Western University
Department of Mechanical & Materials Engineering

MME 4475B – Selected Topics in MME: Applied AISE in MME

COURSE OUTLINE – 2025-2026

CALENDAR DESCRIPTION: The objective of this course is to introduce the fundamental concepts and tools of Artificial Intelligence (AI) with a focus on their applications in mechanical engineering. The course covers the basics of machine learning (ML) and deep learning, providing students with practical skills to develop and apply AI models for engineering analysis, design, and decision-making. Examples and case studies from mathematics, materials engineering, and intelligent systems will be explored throughout the course to demonstrate how these tools can be applied across diverse engineering landscapes.

COURSE INFORMATION:

Instructor: Dr. Elli Gkouti

Email: egkouti@uwo.ca

Lectures/tutorials/labs: See Draft My Schedule

CONSULTATION HOURS: By appointment

PREREQUISITES: Completion of third year of the Mechanical Engineering Program

ANTIREQUISITES: None

ACCREDITATION UNITS: Engineering Science = 40%, Math=40%, Engineering Design=20%

TOPICS:

1. Introduction to AI and cutting-edge AI applications:
   Human intelligence and AI | AI, machine learning, deep learning | AI applications | Future of AI

2. Machine learning basics:
   Types of learning | Classification | Regression | Improving predictive models | Implement ML in Matlab

3. Deep learning:
   Introduction to deep learning | Convolutional neural networks | Recurrent neural networks | Deep generative models | Implement ML in Matlab

4. AI applications in Engineering:
   Intelligent conditional monitoring | Intelligent advanced manufacturing | AI in smart grid | AI in material engineering

5. Apply AI to a specific engineering topic:
   Individual/team projects

LEARNING OUTCOMES:

The Mechanical and Materials Engineering Program has been accredited by Canadian Engineering Accreditation Board (CEAB) of Engineers Canada. Accredited programs provide the academic requirements for licensure as a professional engineer in Canada. Western Engineering has defined indicators of the 12 Graduate Attributes (GAs) that the CEAB expects graduating engineering students to demonstrate. The connections between course learning outcomes and Western Engineering's GA Indicators are identified below.

Upon successful completion of this course, students will be able to:

1. Ability to conduct machine-learning investigations, including implementing models, analyzing data, interpreting results, and forming evidence-based conclusions in labs and project work (IN2, IN3).
2. Ability to apply ML/AI workflows (e.g., data preparation, model selection, evaluation strategies) to engineering problems (PA2) and effectively communicate ideas, analyses, results and conclusions clearly and effectively by explaining ML/AI methods, justifying algorithm choices and presenting results clearly using slides, figures, and visualizations (CS2, CS3).
3. Demonstrate ability to model and solve a variety of engineering problems using appropriate AI/ML methods and computational tools in Matlab, demonstrating advanced and specialized knowledge of machine learning, deep learning, and AI principles as applied to engineering problems (KB4, ET2).
4. Recognize model limitations (e.g., overfitting, data constraints), demonstrating reflective awareness of challenges in applying AI to complex engineering problems (LL1).

CONTACT HOURS: 3 lecture hours, half course

TEXTBOOK: Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016. (optional | any edition)

UNITS: SI will be used; however, English units may be introduced through examples as required.

EVALUATION:

Assessment Type	Weight
Assignments (2)	12%
Lab report (2)	30%
Participation in class activities	8%
Project report (1)	35%
Presentation* (1)	15%

The due dates of the above assessments will be announced during the first week of the course.

*The presentation of each project will take place over two days. Students will be informed of the specific day on which they are scheduled to present. Attendance is mandatory for all students on both days and will be recorded.

COURSE POLICIES: The following course-specific policies will be strictly enforced throughout the course:

Assignment

- Late submission of assignment will translate into a zero mark for that assignment.
- Missing an assignment without academic consideration will translate into a zero mark for that assignment.
- Missing an assignment with academic consideration will automatically shift the weight of the missed assignment into the Project Report.

Laboratory sessions

- Late submission of lab report will result in a grade with a 50% deduction of the mark received for that lab session.

Project report (*designated assessment*)

- Late submission of the project report will result in a grade with a 50% deduction of the mark received.

Presentation

- Missing to give the presentation without academic consideration will result in a zero mark.
- If students miss their scheduled presentation with academic consideration, they will be required to present on the alternate presentation day.
- Missing both presentation days with academic consideration will automatically shift the weight of the missed presentation into the Project Report.

General Faculty / University Policies

The Faculty of Engineering and Western University have overarching policies that prescribe how undergraduate courses should run. The course-specific policies described above should be considered *in addition to* those overarching policies, or as course-specific interpretations of them. In the event of contradictions or confusion between course-specific policies above and general Faculty / University policies, please contact your course instructor for clarification.

Western Engineering's undergraduate polices can be found by navigating to:
https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/policies.html

and then clicking the "*Engineering Undergraduate Policies framework*" link.