University of Manitoba | Price Faculty of Engineering
Department of Electrical and Computer Engineering

Course Outline

ECE 4580 – Optoelectronics

Fall 2025

Instructor

- Prof. Arkady Major, P.Eng.
  E3–559 EITC
  (204) 474–7541
  a.major@umanitoba.ca

Office Hours
- By appointment

Teaching Assistant
- Marzieh Esmaeilzadeh
  esmaeil2@myumanitoba.ca

Contact Hours
- 4 credit hours
- Lectures:
  3 hours x 13 weeks = 39 hours
- Laboratories:
  3 hours x 5 weeks = 15 hours

Prerequisites:
- ECE 3600 Physical Electronics

Course Objectives

The course starts with an introduction to light and optics. Light sources of different types are discussed, including lasers and Light Emitting Diodes (LEDs). Light modulation and detection methods are also discussed. Finally the course covers fibreoptic systems including fibre optic communications.

Course Content

The following topics will be covered:

- Light: Properties, Vision, Radiometry and Photometry
- Optics: Mirrors, Lenses, Ray Tracing and Imaging
- Radiation Sources: Radiation Profiles, Gas Discharge, LEDs
- Lasers: Principles of Operation, Types of Lasers, Modes of Operation
- Laser Diodes: Principles of Operation, Structures, Main Characteristics
- Detectors: Thermal Detectors, Photodiodes, Sources of Noise
- Light Modulators: Electro-optics, Acousto-optics, Liquid Crystals
- Fibre Optics: Theory of Operation, Characteristics of Fibres
- Fibre Optic Communications

Textbook

Instructor course notes.

Other Resources

Fundamentals of Photonics, B.E.A. Saleh and M.C. Teich, Wiley, 2007.

Learning Outcomes

1. Understand fundamental properties of light and operation principles of basic optical components.
2. Demonstrate a mastery of basic mechanisms of light generation (including lasers) through detailed understanding and analysis of operation principles, characteristics, design architectures and trade-offs of semiconductor lasers.
3. Understand and compare operation principles, characteristics, design architectures and trade-offs of optical detectors and modulators of light.
4. Understand basic system design of fibre optic communication link and fundamental theory of fibre optics.
5. Hands-on testing, measurement and development of optical systems in a range of areas spanning the course.

Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1	D	I	I	I	D		I		I			I
2	D	I	I	I	D		D		I			I
3	D	D	D	D	D		D		I			I
4	D	D	D	D	D		D		I			I
5	I	I	D	D	D		D					1

Traditional Territories Acknowledgement

The University of Manitoba campuses and research spaces are located on original lands of Anishinaabeg, Ininiwak, Anisininewuk, Dakota Oyate, Dene and Inuit, and on the National Homeland of the Red River Métis.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of Reconciliation and collaboration.

Important Dates

- **Term Test**
  October 30th, 2025
  In-class
- **Voluntary Withdrawal Deadline**
  November 18th, 2025
- **National Day for Truth and Reconciliation**
  September 30th, 2025
  No classes or examinations
- **Thanksgiving Day**
  October 13th, 2025
  No classes or examinations
- **Remembrance Day**
  November 11th, 2025
  No classes or examinations
- **Fall Term Break**
  November 10th–14th, 2025
  No classes or examinations

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 25%
- Complementary Studies: 0%
- Engineering Science: 50%
- Engineering Design: 25%

Graduate Attributes

KB: A knowledge base for engineering
PA: Problem analysis
IN: Investigation
DE: Design
ET: Use of engineering tools
IT: Individual and team work
CS: Communication skills
PR: Professionalism
IE: Impact of engineering on society/ environment
EE: Ethics and equity
EP: Economics and project management
LL: Life-long learning

Competency Levels

I - Introduced (Introductory)
D - Developed (Intermediate)
A - Applied (Advanced)

Evaluation

The final course grade is determined by the student's performance on assignments, presentation, in laboratories, and on examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments	10	F, S	1, 2, 3, 4
Presentation	10	F, S	1, 2, 3, 4
Laboratories	10	F, S	1, 2, 3, 4, 5
Term Test	20	F, S	1, 2, 3
Final Examination	50	S	1, 2, 3, 4

∗ Method of Feedback: **F** - Formative (written comments and/or oral discussion), **S** - summative (numerical grade)

CEAB Graduate Attributes Assessed

KB.4 – Recalls and defines, and/or comprehends and applies, first principles and concepts in specialized engineering science.

IN.4 – Understands appropriate safe work procedures during experiments or laboratory exercises.

Student Absences

Attendance in lectures, tutorials, and laboratories is mandatory. For short-term absences due to illness or other extenuating circumstances of 120 hours (5 days) or less, students are required to complete a *Self-Declaration Form for Brief or Temporary Absence* available on the University website.🔗 This form must be submitted to the course instructor within 48 hours of the absence. (No additional documentation is required.)
Note that students are responsible to complete any missed work and must consult with the instructor to make appropriate arrangements.
For absences longer than 120 hours, students must contact the instructor and ECE Undergraduate Advisor, Tammy Holowachuk (Tammy.Holowachuk@umanitoba.ca) for further instructions.

Deferred Final Examinations

Students who miss the regular scheduled writing of a final examination, for valid medical or compassionate reasons, may be given the opportunity to write a deferred examination, subject to approval by the Associate Dean (Undergraduate). All requests for a deferred examination must be made within 48 hours of the missed examination, and must follow the procedure described on the Faculty website, without exception. Course instructors do not have the discretion to grant deferred final examinations.
(https://umanitoba.ca/engineering/student-experience#engineering-student-policies)

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations on Academic Integrity* 🔗, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). This includes the unauthorized use of AI when preparing course deliverables. A student found guilty of contributing to cheating by another student is also subject to serious academic penalty. Integrity also applies to respecting copyrighted course content, which should not be distributed without the creator's permission. Uploading content for the purpose of transcription or other AI-enabled features is commonly a violation of the copyright holder's rights.

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

Copyright Notice

Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

Requirements and Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University's *General Academic Regulations*, as well as Section 3 of the Faculty of Engineering *Academic Regulations* dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

Supplemental Resources