

IE 2297A – Integrated System Engineering and Design
Course Outline 2023/24 Rev. – (Aug 1, 2023)

Western University
Faculty of Engineering

IE2297A: Integrated System Engineering and Design
Course Outline Fall 2023

Description: Using an iterative, collaborative, and team-directed learning framework, students will explore how engineers think and will investigate a variety of design processes used throughout the product lifecycle. This course introduces standard system engineering methods and processes and acts as a bridge between ES 1050 *Foundations of Engineering Practice* and the final year Capstone project. It is intended for Integrated Engineering students but would be appropriate as a technical elective for other students interested in the methods used in industry to develop large, complex systems.

Instructor: Minha R. Ha, mha4@uwo.ca

Consultation hours: By appointment, ACEB 2410B

Academic Calendar Copy: Introduction to classical system engineering and associated methods, tools and practices, with application experienced through team-based, interdisciplinary design projects. Students build life-long learning skills while working in self-directed teams to gain knowledge across topics that include the System Engineering V-model, human-centered design, modeling and optimization, Design for X, sustainability, risk management and human decision making.

Prerequisites: Registration in Integrated Engineering

Corequisites: None

Antirequisites: MME 2259a/b

This course is intended for second year Integrated Engineering students.

Note: It is the student's responsibility to ensure that all prerequisite and corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that he/she has not taken a course listed as an antirequisite. The student may be dropped from the course or not given credit for the course towards his/her degree if he/she violates the prerequisite, corequisite or antirequisite conditions.

Contact Hours: 4 lecture hours per week

CEAB Accreditation Units: Engineering Science = 25%, Engineering Design = 75%

Textbooks and References:

No specific textbooks are assigned. References include literature on the design process and on human psychology that are available online or from the Taylor Library.

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Other Required References:

Copies of material discussed in class will be provided.

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	2/1	Use of Engineering Tools	3/1	Impact on Society and the Environment	2/2
Problem Analysis	3/2	Individual and Team Work	3/2	Ethics and Equity	2/1
Investigation	2/1	Communication Skills	3/2	Economics and Project Management	2/1
Design	3/2	Professionalism	2/1	Life-Long Learning	3/1

Notation: x/y , where x is the cognitive level (1: Remember, 2: Understand, 3: Apply) at which the attribute is assessed and y is the academic level (1: Beginner, 2: Intermediate, 3: Advanced) at which the attribute is assessed.

The following Graduate Attributes will be measured to support accreditation of the Integrated Engineering program. The measurements will be derived from the evaluation as described in the rubric for each assessment in their respective OWL Assignment:

Design:

- D1: Demonstrate ability to frame a complex, open-ended design problem in engineering terms
- D2: Demonstrate ability to generate a diverse set of candidate engineering design solutions
- D3: Demonstrate ability to select candidate engineering design solutions for further development
- D4: Demonstrate ability to advance an engineering design to a defined end state - completion

Individual and Team Work:

- ITW2: Demonstrate ability to contribute to team goals

Economics and Project Management:

- EPM3: Demonstrate ability to incorporate risk management into engineering
- EPM4: Demonstrate ability to incorporate change management into engineering

Impact of Engineering on Society and Environment:

- IESE 1: Ability to analyse the interactions of engineering with economic, social, health, safety, legal and cultural aspects of society

Life-long Learning:

- LL1: Ability to assess limitations in knowledge and skills.
- LL2: Learn independently

Topics include:

- Introduction to Systems Thinking, root cause and impact analyses
- Classical System Engineering V-Model, including requirements management and decomposition, conceptual design, system/subsystem design, verification and validation
- Human-Centred Design and understanding user needs
- Modeling and simulation
- Risk management and project planning
- Design for X and sustainable design processes
- Understanding human decision-making and bias

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Specific Learning Objectives

At the end of this course, students will be able to...

- a. Explain and evaluate different design process frameworks appropriate to specific circumstances
- b. Explain and illustrate tools used to understand customer context, jobs-to-be-done, problems and needs and to translate those into actionable requirements
- c. Explain the importance of risk identification and analysis, including limitations of typical engineering tools
- d. Adapt the system/product lifecycle to specific projects and describe design approaches that address each part of the lifecycle (e.g. Design for X)
- e. Describe the impact of human psychology on engineers and on the design process and implications for robust design and project management
- f. Recognize and assess knowledge limitations and address them by learning independently or by interdisciplinary collaboration, to improve design solution robustness
- g. Demonstrate improved judgment and additional psychological coping skills to be more confident and more temperate

Evaluation

Course Component	Weight
Topic Assessments (team) – Weeks 1, 2, 3, 4	20%
Written Reflections (individual) – Weeks 5, 11	20%
Design Project (team) – Presentation Delivery & Content	30%
Topic Assessments – Project Application, Weeks 6-10	10%
Contribution, Feedback & Professional Behaviour (individual)	15%
Design Logbook (individual)	5%
Total	100%

NOTES:

Topic Assessments: Student teams will collaborate to achieve the learning outcomes associated with each of the topic areas. Assessment is required for each learning outcome. The format and grading for each major topic will be discussed in class.

Written Reflections: Students will reflect on, integrate, and synthesize new insights based on what is learned in the course. Students will also include a brief reflection on learning impactful, their contribution to their team, and what remains unclear. The reflection will also include a self-assessment of their personal challenges and reactions, leading to personal goals and potential action plans. The evaluation rubric for these submissions will be discussed in class.

Design Project: Students will work in teams to complete a design project, including multiple presentations to the entire class, a written project report, and multiple prototypes associated with the progress of their designs. Each student in a team will normally receive the same grade, however the instructor reserves the right to adjust individual grades if the instructor deems it appropriate.

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Design Logbook: Students will maintain Design Logbooks to document project work activity as well as their own reflections on the design process.

Contribution, Feedback & Professional Behaviour: Contribution to class discussion and team function and the provision of feedback to peers are integral aspects of full participation in this course. The evaluation rubric of contribution and feedback will be discussed in class.

Late Submission Policy: Late submissions will be penalized per the list below. Presentations must be given on the assigned date.

- Up to 1 hr late: 5% Penalty
- Up to 24 hrs late: 10% Penalty
- Up to 48 hrs late: 20% Penalty
- Beyond 48 hrs late: Submissions will not be accepted; score of 0 will be assigned

Use of 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 improper use of English. Additionally, poorly written work with the exception of 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.

Attendance: Any student who misses more than 25% (or 6 classes) will be reported to the Dean (after due warning has been given). In such cases, on the recommendation of the department, and with the permission of the Dean, the student will be assigned a failing grade in the course.

Absence Due to Illness or Other Circumstances: Students should immediately consult with the instructor or department Chair 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 department Chair regarding how best to deal with the problem. Failure to notify the instructor or department Chair 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 and Plagiarism: Students must write their 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

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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

Use of Electronic Devices: Students may use laptops, tablet computers, or smart phones (vibrate mode only) during class for course related activities. Non-emergency phone calls or text during class are not permitted. Electronic devices may be used during the final project presentation if part of the presentation itself.

Policy on Repeating All Components of a Course: Students who are required to repeat an Engineering course 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 by the student for grading in subsequent years.

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.

Accessibility: 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 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

Support Services: Office of the Registrar, <http://www.registrar.uwo.ca/>
Academic Support & Engagement, <http://academicssupport.uwo.ca/>
Engineering Undergraduate Services, <http://www.eng.uwo.ca/undergraduate/>
USC Student Support Services, <http://westernusc.ca/services/>

Students who are in emotional/mental distress should refer to Mental Health @ Western, http://www.health.uwo.ca/mental_health/, for a complete list of options about how to obtain help.