

MME 2259A – Product Design and Development

COURSE OUTLINE 2021 – 2022

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.

PREREQUISITES: Engineering Science 1021a/b, Engineering Science 1022a/b/y, Engineering Science 1050

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. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

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:

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 tutorial hours; half course.

TEXTBOOK: Course notes will be provided on OWL. 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 5
Assignment 4: Engineering Drawings	8	Oct 5	Oct 12
Assignment 5: Parametric Design using Equations, Configurations, and Design Tables	8	Oct 12	Oct 19
CSWA Exam	10	WK 31: Oct 25 – 30	
Final examination (closed book)	25	–	TBA

Team marks	Weight	Assigned Date	Due Date
Design Project	25	Sep 13	Dec 8

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 in ACEB-2415.

Laboratory sessions

- All students are to attend the laboratory session to which they signed up to ensure participation in weekly design review meetings.
- The CSWA exam will be held during the week of Oct 25 – 30 during the scheduled lab sessions.

Project

- Project teams will be formed via OWL 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. In addition to using the workstations on campus, you may also install either the physical (also install SolidWorks Explorer) install (preferred), or the virtual software environment (if your computer is not SolidWorks compatible) via the ITG Webstore:
<https://webstore.eng.uwo.ca/>
- The [Monday.com](https://www.monday.com) collaboration platform will be used to record and maintain appropriate project documentation. You will receive an invitation to join the course workspace via email.
- 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 OWL 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 6:00 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.

INSTRUCTOR:

Dr. Aaron Price
ACEB 3457, 519-661-2111 ext. 86420, aaron.price@uwo.ca

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 OWL 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.
- ABSENCE DUE TO ILLNESS OR OTHER CIRCUMSTANCES:** Students should immediately consult with the instructor or program Director if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached “Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled”). The student should seek advice from the instructor or program Director regarding how best to deal with the problem. Failure to notify the instructor or program Director immediately (or as soon as possible thereafter) will have a negative effect on any appeal. For more information concerning medical accommodations, see the relevant section of the Academic Handbook:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf
- For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf
- CHEATING:** University policy states that cheating, including plagiarism is a scholastic offense. 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.
- INTERNET AND ELECTRONIC MAIL:** Students are responsible for regularly checking their Western e-mail and the course web site (<https://owl.uwo.ca/portal/>) 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. Price 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. Price 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.
- SSD:** Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 for any specific question regarding an accommodation.
- NOTE:** The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (i.e. <50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.
- 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.

INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

NEW: Requests for Academic Consideration using the Self-Reported Absence Form

If you experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render you unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) you should self-declare using the online Self-Reported Absence portal. This option should be used in situations where you expect to resume academic responsibilities within 48 hours or less.

Each student will be allowed a maximum of two self-reported absences between September and April and one self-reported absence between May and August. Self-reporting may not be used for final exams or assessments (e.g. midterm exams, tests, reports, presentations, or essays) worth more than 30% of any given course.

For full instructions about the Self-Reporting System refer to the Academic Calendar link [here](#).

A. GENERAL REGULATIONS & PROCEDURES (other than self-reported absences)

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM/MIDTERM TESTS (other than self-reported absences)

1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

C. FINAL EXAMINATIONS (cannot be self-reported)

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page 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 sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

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

D. 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 provide documentation if requested by the instructor (see reverse side 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.
 - i) 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.
 - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

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

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

Calendar References: Check these regulations in your 2021 Western Academic Calendar available at www.westerncalendar.uwo.ca.

[Self-Reporting Absences](#)
[Absences Due to Illness](#)
[Academic Accommodations for Students with Disabilities](#)
[Academic Accommodations for Religious or Holy Days](#)
[Course Withdrawals](#)
[Examinations](#)
[Scheduling of Term Assignments](#)
[Scholastic Offences](#)
[Student Medical Certificate](#)
[Engineering Academic Regulations](#)

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 16, 2021
Full courses and full-year half course (i.e. “E”, “Y” or no suffix)	September 16, 2021
Second term half course (i.e. “B” or “G”)	January 11, 2022

Drop Deadlines:

First term half course (i.e. “A” or “F”)	November 12, 2021
Full courses and full-year half courses (i.e. “E”, “Y” or no suffix)	November 30, 2021
Second term half or second term full course (i.e. “B” or “G”)	March 7, 2022

Contact Information:

Undergraduate Services Office	SEB 2097 Phone: 519-661-2130	E-mail: engugrad@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
Mechanical Engineering	SEB 3002 Phone: 519-661-4122	E-mail: mmeundergraduate@uwo.ca

Revised 08/04/21