Western University
Department of Mechanical & Materials Engineering

MME 2259A – Product Design and Development

COURSE OUTLINE 2024

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.
TEB 359, 519-661-2111 ext. 86124, louis.ferreira@uwo.ca

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)

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	**Weight**	**Assigned Date**	**Due Date**
Assignment 1: Sketching and Primary Features	8	Sep 13	Sep 20
Assignment 2: Secondary Features and Parts	8	Sep 20	Sep 27
Assignment 3: Assemblies	8	Sep 27	Oct 4
Assignment 4: Engineering Drawings	8	Oct 4	Oct 11
Assignment 5: Parametric Design using Equations, Configurations, and Design Tables	8	Oct 11	Oct 25
CSWA Exam	10	Week 44 in Lab	
Final examination (closed book)	25	–	TBA

Team marks	**Weight**	**Assigned Date**	**Due Date**
Design Project **Note:** Design Reviews will be conducted in WK 45 and WK 47	25	Sep 20	Dec 6

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.

COURSE POLICIES:

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

Computer requirements

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

Laboratory sessions

- All students are to attend the laboratory session to which they signed up to ensure participation in weekly design review meetings.

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.

Project

- Project teams will be formed via BrightSpace sign-up.
- The maximum team size will be four students, while the minimum team size will be three students.
- Students who do not choose a team will be assigned to one.
- 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.

General Faculty / University Policies

In the event of contradictions between course-specific policies above and general Faculty / University policies described below, please contact your course instructor for clarification.

Attendance Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Associate Dean Academic (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean Academic, the student will be debarred from taking the regular examination in the course.

Missed/Late Accommodation Policy

1. Students missing a test/assignment/lab or examination you will report the absence by submitting an Academic Consideration Request form through STUDENT ABSENCE PORTAL.

2. **Documentation must be provided as soon as possible.**

Exam Accommodation

1. If you are unable to write a final examination, report your absence using the Academic Consideration Request Form through STUDENT ABSENCE PORTAL.

2. Be prepared to provide the Undergraduate Services Office with supporting documentation (below for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.

3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you must submit an Academic Consideration Request Form through STUDENT ABSENCE PORTAL.

   PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

Late Assignments

1. Advise the instructor if you are having problems completing the assignment on time (prior to the due date of the assignment).

2. Be prepared to submit the Academic Consideration Request Form and provide documentation if requested by the instructor (see below for information on documentation).

3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.

4. Some courses may have built-in flexibility for assignment deadlines or the total number of assignments that will be graded. See course-specific policies for details.

5. 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.

   Note: Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

Medical Accommodation

1. The Academic Consideration Request Form is available through the STUDENT ABSENCE PORTAL.

2. Requests for academic consideration must include the following components:
    a. Indication of the course(s) and assessment(s) affected by the request
    b. Medical note, and
    c. Additional supporting documentation as relevant

3. Requests for academic consideration without a medical note or other supporting documentation may be accepted once per term, per course.

4. Undocumented absences cannot be used for examinations scheduled by the Office of the Registrar during official examination periods (including take-home final exams and December mid-year exams for full courses) and practical laboratory and performance tests typically scheduled in the last week of the term. Undocumented absences also cannot be used for the "designated assessment" in each course. When flexibility in assessment exists and is clearly stated on the course outline, both undocumented absences and academic consideration requests with documentation may be denied.

5. **Students must request academic consideration as soon as possible and no later than 48 hours after the missed assessment.**

6. Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline.

    Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete, or granting late withdrawals without academic penalty, may only be granted by the Academic Advising office of the Faculty of Registration.

7. An instructor may deny academic consideration for any assessment that is not required in the calculation of the final grade (e.g., "8 of 10 quizzes"). Assessment flexibility must be indicated on the course outline.

8. An instructor may deny academic consideration relating to the timeframe submission of work where there is already flexibility in the submission timeframe (e.g., 72-hour submission window). This assessment flexibility must be indicated on the course outline.

Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

Academic Integrity

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit Academic Integrity Western Engineering for more information

Academic Offences

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.
Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (http://www.turnitin.com). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Faculty of Engineering AI Policy

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

Use of English Policy

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work except for the final examination 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.

Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the Accessibility Western University for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit Academic Support & Engagement - Academic Accommodation.

Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the Office of Equity, Diversity and Inclusion.

Health and Well-Being

- Health & Wellness Services – Students - Offers appointment-based medical clinic for all registered part-time and full-time students.
- Mental Health Support - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- Crisis Support - For immediate assistant, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click here.
- Gender-Based Violence and Survivor Support - Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, here. To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Links

- **WESTERN ACADEMIC CALENDAR**
- **ACADEMIC RIGHTS AND RESPONSIBILITIES**
- **ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS**
- **UNIVERSITY STUDENTS' COUNCIL (USC) - SERVICES**
- **IMPORTANT DATES AND DEADLINES**
- **ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS**
- **ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS**
- **SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS**
- **STUDENT FORMS**
- **OFFICE OF THE REGISTRAR**
- **RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES (SYLLABI)**
- **ACADEMIC APPEALS**
- **STUDENT ABSENCE PORTAL**

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

Add Deadlines:

First term half course (i.e. "A" or "F")	September 13, 2024
Full courses and full-year half course (i.e. "E", "Y" or no suffix)	September 13, 2024
Second term half course (i.e. "B" or "G")	January 14, 2025

***Drop Deadlines*:**

First term half course without penalty (i.e. "A" or "F")	November 12, 2024
Full courses and full-year half courses without penalty (i.e. "E","Y" or no suffix)	December 2, 2024
Second term half or second term full course without penalty (i.e. "B" or "G")	March 7, 2025

Contact Information:

Undergraduate Services Office: SEB 2097
Phone: 519-661-2130 E-mail: engugrad@uwo.ca

Mechanical Engineering: SEB 3002
Phone: 519-661-4122 E-mail: mmeundergraduate@uwo.ca

Chemical & Green Process Engineering: TEB 477
Phone: 519-661-2131 E-mail: cbeugrad@uwo.ca

Civil Engineering: SEB 3005
Phone: 519-661-2139 E-mail: civil@uwo.ca

Computer, Electrical, Mechatronic Systems & Software Engineering TEB 279
Phone: 519-661-3758 E-mail: eceugrad@uwo.ca

Integrated Engineering ACEB 2410
Phone: 519-661-6725 E-mail: engceli@uwo.ca

Office of the Registrar/Student Central WSSB 1120
Phone: 519-661-2100