

Course Outline

COMP 4900E for Winter 2025

Real-time Operating Systems

Course Information

Instructor: Jun (Steed) Huang

Contact: jun.huang@carleton.ca

Classroom: Days: See brightspace

Lectures: In person

Teaching Assistant

Kathan Abhishek Soni

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Course Calendar Description

This course covers the basics of Real-Time Operating Systems (RTOS). The course focuses on the primary principles of RTOS. Topics include RTOS architecture, inter process communication, determinism, real-time scheduling, interrupt latency, fast context switching, time and space partitioning in hard real-time environments.

Lectures: 1.25 hours twice a week.

Prerequisites

COMP 3000 or equivalent

Topics Covered

Week	Topics
1 & 2	<ul style="list-style-type: none"> • Real-time Operating Systems Overview • Compiling and Debugging Basics (QNX Neutrino) • RTOS Architecture • Processes & Threads
3, 4, 5 & 6	<ul style="list-style-type: none"> • Project requirements document and topics • Mutual Exclusion • Scheduling • Time and Tick • Inter-process communication
8	<ul style="list-style-type: none"> • Pulses & Your Progress Talk
9	<ul style="list-style-type: none"> • Messages & Your Progress Talk
10	<ul style="list-style-type: none"> • Memory usage and management & Your Progress Talk
11 & 12	<ul style="list-style-type: none"> • Intro to h/w programming • Resource Manager & Your Progress Talk
13	<ul style="list-style-type: none"> • Multiprocessor systems & Your Progress Talk

Textbooks and Other Resources

Mandatory: Real-time Operating Systems Book 1 – The theory (Jim Cooling)

QNX Guides (7.1)

<https://www.qnx.com/developers/docs/7.1/#com.qnx.doc.qnx.sdp.nav/topic/bookset.html>

Optional: Hands-On RTOS with Microcontrollers: Building real-time embedded systems using FreeRTOS, STM32 MCUs, and SEGGER debug tools Paperback – (Brian Amos)

Note: You don't need to buy textbook, but you need to buy a CPU that can load QNX to do homework. Typical CPU is Raspberry Pi or your laptop, you may need to spend on QNX cloud on Amazon to do group project. The cost per person should be less than \$50.

Assessment Scheme

Component	Weight	Due Date
Exercises	32	Week 3/5/6/8
Attendance and interaction	5	Every week
Group project proposal	5	Before week 7
Project progress talk	10	After week 7
Take home exam	16	Week 11
Project report	32	Week 13

There will be 4 assignments, mainly run on QNX license. Total assignments will be worth 32 of your total mark. For any discrepancies or questions, first contact the TA. Assignments should be submitted as a typed pdf or word file.

Office hours: See brightspace.

Undergraduate Academic Advisors

The Undergraduate Advisors for the School of Computer Science are available in Room 5302C HP; by telephone at 520-2600, ext. 4364; or by email at scs.ug.advisor@carleton.ca. The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

SCS Computer Laboratory

SCS students can access one of the designated labs for your course. The lab schedule can be found at: <https://carleton.ca/scs/tech-support/computer-laboratories/>. All SCS computer lab and technical support information can be found at: <https://carleton.ca/scs/technical-support/>. Technical support is available in room HP5161 Monday to Friday from 9:00 until 17:00 or by emailing support@scs.carleton.ca.

University Policies

For information about Carleton's academic year, including registration and withdrawal dates, see [Carleton's Academic Calendar](#).

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 [Equity Services](#).

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 [Equity Services](#).

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. For more details, visit the [Paul Menton Centre website](#).

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 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/>

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 the [policy](#).

Student Academic Integrity Policy. Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of F in the course or even being expelled from the program or University. Examples of punishable offences include: plagiarism and unauthorized co-operation or collaboration. Information on

this policy may be found [here](#).

Plagiarism. As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science.

Unauthorized Co-operation or Collaboration. Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis". Please refer to the course outline statement or the instructor concerning this issue.