Carleton University
Department of Systems and Computer Engineering
SYSC3010 Systems Development Laboratory – Fall 2019
Course Outline

Instructor Information and Office hours

C. Schramm, Office: ME4444, Email: Cheryl.schramm@carleton.ca

TA Information and Office hours

Office hours are posted on CULearn.

Calendar Information

Development of expertise in designing, implementing and testing industrial-quality embedded systems through team projects. Applying modern programming languages, system design practices, current development processes (refactoring, iterative and incremental development) as well as current team-management tools (communication, version control) to medium-scale projects.

Includes: Experiential Learning Activity
Lectures two hours a week, laboratory three hours a week.

Prerequisites

Precludes additional credit for SYSC 2101 (no longer offered), SYSC 3110 and COMP 2404. Prerequisite(s): SYSC 2100 and either SYSC 2003 or SYSC 3310 (may be taken concurrently), and enrolment in Computer Systems Engineering.

Students who have not satisfied the prerequisites for this course must either withdraw from the course or obtain a prerequisite waiver by visiting the Engineering Undergraduate Academic Support Office.

It is assumed that students are:

- Proficient in Embedded C programming
- Proficient in programming in an object orient language, either Python or Java, or both; including graphical user-interfaces
- Proficient in Embedded Input / Output Programming
- Conversant with Analog-to-Digital Conversion and Pulse-Width-Modulation
- Competent in Digital Electronics (designing and wiring circuits involving sensors and actuators)
- Competent in Software Testing
Course Objectives

This course is an introduction to the software development life cycle and to team project management. From a technical perspective, the course is expected to draw from material covered in prior and concurrent courses, with lectures largely providing additional depth or considerations regarding scale and complexity. Complementary to the technical aspects and with equal importance are the challenges associated with working with a team to produce a project on schedule. Resulting from this course a student should see the technical importance of topics already covered in their degree program, have broader appreciation of the design process and aspects such as teamwork, discipline, scheduling and communication. Self reflection is a key aspect of professionalism and this is encouraged and examined within the course. The expected result will be a deeper appreciation of the importance of technical knowledge, the design cycle and professional skills which will be beneficial for, co-op placements, the fourth year project and final employment.

Learning Outcomes

1. Students will be able to use industry-standard processes and tools for working effectively in teams, specifically for communication, time management, feedback and version control.
2. Students will be able to describe concepts of iterative and incremental systems development processes.
3. Students will be able to describe the purpose of a proposal, a design document and test plan.
4. Students will be able to describe a system design solution using UML diagrams (architecture, deployment, class, sequence and message dictionaries)
5. Students will be able to explore new technical topics (new language, new computer, new task) independently, going beyond the background course material in their degree so far.
6. Students will be able to describe the importance of interfaces, message protocols as one differentiating aspect of embedded system architecture design as compared to software design.
7. Students will be able to create tests, at both the architectural level and the class level, and for hardware.
8. Students will be able to construct moderately complex systems composed both of embedded computing and web-enabled applications.
9. Students will be able to communicate their design effectively to their peers in both oral and written forms in a collaborative and comparative environment.
10. Students will be able to work cooperatively in groups, scheduling their own work within the time allocated and considering relevant design aspects as safety, performance, cost and product life cycle
11. Students will be able to reflect on the work and challenges encountered

Graduate Attributes (GA’s)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. Activities related to the learning outcomes listed
above are measured throughout the course and are part of the department’s continual improvement process. Graduate attribute measurements will not be taken into consideration in determining a student’s grade in the course. For more information, please visit: https://engineerscanada.ca/.

<table>
<thead>
<tr>
<th>Graduate Attribute</th>
<th>Learning Outcome(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4 Design: Design solution(s)</td>
<td>3,4</td>
</tr>
<tr>
<td>4.5 Design: Design implementation / task(s) definition</td>
<td>2,3,4, 6</td>
</tr>
<tr>
<td>6.1 Individual and Team Work: Personal and group time management</td>
<td>10,11</td>
</tr>
<tr>
<td>6.3 Individual and Team Work: Leadership: initiative and mentoring, areas of expertise, and interdisciplinary teams</td>
<td>1,9,</td>
</tr>
<tr>
<td>7.2 Communication Skills: Professional documents: writing, design notes, drawings, attributions, and references</td>
<td>3,4,9</td>
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Textbooks (or other resources) if applicable

Course material, project requirements and lab exercises will be posted on the course website through CULearn.carleton.ca.

There is no course textbook designated for this course. A bibliography of references that are relevant to this course will be posted on the course Web site.

Evaluation and Grading Scheme

The final grade will be calculated as follows:

<table>
<thead>
<tr>
<th>Team Assessments</th>
<th>60%</th>
<th>Individual Assessments - 40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Proposal</td>
<td>10%</td>
<td>Project Checks</td>
</tr>
<tr>
<td>Project Design Review</td>
<td>15%</td>
<td>Project Reflection</td>
</tr>
<tr>
<td>Project Testing</td>
<td>15%</td>
<td>Lab Work (Including Attendance)</td>
</tr>
<tr>
<td>Project Final Product</td>
<td>15%</td>
<td>Class Peer Reviews (3)</td>
</tr>
<tr>
<td>Team Evaluation</td>
<td>5%</td>
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Failure to work in a group can result in a failing grade.

Most of the work will be done in groups, so that there will be only one group report and joint group presentation that will be graded. When needed, individuals will be awarded separate marks commensurate with their contribution, including zero.

Lecture and Lab Periods

There is one two-hour lecture per week. Lectures are mandatory, some of the lectures involving class-wide exercises that will be graded.

There is one three-hour lab period per week. Labs are mandatory for your learning, and full attendance for the entire 3-hour period is demanded.
• During the first section of term, there will be a lab exercise associated with the current lecture. The lab exercise is to be completed individually and/or in pairs, and must be submitted for grading.
• During the remainder of the term, the labs are either:
  - Open work time for your group’s term project – while there is no explicit deadline, attendance is mandatory. It is a time when all members of the group must be available, and where the TAs and instructor can check in with interim progress.
  - Milestone demonstrations by the group to the instructor and TAs – if a team member is missing from the demo, that person receives zero for the demonstration.

Project

A major component of the course is a project that will lead you through the process of building a reasonably complex system. This will be a group project. Each team member must participate in all aspects of the project: design, coding, testing and debugging, etc. The project will be of the team’s own idea, yet must meet the universal technical requirements posted for the course. With guidance, the teams will plan the project as a series of milestones that progress incrementally and iteratively through the engineering lifecycle. The group’s work will be evaluated at several points, and feedback will be given. The final grade for the project will incorporate marks for both the “process” (how the group functioned over the term) and the “product” (the quality of the final system delivered). Individual marks will be given to each student reflecting their contribution as evaluated both through self and peer assessment. Groups will present their work and defend their work, in several peer reviews conducted during class time.

Week-by-Week breakdown

1. Course Introduction
   a. Course Outline; Course Webpage, Hardware Introduction (Linux, Headless vs Desktop, Programming on RPi versus Downloading)
   b. Distributed Systems – Networking and JSON
      Lab: Team Formation, Hardware Checkout, Getting Started with RPi.

2. Team Projects
   a. Team Exercise (Contract)
   b. Project Preview (Functional Requirements, Ideas)
      Lab: Networking and JSON

3. Proposals
   a. Proposal Exercise: UML Expectations, Sample Proposals
   b. Peer Review – Background; Logistics for Peer Review
      Lab: Adding Hardware to our RPi and/or Arduino

4. Peer Review of Proposals
      Lab: Databases: SQLite and MongoDB

5. Design Strategies for Distributed Systems
   a. System Architecture Diagrams
   b. Message Dictionaries [& Unit Testing of the System]
6. Thanksgiving – No Class (Will be replaced by Friday at the end of term)
   Lab: Git Workflows
7. Peer Review of Designs
   Lab: Work on your project
8. Unit and Integration Testing
   Lab: Work on your project
9. Team Check-ins:
   a. Team Conflict & Team Performance
   b. What is a Code Inspection
   Lab: Review of Unit Test Plan by Tas
10. Peer Review of Code
    Lab: Demo of Unit Test Plans
11. The Bigger Picture
    a. Ethics for Computer Engineers
    b. Indigenous Relations in Canada
    Lab: Work on your project
12. Team Project
    a. Refactoring Reflections
    b. Peer Assessment of Team Members
    Lab: Final Demo of the Project
13. Class-wide Team Project Poster Session (and Equipment Return)

General Regulations

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 2.1.3, Course Selection and Registration and Section 2.1.7, Deregistration.

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

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 current Undergraduate Calendar, Academic Regulations of the University, Section 4.4, 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 Undergraduate Calendar, Academic Regulations of the University, Section 3.3.4, Informal Appeal of Grade and Section 3.3.5 Formal Appeal of Grade.
**Academic Integrity:** Students should be aware of their obligations with regards to academic integrity. 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.

**Plagiarism:** Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

**Academic Accommodation:** You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at [http://www.carleton.ca/equity/](http://www.carleton.ca/equity/). For an accommodation request, the processes are as follows:

- **Pregnancy or 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 see [https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

- **Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your *Letter of Accommodation* at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*). **Requests made within two weeks will be reviewed on a case-by-case basis.** After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website ([www.carleton.ca/pmc](http://www.carleton.ca/pmc)) for the deadline to request accommodations for the formally-scheduled exam (*if applicable*).

- **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 where 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: [https://carleton.ca/sexual-violence-support/](https://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. For more details, see [https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf](https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf)
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