**Course Syllabus, Winter, 2025**

# COURSE DETAILS

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| **Course Title & Number:** | **ECE 4XXX Research Projects in Machine Learning** |
| **Number of Credit Hours:** | 3.0 Hours |
| **Class Times & Days of Week:** | Wednesdays, 2:30-5:30 p.m. – E1-544 |
| **Location for classes/labs/tutorials:** | E1-544, Online study (Microsoft Teams) see the course outline for days and times |
| **Pre-Requisites (or with instructor approval):** | ENG 2030/2040 Engineering Communication: Strategies,  Practice and Design  COMP 2140 Data Structures and Algorithms  ECE 3400 Engineering Algorithms 2 |

# Course Description

ECE 4XXX provides a comprehensive foundation in advanced research communication skills essential for success in academia and graduate studies, particularly in the field of Machine Learning. Students will critically analyze academic literature through structured literature reviews, test algorithms, gather and interpret data, and use advanced tools to assess results. In addition to crafting well-structured research papers, students will present their findings through written, oral, and visual mediums. The course emphasizes the creation of key academic deliverables such as research proposals and technical reports. By fostering lifelong learning, critical inquiry, and information literacy, this course equips students to navigate the complexities of research and make meaningful contributions to their disciplines.

# Instructor Contact Information

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| **Instructor Names:** | **Dr. Ken Ferens**, Associate Professor, Electrical and Computer Engineering  **Dr. Kenneth Brezinski,** Post Doctorate Fellow, Electrical and Computer Engineering |
| **Office:** | E1-544 |
| **Office Phone No.** | 204-474-8517 |
| **Availability:** | *Thursdays. 10:30- a.m-12:00 p.m. (noon)*, or by appointment. |
| **Email:** | [Ken.Ferens@umanitoba.ca](mailto:Ken.Ferens@umanitoba.ca) and [brezinkk@myumanitoba.ca](mailto:brezinkk@myumanitoba.ca) - *Please remember that you must use only* ***your U of M email account*** *to communicate with us. You are also expected to check your emails regularly, such as twice a week – or more.* Important information is often sent only by email.  Please use the following format when emailing the instruction staff:   * Ensure that the **subject line** states exactly what the email is about, and that you include your name *in full.* |
| **Contact Information:** | *To make an appointment, I prefer that you email us. Emails will be replied to within 24 hours during the school week, and by Monday morning over the weekend.* |

# General Course Information

This course syllabus is intended to help you as we navigate the course and the semester. You’ll find most of the information you will need, but it is your responsibility to familiarize yourself with faculty regulations regarding the completion of the course requirements, attendance and withdrawal. Should you have any uncertainty about your standing in the course or about an absence or about a grade, please bring your concerns directly to the instructor’s attention, in person or by email, and *in a timely manner*. For more specific information related to faculty policies and regulations, consult your department or the university calendar.

# Course Goals

**Goals of the Course:**

* To introduce foundational research communication skills relevant to graduate-level research, including strategies for effective reading, critical analysis, and synthesis of academic literature;
* To develop skills in research-oriented writing by exploring methods for structuring arguments, crafting research papers, and presenting findings in a concise, coherent manner appropriate for academic audiences;
* To provide opportunities for practice, feedback, and reflection on research communication, ensuring students gain confidence and proficiency in written, oral, and visual presentation of their research;
* To engage students in hands-on research activities, including testing Machine Learning algorithms, gathering and analyzing datasets, and using advanced computational tools to assess and interpret experimental results.
* To build competencies in logically structured and stylistically appropriate communication for research, empowering students to convey complex ideas clearly and persuasively;
* To guide students in producing key academic deliverables—such as research proposals, presentations, and reports—preparing them for success in both academia and research-focused careers;

# Intended Learning Outcomes

1. ***Outcome 1*** –Understand and apply foundational principles of research communication, including effective reading, critical analysis, and synthesis of academic literature, tailored for graduate-level research.
2. ***Outcome 2*** – Demonstrate the ability to structure logical arguments, craft well-organized research papers, and present findings clearly and persuasively to academic audiences.
3. ***Outcome 3*** –Construct and deliver professional oral and visual presentations, communicating complex ideas to diverse audiences, including peers, faculty, and professionals in academia.
4. ***Outcome 4*** –Apply strategies for self-assessment, peer review, and instructor feedback to improve communication skills across various academic genres, fostering growth and confidence.
5. ***Outcome 5*** – Develop skills to produce essential academic outputs, such as research proposals, comprehensive literature reviews, and structured project reports, reflecting high standards of academic integrity and professionalism.
6. ***Outcome 6*** –Engage in practical research tasks, including testing algorithms, gathering and analyzing data, using computational tools, and interpreting results, to inform and enhance research communication.
7. ***Outcome 7*** –Exhibit professionalism and ethical awareness in both independent and collaborative research activities, ensuring equitable and respectful contributions to team projects.
8. ***Outcome 8*** *–* Demonstrate advanced information literacy and problem-solving abilities, including locating, critically evaluating, synthesizing, and applying diverse information sources to support rigorous academic and research communication.

***Expected Attributes and Competency Levels\*\****

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| **Learning Outcome** | **Attribute\*** | | | | | | | | | | | |
| **A1** | **A2** | **A3** | **A4** | **A5** | **A6** | **A7** | **A8** | **A9** | **A10** | **A11** | **A12** |
| 1 | D | I | I | I |  |  | D | D |  |  |  | A |
| 2 | A | D |  | A |  |  | A | A |  |  |  | A |
| 3 |  |  |  |  |  |  | A | A |  |  |  | D |
| 4 | D | A | D | D |  | A | A | A |  |  |  | A |
| 5 | A | D | A |  |  |  | A | A |  |  |  | A |
| 6 | A | A | A | A | A |  |  |  |  |  |  | A |
| 7 |  |  |  |  |  | A | A | A |  | A |  | D |
| 8 | A | A | A |  |  |  | A | A |  |  |  | A |

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| **\**Attributes*:**  **A1** A knowledge base for engineering  **A2** Problem analysis  **A3** Investigation  **A4** Design  **A5** Use of engineering tools  **A6** Individual and team work  **A7** Communication skills  **A8** Professionalism  **A9** Impact of engineering on society/ environment  **A10** Ethics and equity  **A11** Economics and project management  **A12** Life-long learning | **\*\**Competency Levels*:**  **I – Introductory Level –** working vocabulary in the area of content & underlying major concepts  **D – Intermediate Development Level** – use these introductory concepts & vocabulary to probe more deeply, read the literature & deepen understanding. At this level, students begin to see the complexity of a discipline & the interplay of sub-disciplines  **A – Advanced Application Level –** approaching mastery of content; appreciation for a field’s richness, debates & uncertainties; able to transfer this knowledge across different courses |

**Course Details:**

You should make sure you can easily and regularly consult this syllabus and the class schedule as well as all the required online course materials.

**Lectures:** 2.5 hrs lecture/week × 13 weeks/term = 32.5 hrs

**Instructional Methods:** lectures

**Course Web Site:**  – UM Learn – all course materials are available only on this site – you are expected to check this site ***before class*** [for example, on Tuesdays] – all assignments will also be submitted electronically.

*Note: the distribution of lecture times may vary from week to week; the class schedule may also need to be changed from time to time, as needed. We will always try to notify you in advance, but that may not always be possible. Always consult UM Learn and check your student email before class for updates from the instructional team.*

**Voluntary Withdrawal Date:** Winter Term **– Wednesday, March 19, 2025**

**Assignments & Evaluation:**

The final grade is determined by your performance in ***all*** of the following *inter-related* *elements* (of varying length and complexity). Because there is no final examination, you ***must complete all of these components*** or risk earning a final grade of “F” or “D”. Note, too, that communication of information (written, oral, graphic) will be evaluated in every assignment.

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| **Assignment/Milestone** | Due date | Percentage | Outcomes |
| Research Topic Exploration & Literature Review   * + **Written Report:** Students choose a research topic, conduct an initial literature review, and synthesize findings from at least 5-7 sources. They should analyze existing research, identify gaps, and formulate research questions.   + **Oral Presentation:** A 15-minute presentation to introduce the topic, provide a rationale for its importance, and summarize key findings. This helps students practice concise, coherent, and audience-tailored communication. | X  X | 20  10 | A1, A2, A5, A8  A3, A7, A2 |
| Milestone 1: Research Proposal   * **Written Proposal:** Students create a formal research proposal, outlining objectives, research questions, methodologies, and anticipated outcomes. The proposal should include an abstract, a review of relevant literature, a methodology section, and a projected timeline for the research. | X | 20 | A1, A5, A4, A6, A8 |
| Milestone 2: Draft Research Paper & Feedback Session   * **Draft Paper**: Students submit a draft of their research paper, including an introduction, literature review, methodology, findings (if applicable), and preliminary conclusions. * **Feedback Session**: The instructional team will provide written comments, and the student must respond to and provide adequate responses addressing the concern of the instructional team. | X  X | 15  5 | A2, A4, A5, A6, A7 |
| **Final Paper:** A fully developed research paper, incorporating peer feedback and revisions from previous drafts, designed to meet the standards of academic publication. | X | 30 | A2, A5, A6, A7, A8 |
| **TOTAL** |  | **100** |  |

***Rubrics:*** All required course assignments are assessed according to the rubrics developed for each component in the assignment. These rubrics specifically assess what has been described in the course objectives and the course outcomes, as well as any elements that are specific to a particular genre.

***Grading*: Provided all the required course components have been submitted**, the final grade for each student is cumulative; that is, your final grade is the aggregate of your individual marks. Consult the *University Calendar,* “General Academic Regulations,” for a description of the letter grades. In the past, students who have achieved an average grade that is higher than 3.65 (out of 4) have normally received the “A” as a final grade.

**Due Dates:** Deadlines are part of an engineering professional’s working life. So, too, is the expectation that deadlines will be met and projects completed on time. With that in mind, please note that all assignments are due on the due date, unless students have arranged with the instructional team in advance to submit these assignments at a later time. Late assignments will **NOT** be accepted unless you make such an arrangement with the instructional team in advance. Students will submit an electronic copy in UM Learn. When submitting an assignment or an electronic file, please use the following format:

*Name of Assignment, Name - for example:* Proposal, Student Name – always include a *Title Page* that includes this information as well as the date & the name of the author.

***Return Dates***: Every effort will be made to provide feedback on assignments as quickly as possible, but these may require a longer time to complete. However, the instructional team will do our best to return assignments within two weeks if it is at all possible. You can expect to receive marks and/or feedback for at least 20% of your final grade before the voluntary withdrawal deadline, Wednesday, March 19th. Other grades will be available after that date.

***Academic Integrity*:** Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and academic integrity in all of their pursuits and activities at the university. As such, students who are found to be cheating in examinations or term assignments are likewise subject to serious academic penalty.

***Please note*:** ALL work submitted for review and grading (both written and oral) must be the result of ***your own individual effort*.** Although others may comment on your work and even offer suggestions, *you are exclusively responsible for your own work.* That means that “outside help” – from parents, friends, tutors or former teachers – should not be used to do your work for you. Their doing so is considered to be “inappropriate collaboration” and is subject to the *Student Discipline By-Law:* <http://umanitoba.ca/admin/governance/governing_documents/students/868.htm>

However, keep in mind that, *once your name goes on your final report*, you are *accountable* for the contents of the entire document; consequently, you need to ensure that no one has plagiarized or sought outside help, as described above.

***Copyright*** *–* All course materials are subject to copyright, unless stated otherwise; for example, licensed by Creative Commons. This also applies to recording class lectures. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part, without permission. Course materials (both paper and digital) are for the student’s private study and research.

Please respect copyright and refrain from uploading copyrighted works to UM Learn or any website unless you have received written permission (or it represents an exception to the *Copyright Act*). For more information, see the university’s Copyright Office website at <http://umanitoba.ca/copyright/> . You can also contact [um\_copyright@umanitoba.ca](mailto:um_copyright@umanitoba.ca) .

***Plagiarism*** *–* You must make sure that you document where your words and ideas end and where someone else’s words and ideas begin – including material taken from the less traditional sources, like the web. When in doubt, *cite* [adapted from J.-A. Andre, Course Syllabus, U of C].

**Other Resources**

*Student Accessibility Services:* 520 University Centre, 204-474-7423

<http://umanitoba.ca/student/saa/accessibility/> or [Student\_accessibility@umanitoba/.ca](mailto:Student_accessibility@umanitoba/.ca)

*Writing and Learning Support:* the Academic Learning Centre (ALC), 201 Tier Building, 204-480-1481

<http://umanitoba.ca/student/academiclearning/>

*Student Counselling Centre (SCC)*: support for any aspect of your mental health – 474 University Centre or S207 Medical services, 204-474-8592 – <http://umanitoba.ca/student/counselling/index.html>

*University Health service* (UHS): offers full range of medical services to students, including psychiatric consultation – 104 University Centre, 204-474-8411 (business or after hours calls) – <http://umanitoba.ca/student/health/>

*The Academic Calendar:* The calendar outlines your rights and responsibilities as a student. Become familiar with the policies and procedures, and the regulations that are specific to Engineering – <http://umanitoba.ca/student/records/academiccalendar.html>