

**Western University
Faculty of Engineering
Mechatronic Systems Engineering Program**

MSE 4499 – Mechatronic Design Project

Course Outline Fall 2025/Winter 2026

COURSE DESCRIPTION: In this course, students will work in small teams to tackle a comprehensive engineering design project, building upon the overall undergraduate course material offered through the Mechatronic Systems Engineering program. Throughout the course, students will be expected to complete milestones related to the design process, including problem definition, generation and evaluation of concepts, engineering analysis and testing, and preparation of design documentation. Each team will be supervised by a faculty advisor with whom they will meet regularly. An interdisciplinary committee will evaluate project deliverables such as design reviews, progress reports, presentations and a final engineering report.

ACADEMIC CALENDAR:

https://www.westerncalendar.uwo.ca/Courses.cfm?CourseAcadCalendarID=MAIN_023641_1&SelectedCalendar=Live&ArchiveID=

The aim of the course is to develop and practice the interdisciplinary skills required to solve open-ended engineering design problems from a mechatronics perspective. Students will experience all phases of the design process, including: problem definition, generation and evaluation of concepts, engineering analysis and testing, and preparation of design documentation. Project management and communications skills will also be emphasized. A faculty advisor will supervise project teams and an interdisciplinary committee comprised of Mechatronics program faculty members will assess project outcomes.

PRE OR COREQUISITES: MSE 3302A/B, MSE 3380A/B or MME 3380A/B

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record.

ANTIREQUISITES: CBE 4497, the former MME 4419, CEE 4441, GPE 4497, SE 4450, MME 4499, ECE 4415, ECE 4416, Engineering Science 4499

CEAB ACADEMIC UNITS: Engineering Design 100%

CONTACT HOURS:

LECTURE:	3 hours/week
LAB:	6 laboratory hours / every week during the Fall and Winter terms
TUTORIAL:	N/A

RECOMMENDED/REQUIRED TEXT: Not required. General instructions and guidelines related to the course are available on OWL Brightspace <https://westernu.brightspace.com/>

RECOMMENDED/ REQUIRED SOFTWARE: Students are expected to know how to use computer software necessary to carry out their design project efficiently. This includes programming environments, CAD and relevant computational modelling software, version control, etc.

RECOMMENDED RESOURCES/REFERENCES: None assigned. It is expected that each student will undertake a suitable literature search for the individual project undertaken. Also, the following textbooks related to the engineering design process, from the perspective of both general and mechatronics engineering, may be useful as references:

Clive L. Dym and Patrick Little, Engineering Design: A Project-Based Introduction, 3rd edition, New York: John Wiley & Sons, 2009.

Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Upper Saddle River, NJ: Prentice Hall: 2000.

George E. Dieter and Linda C. Schmidt, Engineering Design, 5th edition, New York, NY: McGraw-Hill, 2013.

David G. Alciatore and Michael B. Hstand, Introduction to Mechatronics and Measurement Systems, 4th edition, New York: McGraw-Hill, 2012.

J. Edward Carryer, R. Matthew Ohline and Thomas W. Kenny, Introduction to Mechatronic Design, Upper Saddle River, NJ: Prentice Hall, 2011.

Klaus Pohl, Requirements Engineering: Fundamentals, Principles and Techniques, London: Springer-Verlag, 2010.

Pankaj Jalote, A Concise Introduction to Software Engineering, London: Springer-Verlag, 2008.

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)

Knowledge Base		Engineering Tools	A	Impact on Society	A
Problem Analysis	A	Individual & Teamwork	A	Ethics and Equity	A
Investigation	A	Communication	A	Economics and Project Mgmt.	A
Design	A	Professionalism	A	Life-Long Learning	A

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and

been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e. g. no review).

COURSE MATERIALS: Weekly content and guides for the laboratories will be available on the course OWL site. The material for this course will be taught in both lectures and labs; therefore, it is imperative that you attend each lecture and lab.

UNITS: SI

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES: Mechatronics, as an engineering discipline, strives to optimally integrate mechanical, electronic and computer systems to create high quality products and processes. By the end of this course, students should be able to apply sound engineering design principles and methodology in arriving at a solution to an open-ended design problem. Students should be able to demonstrate good oral and written communication skills and work effectively in a team environment of 4 members.

The following table summarizes the course learning outcomes along with CEAB GAls where the GAls in bold indicate ones to be measured and reported annually.

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES	(CAEB) Graduate Attribute
1. Problem Analysis An ability to use appropriate knowledge and skills to identify, formulate, analyze and solve complex engineering problems pertaining to capstone project in order to reach substantiated conclusions.	PA1, PA2, PA3
2. Investigation a. Applied level ability to define and plan the investigation pertaining to capstone project successfully (whether experimental or analytical). b. Applied level ability to conduct an investigation pertaining to capstone project successfully. c. Applied level ability to analyse and interpret data generated in the group's capstone project to reach valid conclusions.	I1 I2 I3
3. Design a. Applied level ability to frame a complex, open-ended design problem of capstone project in engineering terms. b. Applied level ability to generate a diverse set of candidate engineering design solutions for capstone project. c. Applied level ability to select candidate engineering design solutions of capstone project for further development.	D1 D2

d. Applied level ability to advance an engineering design of capstone project to a defined end state – completion.	D3 D4
4. Use of Engineering Tools a. Applied ability to identify and select appropriate engineering tool(s) and resources for capstone project. b. Applied ability to apply appropriate engineering tool(s) and resources for capstone project. c. Applied ability to create/develop/adapt appropriate engineering tools for capstone project.	ET1 ET2 ET3
5. Individual and Team Work Advanced level ability to work effectively as a member and leader in MSE 4499 student team setting.	ITW1, ITW2, ITW3
6. Communication Skills a. Advanced level ability to follow instructions (listening and reading for comprehension). b. Advanced level ability to communicate orally using appropriate materials, language, non-verbal communication and effective graphical tools. c. Advanced level ability to articulate ideas in writing using appropriate technical language, and effective graphical tools.	CS1 CS2 CS3
7. Professionalism Developed level understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.	PR1, PR2, PR3
8. Impact of Engineering on Society and the Environment a. Advanced ability to analyze the interactions of engineering with economic, social, health, safety, legal and cultural aspects of society pertaining to capstone project. b. Advanced understanding of the concept of sustainable design and development pertaining to capstone project. c. Advanced level understanding of the concept of environmental stewardship pertaining to capstone project.	IESE1 IESE2 IESE3

9. Ethics and Equity a. Advanced level knowledge of professional ethics pertaining to capstone project. b. Advanced level ability to apply Ethical Behaviour pertaining to capstone project. c. Advanced level ability to apply the principles of professional accountability pertaining to capstone project. d. Advanced level of awareness of the principles of equity pertaining to capstone project.	EE1 EE2 EE3 EE4
10. Economics and project management Advanced level ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations, to perform cost analysis and generate project budgets, and to schedule and manage a large design project.	EPM1, EPM2, EPM3
11. Life-long Learning a. Advanced level ability to assess limitations in knowledge and skills. b. Advanced level ability to learn independently.	LL1 LL2

Project Topic: The project topic may be selected from a list of projects suggested by faculty advisors, industry, or may be suggested by a student team. The project scope should be large enough to enable an approximate even workload distribution among team members. Project teams can be **formed by 4 members**. The topic must be clearly defined and it must be related to major aspects of Mechatronic Systems Engineering, including significant elements of electronic and mechanical engineering in addition to some elements of other fields (e.g., control, embedded systems, software engineering, etc.), contain a significant amount of engineering design, and **be approved by the course coordinator**.

EVALUATION: Over the course of the year, students will be required to deliver/meet a number of milestones. These will be evaluated on a team and individual basis as follows:

Name	% Weight	Assigned	Due Date	CEAB GAs ASSESSED
Project Selection	2%		Sep. 18, 2025	N/A
Optional Progress Report - w1	N/A		Oct. 2, 2025	N/A
Optional Progress Report - w2			Oct. 9, 2025	
Design Review 1 *	4%		Oct. 16, 2025	
Optional Phase 1 Report Pres.	N/A		Nov. 6, 2025	

Phase 1 Report	15%		Nov. 13, 2025	D3, D4, LL1, EE4
Design Review 2 *	4%		Feb. 5, 2026	
Detailed Design Doc. Oral Presentation – week 1 **	10%		Feb. 26, 2026	ET1, ET2, ET3, LL1, I1, I2, I3
Detailed Design Doc. Oral Presentation – week 2 **			March 5, 2026	
Design Showcase Presentation	20%		March 27, 2026	CS2
Final Report	40%		April 8, 2026	D4, I3, CS3, IESE3
Reflections and Lessons Learned ***	5%		April 8-10, 2026 **	EE2, EE3, EE4

Note that the dates listed above are **tentative** and may be adjusted if needed. Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity and neatness. Unless stated otherwise, assignments should be submitted electronically through OWL Brightspace.

* The design review will be held between each team and a panel of faculty advisors.

** This assignment includes submission of presented PPT document which is also evaluated.

*** This is an individual assignment where there is 48-hour flexibility in the deadline.

Important Evaluation Information

- Grade Distribution:** All team members are expected to contribute equally to the team's efforts. This will be periodically verified by the project advisor(s), course instructor and/or TA with team members being held accountable for their activities. Furthermore, each submitted group assignment **MUST** be accompanied by a grade distribution form given along with each assignment. Submitted grade distribution forms cannot be applied retroactively. Based on the grade distribution form, grades of team members who contribute less will be adjusted consistently with their low contribution. **Moreover, at the latitude of the course instructor and project advisor consultation, students who continue to demonstrate insufficient contribution may be removed from the team resulting in course failure. While it is preferred that issues of design team dynamics be resolved within the team, such issues must be reported to the course coordinator immediately if a satisfactory resolution is not achieved within the team shortly after lack of improvement is noticed.**
- Attendance at design reviews, Detailed Design Documentation Oral Presentations, Design Reviews, Design Showcase and lectures is mandatory. Absence from any session, or a portion of a session, without permission will result in a zero assigned to the corresponding deliverable.
- Course Passing Minimum Requirements:** To obtain a passing grade in the course, the final report grade must be at least 60%. In addition, **component grades below 60% may result in immediate project termination and a final course grade of 48% or less.** Students who have failed this course (i.e., final average < 50%) must repeat all components of the course.

COURSE POLICIES:

- **Logbook:** Students are expected to keep a project logbook that is available for periodic review by their advisor/coordinator, and attend and participate in required course lectures as well as regular meetings with their faculty advisor(s). Team meetings, including meetings with the faculty advisor(s) must be documented and made available upon request by course instructor and/or TA. Grading information and due dates are provided on the course OWL Brightspace site. Written reports are evaluated by the course coordinator and TA with input from the faculty advisor if necessary. Factors considered in the evaluation of the submissions include the level of challenge involved in the project, the manner in which the project is carried out as well as the clarity and accuracy of the reports.
- **Parts and Material Return:** Unless other arrangements have been made, students may be required to return any large components, equipment or documentation provided by the Department/Faculty during the course of the project to the Electronics Shop as directed. Failure to do so may result in the withholding of a grade in the course.
- **AI Use:** The use of generative Artificial intelligence (GenAI) tools won't be discouraged in this course. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to meeting the course objectives. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource. ***Furthermore, to verify effective use of AI in a submitted course deliverable, students may be selected randomly for an interview pertaining to parts of the deliverable they were assigned to by their design team.*** If irresponsible use of GenAI tools is determined by the instructor, academic offences penalties might be imposed against the student.

LATE SUBMISSION POLICY:

Advise the instructor if you are having problems completing the assignment on time prior to the due date of the assignment and be prepared to submit an Academic Consideration Request and provide documentation if requested by the instructor at:

<https://www.eng.uwo.ca/undergraduate/academic-consideration-for-absences.html>

If you are granted an extension, establish a due date with the instructor. The approval of the Chair of your Department is not required if assignments are completed prior to the last day of classes. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

Documentation is mandatory.

This course employs flexible deadlines for the Reflections and Lessons Learned assignment only. This assignment's deadlines can be found above in the course outline. For this assignment, students are expected to submit the assignment by the deadline listed. Should illness or extenuating circumstances arise, students are permitted to submit this assignment up to 48 hours past the deadline without academic penalty. Should students submit the assessment

beyond 48 hours past the deadline, a late penalty of 10% per day will be subtracted from the assessed grade. **As a flexible deadline is used for this assignment, requests for pertinent academic consideration will not be granted.** If you have a long-term academic consideration or an accommodation for disability that allows greater flexibility than provided here, please reach out to your instructor at least one week prior to the posted deadline.

All deliverables will be penalized by 10% of the available marks per day for late submission. Deliverables submitted more than 5 days late will not be accepted.

ATTENDANCE: Attendance is mandatory for all lectures, design reviews, oral presentations, and design showcase.

FACULTY OF ENGINEERING POLICIES:

Students must familiarize themselves with the policies of the Faculty of Engineering

<https://www.eng.uwo.ca/electrical//pdf/2025-UG-Policy-and-Procedures.pdf>