

ENGG*4450 - Large-Scale Software Architecture Engineering

Fall 2024 Course Outline

Section: 01

Credits: 0.50

Land Acknowledgement: Guelph

The University of Guelph resides on the ancestral lands of the Attawandaron people and the treaty lands and territory of the Mississaugas of the Credit. We recognize the significance of the Dish with One Spoon Covenant to this land and offer respect to our Anishinaabe, Haudenosaunee and Métis neighbours. Today, this gathering place is home to many First Nations, Inuit, and Métis peoples and acknowledging them reminds us of our important connection to this land where we work and learn.

Calendar Description

This course introduces the students to the analysis, synthesis and design of large-scale software systems at the architectural level. This is in contrast to the algorithmic and data structure viewpoint of most software systems. Large-scale software systems are complex, execute on many processors, under different operating systems, use a particular or many language(s) of implementation, and typically rely on system layers, network connectivity, messaging and data management and hardware interfacing. The material covered includes architectural styles, case studies, architectural design techniques, formal models, specifications and architectural design tools. The laboratory sessions will expose the students to analyzing and redesigning an existing large-scale software system.

Prerequisite(s): (CIS*2420 or CIS*2520), ENGG*2100

Restriction(s): Non-BENG students may take a maximum of 4.00 ENGG credits.

Department(s): School of Engineering

Course Description

This course caps a series of several software development and programming courses that started with CIS*1500 and included courses on object oriented design, algorithms and data structures. This course introduces software engineering processes and tools to deal with the complexity involved in designing, implementing and testing of large scale software systems that may involve tens or hundreds of developers. We will emphasize open-source and distributed development models.

"Software development is no longer bound by time zones or national borders. Projects of all— academic, commercial, and open source may have their GUI designers in Boston, their database team in Bangalore, and their testers in Budapest and Buenos Aires. Working effectively in such teams is challenging: it requires strong communication skills, and makes proper use of coordination tools such as version control and ticketing systems more important than ever." – Undergraduate Capstone Open Source Projects (<http://ucosp.ca/about/>)

Lecture Schedule

TuTh 4pm-5:20pm in ROZH*102 (9/5 to 12/13)

Lab Schedule

Day	Time	Location
Friday	2:30 PM - 4:20 PM	THRN 1319
Wednesday	7:00 PM - 8:50 PM	THRN 1319
Wednesday	3:30 PM - 5:20 PM	THRN 1319

Instructor Information

Fattane Zarrinkalam

Email: fzarrink@uoguelph.ca

Additional Support

Teaching Assistants

Teaching Assistant (GTA)

Hadiseh Moradisani
Amber Goel

Email

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Textbooks

Group	Title	Author	ISBN
Recommended	UML Distilled: A Brief Guide to the Standard Object Modeling Language	Martin Fowler	9780321193681
Recommended	Software Engineering	Ian Sommerville	013394303
Recommended	Object-Oriented Software Engineering	Bernd Bruegge and Allen H. Dutoit	0136061257

Learning Resources

Required Resources

Course Website (Website) (<http://courselink.uoguelph.ca>)

Course material, news, announcements, and grades will be regularly posted to the ENGG*4450 CourseLink site. You are responsible for checking the site regularly.

Required Resources (Textbook)

There is no required textbook for the course

Additional Resources

Lecture Information (Notes)

All of the lecture notes will be posted on the web page as the term progresses.

Lab Information (Other)

The handouts for all the lab sessions will be provided within the lab section. All types of resources regarding tutorials, links to web pages, etc. can be found in this section.

Assignments (Notes)

Download the assignments according to the schedule given in this handout.

Exams (Notes)

Some final exams of previous years are posted as samples. The solutions are also posted for your convenience.

Miscellaneous Information (Other)

Other information related to Large-scale Software Architecture Engineering will be posted on the course website.

Communication & Email Policy

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements and/or changes will be posted to the course website. **It is your responsibility to check the course website regularly.**

Electronic communication should be limited to the **course forum**, however topics of a personal and confidential nature (e.g. marks) should be emailed to the instructor: fzarink@uoguelph.ca. As per university regulations, all students are required to check their mail.uoguelph.ca e-mail account regularly: e-mail is the official route of communication between the University and its students.

Campus Resources

If you are concerned about any aspect of your academic program: Make an appointment with a Program Counsellor (<https://www.uoguelph.ca/uaic/programcounsellors/>) in your degree program. If you are struggling to succeed academically: There are numerous academic resources offered by the Learning Commons (<https://www.lib.uoguelph.ca/using-library/spaces/learning-commons/>) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills.

Course Learning Outcomes

1. Analyze client requirements and formulate use cases.
2. Reverse engineer a design through code inspection and reverse engineering tools.
3. Produce design specifications according to standards (e.g. UML).
4. Describe and compare different software development methodologies.
5. Master version control and concepts such as branching and merging.
6. Apply verification and validation strategies to software development.
7. Concisely and articulately communicate through written documentation for software projects.
8. Work effectively as part of a medium to large development team.

Teaching and Learning Activities

Teaching and Learning Activities

Schedule and Information

Lecture Schedule

Lecture

1	Orientation
2	Introduction
3	Modeling & UML
4, 8	Modeling Software Structure (class, package and component diagram)
5, 6, 7	Modeling Software Behaviour (use case, activity and sequence diagram)
9, 10	Software Processes
11, 12	Requirements Engineering
13, 14	Project Management
15	Project Planning
16	Architectural Design
17	Design & Implementation
18	Software Testing

Topics schedule will be adjusted throughout the course as needed.

Tutorial/Laboratory Schedule

There are several labs in the course meant to familiarize students with software engineering tools. The labs will be started from Week 2 of the Fall semester and followed by a lab exam that will test proficiency in software use as well as the practical application of concepts covered in lectures.

Week

Topics

2	Lab 1: Version Control
3	Lab 2: Object-oriented analysis and design
4	Lab Quiz 1
5	Lab 3: Project Management
6	Assignment 2 help session & Case study presentation
7	Lab 4: Code Review
8	Assignment 3 help session & Case study presentation
9	Lab Quiz 2
10	Lab 5: Automated Testing

11	Assignment 4 help session & Case study presentation
12	Lab Quiz 3
13	Help session for final exam

Assessment Breakdown

Description	Weighting (%)
Assignments	30%
Lab Quizzes	15%
Case Study Presentation	5%
Midterm	10%
Final Exam	40%

Assessment Details

Assignment

Assignments

30%

1. A1: Reverse Engineering & Design Recovery (5%), by PDF to CourseLink Dropbox class
2. A2: Implementing Change Requests (5%), by PDF to CourseLink Dropbox
3. A3: Requirements Analysis (10%), by PDF to CourseLink Dropbox
4. A4: Build and Test a New Feature (10%), by PDF to CourseLink dropbox

Assignments must be submitted to CourseLink Dropbox, before midnight on the due date of each assignment which will be announced in the CourseLink. TA and instructor will not answer any queries related to the assignments in the 24 hour period prior to the deadline

You will work in teams of approximately 6-7 students for all assignments. Teams will be announced in the first or second week of the term. Each team will submit a single report for each assignment. All members of a team will receive the same grade for the assignment, except in exceptional circumstances at the discretion of the instructor. Detailed instruction on the content of each assignment will be distributed during the term.

Course Learning Outcomes Assessed: 1, 2, 3, 5, 6, 7, 8

Quizzes

Lab Quiz

15%

1. Lab Quiz 1 5%
2. Lab Quiz 2 5%
3. Lab Quiz 3. 5%

Each lab quiz will test all material covered in lectures and labs to-date.

Course Learning Outcomes Assessed: 1, 2, 3, 5, 6, 7

Case Study

Case Study

5%

Presented per group. Each group will select a Case Study from Volume 1 and 2 of The Architecture of Open Source Applications (<http://aosabook.org/>) to present in class.

Course Learning Outcomes Assessed: 7, 8

Midterm

Midterm

10%

Date: October 24, 2024

Course Learning Outcomes Assessed: 1, 3, 4

Exam

Final Exam

40%

Date: See "Final Exam" Section Below

Course Learning Outcomes Assessed: 1, 2, 3, 5, 6, 7

Final Exam

Date: Dec 11

Time: Wed 2:30pm-4:30pm

Location: TBA *Please see Web Advisor closer to the date of scheduled final for location.*

To understand rules and regulations regarding Examinations students are encouraged to read Student's Responsibilities (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/examinations/>)

If the student is unable to meet the final exam requirements due to medical, psychological or compassionate circumstances they are encouraged to review Student's Responsibilities in the Academic Consideration, Appeals and Petitions (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>) section of the Academic Calendar.

Last Day to Drop Course

The final day to drop Fall 2024 courses without academic penalty is the last day of classes: November 29

After this date, a mark will be recorded, whether course work is completed or not (a zero is assigned for missed tests/assignments). This mark will show on the student's transcript and will be calculated into their average.

Course Grading Policies

Passing Grade

The passing grade is 50%.

Missed Assessments

If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/>) for information on regulations and procedures for Academic Consideration

Late Assignments

Due dates for the assignments are firm. Assignments must be submitted to CourseLink Dropbox, by midnight on the submission date (i.e. by 11:59PM). Late submissions of assignments will not be accepted.

Clarification About Grades

If you have questions about the grade your assignment received, please ask your TA. However, all requests for re-marking must be made to the instructor. Any item that is remarked will be re-marked entirely. Therefore it is strongly suggested that you thoroughly review your entire document before making a re-marking request. Re-marking requests will not be honoured more than one week after the document has been returned.

Course Standard Statements

Relationships with other Courses & Labs Previous Courses:

- CIS*2520: Data structures & algorithms.
- ENGG*2100: Design practices.

Follow-on Courses:

ENGG*4120 or ENGG*4170: Collaborative design project.

School of Engineering Statements

Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on

Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible

Standard Statements for Undergraduate Courses

Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/>) is outlined in the Undergraduate Calendar.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to make a booking at least 10 days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time. For students at the Guelph campus, information can be found on the SAS website. (<https://www.uoguelph.ca/sas/>)

Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the Academic calendar for information on regulations and procedures for Academic Accommodations of Religious Obligations (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-accommodation-religious-obligations/>).

Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all undergraduate students except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in the Undergraduate Calendar - Dropping Courses (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/dropping-courses/>).

Email Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

Health and Wellbeing

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (<https://wellness.uoguelph.ca/>). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (<https://wellness.uoguelph.ca/navigators/>) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources (<https://wellness.uoguelph.ca/shine-this-year/>). The Student Wellness team are here to help and welcome the opportunity to connect with you.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

Recording of Materials

Presentations that are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars (<http://www.uoguelph.ca/registrar/calendars/?index>) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration. (<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>)

Professional Accreditation Outcomes

Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

1. Knowledge Base

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
1.3	Recall, describe and apply fundamental engineering principles and concepts	Advanced	No
1.4	Recall, describe and apply program-specific engineering principles and concepts	Advanced	Yes

2. Problem Analysis

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
2.1	Formulate a problem statement in engineering and non-engineering terminology	Advanced	No

2.2	Identify, organize and justify appropriate information, including assumptions	Advanced	No
2.3	Construct a conceptual framework and select an appropriate solution approach	Advanced	No

3. Investigation

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
3.2	Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system)	Advanced	No
3.3	Analyze and interpret experimental data	Advanced	No

4. Design

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
4.1	Describe design process used to develop design solution	Advanced	No
4.2	Construct design-specific problem statements including the definition of criteria and constraints	Advanced	No
4.4	Evaluate alternative design solutions based on problem definition	Advanced	Yes
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	Advanced	No

5. Use of Engineering Tools

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
5.2	Demonstrate proficiency in the application of selected engineering tools	Advanced	Yes

6. Individual & Teamwork

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
6.2	Understand all members' roles and responsibilities within a team	Advanced	No
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	Advanced	No

7. Communication Skills

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	Advanced	Yes
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	Advanced	No

7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	Advanced	No
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	Advanced	No
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	Advanced	No

9. Impact of Engineering on the Environment

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
9.2	Evaluate the uncertainties and risks associated with engineering activities	Advanced	No
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems		

11. Economics and Project Management

	Graduate Attribute Indicator	Instructional Level	Data Collection for Accreditation
11.1	Apply project management techniques and manage resources within identified constraints	Advanced	No
11.2	Identify risk and change management techniques, in the context of effective project management	Advanced	No
11.3	Estimate economic impact and feasibility of an engineering project or design using techniques such as cost benefit analysis over the life of the project or design	Advanced	No