

**Carleton University**  
**Department of Systems and Computer Engineering**  
***SYSC 5701 Operating System Methods for Real-Time Applications Fall 2011***

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**Course Outline**

**Instructor:**

Professor Trevor W. Pearce,  
Room 3215 V-SIM, 520-2600 ext. 4054, pearce @ sce.carleton.ca

**Course Description and Objectives:**

To develop an understanding of the design, implementation and use of operating systems in the context of real-time systems. The intent is to study real-time issues relevant to operating systems, not the applications that use the operating systems.

A note on the interpretation of “real-time”: In this course, the applications of interest are embedded systems. These systems do not have a general-purpose operating system (i.e. operating systems like Windows and UNIX/Linux are **NOT** of interest). The systems of interest are (often) built on top of a simple kernel that provides priority pre-emptive multitasking (**NOT** time sharing/slicing).

**Prerequisites:**

1. Some previous exposure to concurrent processes, for example, through an undergraduate-level operating system course.
2. Some low-level programming experience with an assembly language and interrupts.
3. Programming experience with a high-level language (preferably C or C++).

**Textbook:**

**None.** Reading material will be suggested to augment lecture content.  
A few years ago, the course used the text:  
Real-Time Systems, Jane W. S. Liu, Prentice-Hall Inc., 2000

**Course Web Site:** <http://www.sce.carleton.ca/courses/sysc-5701/>

**Grading Scheme:**

<b>Assignments</b>	<b>30 %</b>	2 assignments worth a total of 30%
<b>Term Report</b>	<b>40 %</b>	individual projects
<b>Final Exam</b>	<b>30 %</b>	in last class

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All work submitted in this course must be original – **plagiarism** will result in a grade of **F**, and will be reported to the Dean of Graduate Studies for further consideration.

**Topics:**

Week 1:	Introduction to concurrency
Week 2:	Real-Time Systems
Week 3 – 5:	Kernel, IPC and scheduling methods
Week 6 – 8:	Hard real-time methods
Week 9 – 10:	Concurrent languages/environments
Week 11 – 12:	Distributed computing methods
Week 13:	Student Term Report Presentations

**Term Report:**

Prepare a **20 – 25** page report (12 pt font, 15 by 23 cm text area, 1.5 line spacing) on a topic relevant to this course. Some initial suggestions for topic areas are given below, but feel free to suggest your own topic.

Completion of a report requires **independent study** – some lectures may address the content of your report; however, **you** are responsible for selecting the topic, researching and writing your report. **NO PLAGIARISM!**

**Term report format:**

- **title page:** your name, student number, project title, course number, date (not counted in page count)
- **executive summary:** one page – summarize significant findings documented in report
- **introduction:** 1 – 2 pages – places your project area in the context of a bigger picture – should point out related topics, and set the stage for the scope of your project
- **scope:** 1 page – gives a statement of the scope of the report
  - clearly identifies the project area (in terms of your introduction)
  - states what you are going to say about the area
  - states how the remainder of the report is organized to present your topic
- **body:** major content of the report – often organized as several chapters – some possible (but not required) content might involve: background history, state-

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of-the-art survey, case study example, analysis of competing approaches, example code fragments

- **open research areas:** 1 – 2 pages – suggests some open research questions that follow from your report
- **references** (not counted in page count)

**Term Report Proposal:** due no later than **Wednesday, September 28, 2011**

Submit a statement of the area and scope of the project – between 1 and 2 pages (**hardcopy**, no email please). This proposal is not expected to be as detailed as the scope section of the report, but should convey the topic area, the intended depth, and the general approach that will be taken.

The course instructor will provide written feedback on the proposals on **Wednesday, October 5, 2011**.

**Term Report:** due at the beginning of class: **Monday, December 5, 2011**

**LATE REPORTS WILL NOT BE ACCEPTED !**

(early reports are gladly accepted ☺ )

**Term Project Topic Suggestions:**

Pick a topic that you feel might be appropriate and interesting. These suggestions are not intended to be a complete list of all possible topics:

- EDF (earliest deadline first dynamic scheduling)
- RMA (rate monotonic static analysis)
- priority issues in embedded systems
- hard real-time analysis
- an academic operating system project targeted at real-time, embedded applications
  - e.g. RT-MINIX
- real-time Java
- fault-tolerance in real-time embedded systems
- time-triggered scheduling
- real-time programming languages
- dedicated hardware support for real-time operating system functionality
- propose your own topic

**A Note About Document Access:**

All students registered in at least one course have access to Library resources. This includes a number of electronic databases, such as ACM and IEEE. To obtain electronic documents, you must have a PIN that enables access through the Library server. This is not a complex process, but it requires that you visit the Library to obtain a barcode label for your student card. This cannot be done electronically; you must visit the Library physically. If you have not done this already, please do so ASAP.

**Accommodations**

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

**Pregnancy obligation:** write to me 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 <http://www2.carleton.ca/equity/accommodation/>

**Religious obligation:** write to me 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 <http://www2.carleton.ca/equity/accommodation/>

**Students with disabilities requiring academic accommodations** in this course must register with the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation of disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC, 613-520-6608, every term to ensure that I receive your Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you only require accommodations for your formally scheduled exam(s) in this course, please submit your request for accommodations to PMC by the deadlines published on the PMC website: <http://www2.carleton.ca/pmc/new-and-current-students/dates-and-deadlines/>