



Course Outline

Instructor

- Gabriel Thomas, P.Eng.
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Office Hours

- By appointment

Teaching Assistant

- Enze Cui
cuie@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 3780 Signal Processing 1

**Traditional Territories
Acknowledgement**

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on original lands of the Anishinaabeg, Cree, Ojibwe-Cree, Dakota, and Dene peoples, and on the 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.

ECE 4440 – Computer Vision

Winter 2024

Course Objectives

An introduction to theory and techniques used for processing and analysis of digital images for autonomous machine interpretation.

Course Content

The following topics will be covered:

- Digital Image Fundamentals
- Intensity Transformations and Spatial Filtering
- Filtering in the Frequency Domain
- Image Restoration and Reconstruction
- Morphological Image Processing
- Image Segmentation
- Feature Extraction
- Image Pattern Classification

Textbook

Digital Image Processing, R.C. Gonzalez and R.E. Woods, 4th Ed., Pearson, 2017.

Learning Outcomes

1. Learning digital image fundamentals: visual perception, digital image pixels, image features.
2. Applying knowledge of Matlab in digital image representation, colour spaces, histogram, quantization of image features.
3. Learning and applying knowledge in analyzing image filtering, DFT, enhancement, and registration methods.
4. Learning and applying knowledge in analyzing image decomposition and reconstruction with wavelets, image morphology, WFT.
5. Learning and applying knowledge in analyzing image segmentation, representation, description, and recognition techniques.

Expected Competency Levels

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

Copyright Notice

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Important Dates

- **Term Test**
Friday, February 16th, 2024
6:00PM–8:00PM
- **Voluntary Withdrawal Deadline**
March 20th, 2024
- **Louis Riel Day**
February 19th, 2024
No classes or examinations
- **Spring Break**
February 20th–23rd, 2024
No classes or examinations
- **Good Friday**
March 29th, 2024
No classes or examinations

Accreditation Details

Accreditation Units

- Mathematics: 15%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 85%
- Engineering Design: 0%

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)

CEAB Graduate Attributes Assessed

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

PA.4 – Evaluates a solution to a complex engineering problem.

Evaluation

The final course grade will be determined from a student's performance in laboratories, periodic quizzes, term test, and a final examination. Students must complete all of the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Laboratories	25	F, S	2, 3, 4, 5
Term Test	25	F, S	1, 2, 3, 4
Final Examination	50	S	1, 2, 3, 4, 5

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

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). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

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.

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.

Requirements/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, smart watches, 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](#)