Course Objectives

Software engineering is concerned with the theories, methods, and tools for developing complex, large-scale software. It encompasses a wide range of topics, including requirements elicitation and specification, software design, software construction (i.e., implementation), validation and verification, software maintenance, and the management of the software process. Every software development project involves one or more of these activities. With the Unified Modeling Language (UML) becoming the de-facto standard notation for software development in the IT industry, software development is becoming increasingly model-driven (or model-based), with less manual generation of source code and more automated generation of source code (from models).

A single course is clearly incapable of covering all these topics in depth. The aim of this course is to provide you with a broad understanding of the phases and activities in model-driven software development, and to introduce you to specific concepts that have not been covered systematically in first-year and second-year programming courses, yet are widely regarded as essential for engineering large software systems.
More specifically, the goals of this course are:

1. To understand how the software development life cycle consists of multiple phases, to understand the role of each phase, the relationships between them, and the main principles that underlie these phases.
2. To learn model-based software development, using the UML to render the models.
3. To understand the challenges of software evolution.
4. To understand the challenges of software verification and validation.

**Learning Outcomes**

The three main objectives/outcomes of this course are:

1. Students should be able to conduct requirement elicitation and produce software requirements in the form of use case models.
2. Students should be able to produce analysis models consisting of UML models (composed of class, sequence, state machine diagrams), following well-established heuristics.
3. Students should be able to conduct system design and object design using patterns.

**Graduate Attributes**

- Software Engineering
- 2.1 Problem clarification, definition and approach, including dealing with ill-defined problems
- 4.1 Clear design goals (See 11.1)
- 4.4 Design solution(s)
- 5.1 Diagrams and engineering sketches

**Course Web Site**

https://carleton.ca/culearn/

**Textbook and References**

The following textbook will be the primary reference:


Although the course material will draw extensively from other sources, this textbook provides an excellent basis for this course. Students are therefore encouraged to purchase it.

The course slides will be made available in PDF format on the course web site, on a weekly basis.

Important notice: Course notes are subject to changes without notice until presented in class. After being discussed in class, changes to course notes will be posted online.
Evaluation and Marking Scheme

21% Assignments (3)

12% Labs (6)

22% Mid-Term Exam (Date TBD, in-class, closed-book)

45% Final Exam (Centrally scheduled, 3 hours, closed-book).

Labs

Attendance at the scheduled laboratory periods is mandatory, and attendance will be taken. During the labs you will work on short exercises that are intended to provide practical experience with tools and techniques related to the concepts presented in the lectures. You will normally be required to demonstrate and submit your lab work by the end of the lab period (or other specified deadline), as indicated in that week's lab handout.

Your work in each lab period will be graded satisfactory, marginal, or unsatisfactory.

- **Satisfactory** (75-100%) means that you were present at the lab and made reasonable progress towards completing the lab exercises. Note that you do not have to finish all the exercises to receive a satisfactory grade.
- **Marginal** (50-75%) means that you made some progress towards completing the exercises, but your solutions to were not sufficiently complete to warrant a satisfactory grade. This grade indicates that you may be falling behind, and should take steps to remedy this situation.
- **Unsatisfactory** (0-50 %) means that you were absent from the lab period, or you attended but made little or no progress towards completing the lab exercises. This indicates that you are likely having difficulty understanding important concepts and should seek help from your instructor as soon as possible. You will also receive unsatisfactory if you do not demonstrate or submit your work before the deadline or if it is apparent to the TA that you did not do enough of the lab work on your own; that is, you relied on your colleagues to explain the exercises and provide solutions. If you are absent from a lab period for any reason, it is up to you to do the missed lab work on your own time. Serious long-term illness will be dealt with on an individual basis. In these circumstances, please contact your instructor to discuss appropriate arrangements.

Assignments

Students are encouraged to discuss issues when working on assignments; however, you are expected to submit your own work for grading (assignments are individual work). There is a fine line between cooperating with your colleagues (discussing problems and ideas) and copying solutions (plagiarism). Not only plagiarism is an instructional offence (see the Undergraduate Calendar), but doing the assigned work by yourself is by far the best way to prepare for the exams.

**Submission:** Assignments are due at midnight of the due date and must be submitted online on cuLearn. When submitting assignments, double check that your material has indeed been submitted.

**Late assignments** will be graded according to the following policy: a cumulative 10% penalty per day
(i.e., 24 hours) with a maximum of two days.

Exams

1. To pass this course, a student must obtain an appropriate overall mark (D- or higher), a passing mark (D- or higher) for the final exam and get credit for at least five out of six labs.

2. The final exam will be held during the formal examination period set out in the University Calendar and will be scheduled by Exam Services. The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available. Students who miss the final exam may be granted permission to write a deferred examination (see the Undergraduate Calendar for regulations on deferred exams).

3. Students who miss the midterm due to illness must provide a valid medical certificate to the instructor no later than 48 hours after returning to campus. The certificate must clearly state the name of the doctor with contact information. Once the certificate has been verified, a make-up midterm examination will be arranged (outside of the class hours).

4. Students who have previously taken SYSC 3020: please note that there are no lab exemptions from this course.

General Regulations

- **Copyright on Course Materials**: The materials created for this course (including course outline, slides, posted notes, labs, project, assignments, quizzes, exams and solutions) are intended for personal use and may not be reproduced or redistributed or posted on any website without prior written permission from the author(s).

- **Attendance**: Students are expected to attend all lectures and lab periods. The University requires students to have a conflict-free timetable. For more information, see the current Undergraduate Calendar, Academic Regulations of the University, Section 1.2, Course Selection and Registration and Section 1.5, Deregistration. Requests to accommodate a missed midterm exam, lab periods, etc., because of conflicts with jobs or vacation plans will not be considered.

- **Health and Safety**: Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: [http://sce.carleton.ca/courses/health-and-safety.pdf](http://sce.carleton.ca/courses/health-and-safety.pdf).

- **Deferred Term Work**: Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the Academic Regulations of the University, Section 2.6, Deferred Term Work.

- **Appeal of Grades**: The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the Academic Regulations of the University, Section 2.7, Informal Appeal of Grade and Section 2.8, Formal Appeal of Grade.

- **Academic Integrity**: Students should be aware of their obligations with regards to academic integrity. Examples of violations include plagiarism, test and exam rules. Please review the information about academic integrity at: [https://carleton.ca/registrar/academic-integrity/](https://carleton.ca/registrar/academic-integrity/) This site also contains a link to the complete Academic Integrity Policy that was approved by the
University's Senate.

- **Academic Accommodations**: Requests for Academic Accommodation You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:
  - **Pregnancy obligation**
    Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
  - **Religious obligation**
    Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
  - **Academic Accommodations for Students with Disabilities**
    If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/PMC
  - **Survivors of Sexual Violence**
    As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support
  - **Accommodation for Student Activities**
    Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

**Tentative Week-By-Week Schedule**

The following is a tentative outline of the course; it might change, based on time constraints:

**Week 1**: Introduction to Software Engineering. The nature of software, history and scope of software engineering, relationships with other fields, fundamental principles, software life cycle.

**Week 2**: Requirement Elicitation. Using UML Producing a specification of the system that the client understands. Relationship between requirements and specifications, the uses of specifications, the qualities of specifications, the requirements engineering process and products.
Week 3: Requirement Elicitation (continued).

Week 4: Object Oriented Analysis using UML. Producing an analysis model that the developers can unambiguously interpret. Formalizing the requirements (requirement elicitation) into specifications (Analysis).

Week 5: Object Oriented Analysis (continued).

Week 6: Object Oriented Analysis (continued).

Winter Break. Classes are suspended.

Week 7: Object Oriented Analysis (continued).

Week 8: System Design. Definition and objectives, object-oriented design with UML, architectural design, detailed design (with strong emphasis on design patterns), concurrent software, safety analysis and fault tolerance.

Week 9: System Design (continued).

Week 10: System Design (continued).

Week 11: Design Patterns.

Week 12: Verification and Validation.