

**Western University  
Faculty of Engineering**

**ES2297A: Integrated System Engineering and Design  
Course Outline 2020**

**Description:** This course introduces classical system engineering and related methods and practices to Integrated Engineering Students. It is intended to bridge between the principles introduced in ES 1050 Foundations of Engineering Practice and the independent application of all the students developed knowledge and skills in the final year capstone ES 4499 Interdisciplinary Engineering Design Project.

**Instructor:** Don Uffen, P.Eng., [duffen@uwo.ca](mailto:duffen@uwo.ca)

Consultation hours: By appointment

**Academic Calendar Copy:** Introduction to classical system engineering and associated methods, tools and practices, with application experienced through team-based, interdisciplinary design projects. Case-based and interactive classroom lessons are combined with structured laboratory sessions to build knowledge and competence. Topics include the System Engineering V-model, human-centered design, modeling and optimization, Design for X, reliability and maintainability, sustainability and risk management.

**Prerequisites:**

Completion of first year of Engineering program and registration in Yr.2 Integrated.

**Corequisites:**

None

***Antirequisites:***

MME 2259

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:** 3 lecture hours, 3 tutorial hours/week; 0.5 course.

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

**Textbooks and References:**

No specific textbooks are assigned. References include pertinent codes and standards, government publications and legislation and other technical references from Taylor Library.

**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	2/1

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.

**Topics:**

- Classical System Engineering (V model):
  - Requirements Development
  - Conceptual Design & Functional Architecture
  - Requirements Decomposition and Allocation
  - Subsystem Design
  - System Integration
  - Verification and Validation
- Project Management
- Customer Needs Elicitation and Analysis, House of Quality
- Human-Centered Design, Human Factors and Ergonomics
- Design for X (Design for Cost, Manufacturability, Assembly, etc.)
- Modeling and Simulation, Design Optimization and Limitations. OnShape will be utilized for solid modeling
- Change Management/Configuration Management
- Sustainable Design and Resilience
- Reliability and Maintainability
- Risk Identification and Management

***LEARNING OUTCOMES:***

Engineering design is the process of creating products and systems that satisfy the needs of a customer. The lectures cover the system engineering process and related topics to produce robust system-level designs.

Students practice engineering design methodology by participating in group projects. At the end of the course each student should be able to:

- Understand problem context
- Identify customer and market needs in relation to context
- Apply classical design development methods and processes
- Understand risk identification and analysis, including limitations of tools
- Understand robust design

## Evaluation

Course Component	Weight	Approximate Date
Class Participation (individual)	30%	Throughout
2 Written Summaries (individual)	10%	9 Oct, 6 Nov
Project 1 Requirements (group)	5%	30 Sept
Project 1 Presentation (group)	5%	16 Oct
Project 1 Logbook (individual)	10%	16 Oct
Project 2 Requirements (group)	5%	30 Oct
Project 2 Presentation (group)	10%	30 Nov
Project 2 Logbook (individual)	10%	30 Nov
Project 2 Design Report (individual)	15%	4 Dec

To obtain a passing grade in the course, a mark of 50% or more must be achieved across the Project 1 and Project 2 course components (in lieu of final exam). A project grade < 50% will result in a final course grade of 48% or less.

**Homework Assignments:** Assignments (individual and group exercises) will be discussed during class hours. The assignments must be submitted for marking by the due dates discussed in class. Written assignments will be submitted electronically - see the provisions concerning plagiarism below.

**Class Participation and Contribution:** Class discussion is an integral aspect of full participation in this course. As we will be using the case method of teaching, students are expected to prepare by reading the cases ahead of class and to appropriately contribute in class. Grade weighting of this element of evaluation reflects this importance to the course. The evaluation rubric of class contributions will be discussed in class.

**Written Topic Summaries:** At the end of each major section of the course, the student will be required to provide a written summary of the section topics, describing the content, what they learned from it and how it ties to the course as a whole, with emphasis on how it relates to them and their leadership experience. Each entry should be 1000-1500 words.

**Logbooks:** Each student shall keep a logbook listing at least the following:

- a) Details of meetings - date, time, duration, those present, main topic
- b) Details of work on the Design Project - date, duration, and aspects of work done personally

**Project Presentations & Written Reports:** In lieu of a final examination, this course employs two projects that will be discussed in detail in class during the term. The evaluation of this project will consist of a written group Requirements document, a group presentation that will take place during class and, for the second project, an individual written report.

Each student will normally receive the same grade for the group Project Requirements document and Project Presentations. The written Final Project Report is to be submitted individually and will be graded individually. The report should be 4000±1000 words. Each student will have the opportunity to submit an individual group evaluation. This will inform the instructor if the students believe that differential grades should be assigned to group members. The student is expected to justify this with specific reasons. The instructor may or may not change the grade based on these submissions. An important factor in this decision will be whether the group requested assistance in how to improve its function during the term and at least attempted to act on this advice.

**Late Submission Policy:** Late submissions will be penalized 5% per day and will not be accepted beyond 5 days late. Presentations must be given on the assigned date.

**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 4 classes) will be reported to the Dean (after due warning has been given). 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](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](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 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](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/>  
Student Development Centre, <http://www.sdc.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/](http://www.health.uwo.ca/mental_health/), for a complete list of options about how to obtain help.

***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 ACCOMMODATION WILL NOT BE GRANTED AUTOMATICALLY ON REQUEST. YOU MUST DEMONSTRATE TO YOUR DEPARTMENT (OR THE UNDERGRADUATE SERVICES OFFICE IF YOU ARE IN FIRST YEAR) THAT THERE ARE COMPELLING MEDICAL OR COMPASSIONATE GROUNDS THAT CAN BE DOCUMENTED BEFORE ACADEMIC ACCOMMODATION WILL BE CONSIDERED. DIFFERENT REGULATIONS APPLY TO TERM TESTS, FINAL EXAMINATIONS AND LATE ASSIGNMENTS. READ THE INSTRUCTIONS CAREFULLY. (SEE THE 2014 UWO ACADEMIC CALENDAR).

**A. GENERAL REGULATIONS & PROCEDURES**

1. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
2. Bring your request for academic accommodation to the attention of the chair of your (or the Undergraduate Services office if you are in first year) **PRIOR** to the scheduled time of the test or final examination or due date of the assignment. If you are unable to contact the relevant person, leave a message with the appropriate department (or with the Undergraduate Services Office if you are in first year). The address, telephone and fax numbers are given at the end of these instructions. Documentation must be provided as soon as possible.
3. 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 TESTS**

1. If you are unable to write a term test, inform your instructor and the Chair of your Department (or the Undergraduate Services Office if you are in first year) **PRIOR** to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office and inform the Chair of the Department (or the Undergraduate Services Office if you are in first year).
2. Be prepared to provide supporting documentation to the Chair and the Undergraduate Services Office (see next page for information on documentation).
3. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair (or the Undergraduate Services Office if you are in first year) is required when rescheduling term tests.

**C. FINAL EXAMINATIONS**

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 (please spell your full name).
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, 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.

**N.B. 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 Associate Dean 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. 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.

**E. SHORT ABSENCES**

If you miss a class due to a minor illness or other problems, check your course outlines for information regarding attendance requirements and make sure you are not missing a test 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 may want to seek advice from the academic counsellor in your Department or Ms Karen Murray in the Undergraduate Services Office if you are in first year.

#### 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 if you are in first year). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence.**

**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

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).

**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.**

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 2014 Western Academic Calendar available at [www.westerncalendar.uwo.ca](http://www.westerncalendar.uwo.ca).

Absences Due to Illness: <http://www.westerncalendar.uwo.ca/2014/pg117.html#>

Academic Accommodations for Students with Disabilities: <http://www.westerncalendar.uwo.ca/2014/pg118.html>

Academic Accommodations for Religious or Holy Days: <http://www.westerncalendar.uwo.ca/2014/pg119.html>

Course Withdrawals: <http://www.westerncalendar.uwo.ca/2014/pg157.html>

Examinations: <http://www.westerncalendar.uwo.ca/2014/pg129.html>

Scheduling of Term Assignments: <http://www.westerncalendar.uwo.ca/2014/pg97.html>

Scholastic Offences: <http://www.westerncalendar.uwo.ca/2014/pg113.html>

Student Medical Certificate: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

**Engineering Academic Regulations:** <http://www.westerncalendar.uwo.ca/2014/pg1442.html>

**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.

#### **Drop Deadlines:**

First term half course (i.e. "A" or "F"):	November 5, 2014
Full courses and full-year half courses (i.e. "E", "Y" or no suffix):	November 30, 2014
Second term half or second term full course (i.e. "B" or "G"):	March 7, 2015

Undergraduate Services Office:	SEB 2097	telephone: (519) 661-2130	fax: (519) 661-3757
Dept. of Chemical and Biochemical Engineering & Green Process Engineering	TEB 477	telephone: (519) 661-2131	fax: (519) 661-3498
Dept. of Civil and Environmental Engineering:	SEB 3005	telephone: (519) 661-2139	fax: (519) 661-3779
Dept. of Electrical and Computer Engineering, Software Engineering, Mechatronics Engineering	TEB 279	telephone: (519) 661-3758	fax: (519) 850-2436
Dept. of Mechanical and Materials Engineering:	SEB 3002	telephone: (519) 661-4412	fax: (519) 661-3020