Carleton UNIVERSITY | Department of Systems and Computer Engineering

SYSC 3310
Introduction to Real-Time Systems

Calendar description

Principles of event-driven systems. Microcontroller organization. Development of embedded applications. Programming external interfaces, programmable timer. Input/output methods: polling, interrupts. Real-time issues: concurrency, mutual exclusion, buffering. Introduction to concurrent processes.

Includes: Experiential Learning Activity.

Lectures three hours a week, laboratory two hours a week.

http://calendar.carleton.ca/undergrad/courses/SYSC/

Prerequisites

SYSC 2006 with a minimum grade of C-, and SYSC 2320.

Precludes additional credit for SYSC 2003, SYSC 3006.

Prior knowledge

Students should:

- Have knowledge and experience in the C programming language.

Course objectives

- Understand the complexities and nuances of embedded programming.
- Gain experience in the implementation of event-driven systems, i.e., interrupt-driven.
- Gain experience in the implementation of diverse I/O strategies, e.g., PWM, debouncing.
- Understand real-time issues (e.g., priority inversion) and implement appropriate solutions.

List of topics

- Revision of C programming
- Basic I/O and interrupts
- Timers
- Analog I/O
- State machines and revisions for midterm

- Race conditions and introduction to scheduling
- Rate monotonic scheduling and priority inversion
- Dynamic scheduling and soft/hard scheduling
- WCET analysis and future of embedded systems

Learning outcomes

By the end of this course, students should have:

- Proficiency in embedded programming using C.
- A comprehensive understanding of interrupt behavior and operation.
- Ability to interface with embedded hardware (peripheral devices) within a microcontroller.
- Experience in I/O implementation strategies.

Graduate Attributes (GAs)

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/.

Graduate Attribute	Learning outcome(s)
1.5.S: Knowledge Base: Developed: Computer Systems	1-4
2.4: Problem Analysis: Developed: Interpreting the solution – validity of results	2
3.2: Investigation: Developed: Design of experiment	2, 3
4.2: Design: Developed: Detailed design specifications and requirements	3, 4
5.1: Use of Engineering Tools: Developed: Diagrams and engineering sketches	1-4

Accreditation Units (AUs)

For more information about Accreditation Units, please visit: https://engineerscanada.ca/.

The course has a total of 49 AUs, divided into:

- Engineering Science: 60%
- Engineering Design: 40%

Instructor and TA contact

Specific to course offering (tbd)

Textbook (or other resources)

Specific to course offering (tbd)

Evaluation and grading scheme

Specific to course offering (tbd)

Breakdown of course requirements

Specific to course offering (tbd)

Tentative week-by-week breakdown

Specific to course offering (tbd)

General regulations

Specific to course offering (tbd)