Western University
Department of Mechanical & Materials Engineering

MME 2259A – Product Design and Development

COURSE OUTLINE 2025

CALENDAR DESCRIPTION: Introduction to the engineering design and structured design methods. Topics include: mechanical design process; design specifications, concept generation and selection; detailed design, design simulation, design for manufacturing and assembly, design for product safety; principles of life-cycle engineering.

INSTRUCTOR: Dr. Louis Ferreira, P.Eng.
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ACCREDITATION UNITS: Engineering Science = 25%, Engineering Design = 75%

TOPICS:

Introduction to the Product Design Process
Types of design, design vs. analysis; influence of design on cost and quality; product life-cycle.

Product Design Specifications
Problem statement; customer needs, product design specifications, Quality Function Deployment (QFD).

Planning and Scheduling
Product design planning; project plan; work breakdown structure; Gantt chart; network diagrams; critical path method (CPM); resource estimation techniques; PMBOK; Stage-Gate Process.

Conceptual Design
Establishing product functions; functional decomposition, morphological analysis; concept creation, Theory of Inventive Problem Solving (TRIZ), concept selection.

Detail Design
Computer aided design (CAD) modeling; design simulation; manufacturing documentation; engineering drawings; Geometric Dimensioning and Tolerancing (GD&T);

Design for Manufacturing and Assembly (DFM, DFA)
Factors influencing process selection; fabrication guidelines; design for manufacturing; design for assembly; machining; molding; forming sheet metal; design of weldments; etc.

Design for Reliability
Reliability and failure; risk assessment; preliminary hazard analysis, fault tree analysis; failure modes and effects analysis (FMEA).

Human Factors in Design
Principles of user-friendly designs; human factors engineering.

Design for Environment and Sustainability
Green design; design for zero waste; design for disassembly.

Intellectual Property
Intellectual property and patents

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.

Engineering design is the process of creating products and systems that satisfy the needs of a customer. The lectures cover design philosophy, methodology, and general design process techniques. Students practice engineering design methodology by participating in a group project. At the end of the course each student should be able to:

- Characterize product design process as an open-ended, structured problem-solving activity (PA1, PA2, PA3)
- State a problem, establish design constraints, and justify design decisions (D1)
- Record and maintain appropriate design documentation (CS3)
- Plan a design project (EPM 2, EPM 3)
- Create, evaluate and select design concepts (D2, D3)
- Conduct detailed design with CAD (KB4)
- Establish proficiency in solid modelling techniques (ET2)
- Apply design rules for material selection, design for manufacturability, design for assembly (D4)
- Recognize issues of product safety, risk, and reliability (IESE 1, IESE 2, IESE 3)
- Describe design process both verbally and in written form (CS2, CS3)

CONTACT HOURS: 3 lecture hours, 3 lab hours; half course.

TEXTBOOK: Course notes will be provided online. No textbook is required.

EVALUATION: The course grade will be determined as follows:

Individual marks (No Collaborating Permitted)	**Weight**	**Assigned Date**	**Due Date**
Assignment 1: Sketching and Primary Features	5	Sep 12	Sep 19
Assignment 2: Secondary Features and Parts	5	Sep 19	Sep 26
Assignment 3: Assemblies	5	Sep 26	Oct 3
Assignment 4: Engineering Drawings	5	Oct 3	Oct 10
Assignment 5: Parametric Design using Equations, Configurations, and Design Tables	5	Oct 10	Oct 24
CSWA Exam (Designated Assessment – see Course Policies below)	10	Week of Oct 27 in Lab	
Final examination (closed book)	25	TBA	

Team marks	**Weight**	**Assigned Date**	**Due Date**
Design Project – Problem Statement and Constraints	4	Sept 26	Oct 7
Design Project - Concept Generation and Evaluation	10	Oct 3	Nov 11
Design Project – Video Presentation	4	Oct 3	Nov 18
Design Project - Concept Selection	5	Oct 3	Nov 18
Design Project - Design Drawings and CAD files	10	Oct 3	Dec 9
Design Project - Final Report Combined Document	7	Oct 3	Dec 9

COURSE POLICIES:

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

Student-prepared materials/information sheets/crib sheets are not allowed in any form on written examinations. Students who have failed this course (i.e. < 50%) must repeat all components of the course. No special permissions will be granted enabling the student to retain any marks from prior years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

Computer requirements

- Access to SolidWorks workstations is available during the scheduled lab periods.

Laboratory sessions

- Attendance at laboratory sessions is not mandatory. However, it is recommended that students use laboratory sessions to get guidance from the TA's. You are not limited to attending only the lab section that you are registered in. If you choose to attend another lab section; however, if there is not sufficient space, then you may be asked to give up your lab workstation to another student registered in that section.

Assignments

- Assignments have a flexible submission deadline. Assignments are due at 5pm on the Friday one week after they are released (two weeks over Reading Week). However, assignments are not collected until the following Monday at 5pm, and no late penalty will be applied until after that 3-day grace period. Since the submission deadline already includes flexibility in the form of a 3-day grace period, the instructor reserves the right to deny academic consideration for assignments which are submitted following the end of the period of flexibility.
- Any missed assignment (with medical accommodation) will be weighted to the CSWA exam. No special assignment will be provided.

CSWA examination

- The **CSWA exam** will be held in the scheduled lab session (see schedule above).
- TAs will take attendance with ID validation during the CSWA exam.
- If you are **absent from writing the CSWA exam**, and it is a valid absence, then you can write it during your scheduled lab period the following week under TA supervision.
- If you do not achieve the minimum score on the CSWA exam to obtain the certification, then only your first attempt will count towards your course grade. A re-take session will be organized in the B-term.
- **NOTE:** This is a 'Designated Assessment' which is central to the learning objectives of this course. Accordingly, **students seeking academic consideration for this assessment will be required to provide formal supporting documentation**. This is **THE** assessment in this course that requires documentation if you miss this exam.

Project

- Project teams will be formed via online sign-up.
- The maximum team size will be four students, while the minimum team size will be three students. Emphasis will be to create 4-member teams.
- Students who do not choose a team will be assigned to one.
- Since there are multiple students per group, then there will be no leniency or grace period for late submissions. If a team member cannot submit their part of a project deliverable, then the rest of the team will submit theirs by the due date.

- SolidWorks will be used extensively for CAD modelling in this course: https://webstore.eng.uwo.ca/
- The default assumption is that everyone contributes equally to the team effort (i.e., project and labs) and hence everyone should receive the same mark for the common team submission.
- Note that whenever individual contributions to the team effort are not equitably shared by the team members, individual adjustments of the marks might occur at the discretion of the instructional team of the course (i.e., course instructor and teaching assistants).

Term work

- If a minimum of 50% is not obtained on term work (project, assignments, CSWA exam), the student will fail the course irrespective of the mark obtained in the final examination.

Submissions

- All submissions are to be submitted via BrightSpace using the SolidWorks Pack and Go functionality for CAD files with accompanying reports in PDF format. All assigned work is due according to the deadlines specified for each deliverable.
- Late submissions will be penalized by 2^{n+1}%, where n is the number of days past the set due date. Weekends count as a single day. Any deliverables submitted more than 5 days late will not be accepted. Work submitted after the last day of classes will not be accepted and will receive a grade of 0 automatically.
- All submissions are due by 5:00 pm on the prescribed due date.

Final examination

- The exam will take place during the December examination period. The schedule will be announced in advance.
- The exam will be closed book.
- The length of the final exam will be three hours.

UNITS: SI

ENGLISH: In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

CONSULTATION: Weekly office hours will be scheduled in accordance with class availability.

CLASSROOM DEMEANOR: The instructor is committed to providing a respectful learning environment for all students involved in this course. This is a collective responsibility of the instructor and students, and therefore students partaking in this course agree to abide by this criterion. This includes arriving at lectures on time and acting in a professional manner during class. Students may use laptops, tablet computers, or smart phones only to access the course BrightSpace site during lectures and tutorials. No other electronic devices may be used at any time during lectures, labs, tutorials, or examinations. Texting during lectures and lab is prohibited.

PARTICIPATION: All activities are mandatory unless otherwise stated. Any student who, in the opinion of the instructor, is not sufficiently participating in class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the program, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

INTERNET AND ELECTRONIC MAIL:

Students are responsible for regularly checking their Western e-mail and the course web site and making themselves aware of any information that is posted about the course. If the student fails to act on information that has been posted on these sites and does so without a legitimate explanation (i.e., those covered under the illness/compassionate form), then there are NO grounds for an appeal.

While email is a useful tool for coordinating office hour appointments or for simple clarifications, an in-person meeting is recommended to address more complex questions. Please make an appointment to discuss any personal, academic, group work or controversial issues in person, especially any concerns that you might have about your grades. Dr. Ferreira will check email Monday through Friday during normal office hours; you can expect a response within 24 hours during the workweek. Over weekends and holidays Dr. Ferreira will not be checking email regularly, so plan accordingly. Due to increased demand, emails sent after 4:00 pm the day before the exam may not be responded to before the exam.

NOTE:

Note that the efforts of the student design team on the term project constitute 25% of the grade for this course. Each student will be asked to specify the contribution made by each member of the team, including his/herself. Team grades may be adjusted for each student based on self and peer evaluation.

AI Policy:

The following policy regarding the use of AI (artificial intelligence) pertains specifically to this course.
Lab Assignments: The use of AI is NOT permitted in lab assignments. Use of AI in lab assignments will constitute an academic offence.
CSWA exam: The use of AI is NOT permitted during the CSWA examination. Such use of AI will constitute an academic offence.
Design Project: The use of AI is not restricted for any part of the design project. However, any use of AI must be indicated clearly. For example, any text that is generated by AI should be highlighted or appear in a distinguishing text colour defined at the beginning of the document. Any design decisions or concept evaluations that are either entirely or in part derived from AI must be indicated clearly. Failure to indicate any use of AI will be an academic offence.

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.