

Laboratory (3 hours every odd week, Photonics Lab, Minto 6040)
The lab is scheduled 11:30am-2:30 pm on Friday odd weeks (Lab section 1). There are five planned lab experiments. The labs will be done by lab groups of 3-4 students. The first introductory lab will be on January 11. There is a prelab on laser safety, which must be completed satisfactorily by each student before he/she will be allowed to perform the actual labs.

Prelab --- Laser Safety
Lab 1 --- Basic Optics and Properties of a Laser
Lab 2 --- Optical Fibers
Lab 3 --- Optical Sources (LEDs and Laser Diodes)
Lab 4 --- Photodetectors and Optical Receivers
Lab 5 --- Optical Communication Link

Be prepared for the lab experiment by reading the lab instruction sheets before entering the Photonics Lab. Each student must keep his/her own lab notes in a **hard-covered lab book**, and have the lab book initialed by the instructor or one on the TAs for the course, at the end of each lab period. A lab report must be submitted for each experiment in the lab book (no loose sheets) one week after completion of the lab. This report should include the measurement set-up, a clear description of the measurement performed, data, sample calculations, discussion of results and conclusions. It is not a formal lab report with Purpose, Apparatus, Observations etc., and background theory given in the lab description does not have to be copied over again in the report. A late lab report will be deducted marks at 2 marks per day up to 3 days. A lab report will not be accepted if it is more than 3 days late

Problems
Several problems will be assigned each week on the course website to help the student understand the lecture material and prepare for the midterm and final exams. The student's solutions will not be submitted or graded. Solutions will be posted or will be available from the TA.

Course Grade
The final grade will be determined using the following weighting.

All 5 lab reports	20%
2 midterm examinations	30% (in class February 14 and March 28)
Final examination	50% (will be worth 65% or 80% if one or both midterms are missed for valid, supported reasons e.g. med certificate)
Total	100%

Attendance at all labs is mandatory. Each student must submit all lab reports. A student must receive at least 50% overall and at least 50% on the final exam in order to pass the course. The final examination is for evaluation purposes only and will NOT be returned to the student. If a midterm exam is missed for a medical reason, the midterm weight will be added to the final exam.

Student Responsibilities in the Laboratory
1) Attend each lab punctually. Absence (without permission of the instructor) means no mark for that lab. If you have a valid reason (medical certificate required) for missing a scheduled lab, the lab must be completed as soon as possible after the scheduled lab period.
2) Your eyes will be exposed to potentially harmful laser radiation in the lab. You will be provided with safety goggles. All safety instructions given by the instructor or TA must be observed. Failure to do so will mean expulsion from the lab and a grade of F in the course..
3) Food or drink is not permitted in any lab, especially the Photonics Lab where cleanliness is critically important.

Plagiarism
Plagiarism is a serious instructional offense that will not be tolerated. It involves passing off someone else's original work as your own. Most cases of plagiarism can be avoided by carefully citing sources for any ideas, statements, results etc. that are not your own. Please refer to the section on instructional offenses in the Undergraduate Calendar for additional information.

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**:** write to me 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: http://carleton.ca/equity/accommodation/student_guide.htm

Religious obligation**:** write to me 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: http://carleton.ca/equity/accommodation/student_guide.htm

Students with disabilities requiring academic accommodations**:** in this course must register with the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation of disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC, 613-520-6608, every term to ensure that I receive your *Letter of Accommodation*, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you only require accommodations for your formally scheduled exam(s) in this course, please submit your request for accommodations to PMC by the last official day to withdraw from classes in each term. For more details visit the PMC website: http://www.carleton.ca/pmc/students/acad_accom.html