

ELEC5701 / ELG6371
Fibre and Waveguide Components for
Communications and Sensors (0.5 credit)
Fall 2024

Instructor: Khaled Mnaymneh, PEng
Lecture: Fridays (6:05 p.m. – 8:55 p.m.)
Location: ME 3174
Email: khaled.mnaymneh@carleton.ca

Course Description (from Grad. Calendar)

Optical wave propagation in dielectric waveguides. Theory and practice for passive photonic devices used for routing, filtering, and signal processing, including structural and biochemical sensors. Directional couplers and splitters, filters (gratings and etalons), Mach-Zehnder interferometers, arrayed waveguide gratings, and dispersion compensators.

Course Description (adjusted for more detail)

Review of theoretical concepts of photonics and optical wave propagation in dielectric waveguides. Theory and practice for passive photonic devices used for routing, filtering and signal processing. Directional couplers and splitters, filters (grating and etalons) and Mach-Zehnder interferometers. Theory of dispersion and photonic band gap structures. Introduction to fabrication techniques for photonic integrated circuitry (PICs) and a brief introduction to quantum technologies based on conventional PIC technologies.

Textbook/Reference Material:

The recommended text for this course is:

Fundamentals of Photonics
By Bahaa E. A. Saleh, Malvin Carl Teich
ISBN-10: **0471358320** | ISBN-13: **978-0471358329**

Photonics: Optical Electronics in Modern Communications
By Amnon Yariv, Pochi Yeh
ISBN-10: **0195179463** | ISBN-13: **978-0195179460**

Optical Waves in Crystals: Propagation and Control of Laser Radiation
By Amnon Yariv, Pochi Yeh
ISBN-10: **0471430811** | ISBN-13: **978-0471430810**

Grading:

	%
Journal Club; presentations and participation	10
Midterm	30
Final Presentation	20
Final Assignment	40
Total	100

Tentative Schedule

Week 1: Introduction to course; mathematics and notation needed for the course (and the topic)

Week 2: Ray optics; Review of Maxwell's equations; optical modes; optical properties of materials

Week 3: Condensed Matter physics; band structures' electronic properties of materials

Week 4: Dispersion; Green's Functions; Kramer-Kronig relations

Week 5: Scattering and Propagation, Guided and Evanescent Waves in Integrated waveguides

Week 6: Coupled Mode Theory; Cavity Resonators, Ring Resonators; Spectral Engineering

Week 7: Fiber Optics: propagation, fabrication

Week 8: FALL BREAK

Week 9: MIDTERM

Week 10: Photonic Crystals: Theory and Fabrication

Week 11: Intro to Quantum Optics; integrated quantum optics

Week 12: Project talks

Week 13: Project talks; varia

Inability to Complete an Assignment or Write the Midterm due to Illness

Students who are not able to contribute to a group project, submit an individual assignment, or write the midterm exam due to a certified illness will have the weight of the assignment/exam added to their final examination, upon provision of the appropriate documentation at least two weeks before the final examination.

While every attempt will be made to keep to the schedule listed above, circumstances may necessitate modifications throughout the semester

Medical certificate

Please note that in all occasions that call for a medical certificate you must use or furnish the information demanded in the standard university form. <http://www1.carleton.ca/registrar/forms/>

Academic Accommodations for Students with Disabilities

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your **Letter of Accommodation** at the beginning of the term, and 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 me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (*if applicable*).

Religious observance

Students requesting academic accommodation on the basis of religious observance should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory academic event. Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student. Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services Department for assistance

Pregnancy

Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required.

Plagiarism

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. For more information on Carleton University's Academic Integrity Policy, consult: <http://www1.carleton.ca/studentaffairs/academic-integrity/>