EE8205: Embedded Computer Systems
Course Management (Fall 2024)

Introduction:
This document provides a summary of the course management while complete details are available at EE8205 Website http://www.ecb.torontomu.ca/~courses/ee8205/. The course website will be updated, and it is your responsibility to check the announcement regularly. Announcements and Marks will also be posted on D2L. Moreover, assignments and exams submission will be organized via D2L.

Course Objectives:
This course introduces the concepts of embedded system organization and real-time systems. The course covers the background knowledge required for understanding embedded systems, system on chip technology and real-time operating system. The students will be able to grasp the main principles of real-time systems and understand the concept of hardware-software codesign.

Text, Reference Books and Related Material:
M. Wolf, Computer as Components: Principles of Embedded Computing System Design, 4th Edition, Morgan Kaufman Publishers 2016, ISBN 978-0-12-805387-4 **(TEXTBOOK)**

Daniel W. Lewis, Fundamental of Embedded Software with the ARM Cortex M3, 2nd Edition, Pearson 2013, ISBN 978-0-13-291654-7

SystemC: From the Ground Up, 2nd Edition, D.C. Black, J Donovan, B. Bunton, A. Keist, Springer 2010 ISBN 978-0-387-69958-5.

Alan Burns and Andy Wellings, Real-time Systems and Programming Languages, Addison-Wesley 2001 ISBN 0 201 72988 1

The instructor will also identify relevant e-books and review articles.

Tentative Lecture Schedule:

Lectures/Weeks	Lecture Topics
1	Introduction to Embedded Computer Systems
2	Hardware-Software Codesign - Introduction
3	Embedded CPUs and IP Cores
4	ARM Cortex M3 Microcontroller and Programming
5	Real-time Operating System RTX and VxWorks
6	SystemC and Hardware Software Codesign
7	JPEG Implementation using SystemC
8-9	Real-time Scheduling and Priority Inversion
10	Co-synthesis of Embedded Systems
11	Embedded System Reliability and Fault Tolerance
12	Embedded System Design – A Case Study
	Embedded System on Programmable Chips (if time permits)

Course Evaluation and Marking Scheme:
- Labs: 20% + (5% Bonus Marks)
- Main Project: 40%
- Final Exam: 40%

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Course Projects:

The Independent Project is the main project, where students study, simulate or build an embedded system related project. Details of typical projects are given below.

Main Project:

Details and Selection

Please choose a topic from any one of the following areas for your project. The project topics include but not limited to the following areas:

1. Case study and review of a specific embedded system related to aerospace, biomedical, space, multimedia, or consumer electronics (smart-phone, HDTV, etc.) device.
2. Development of a μcLinux based Real-time/Embedded Multitasking Application of your choice by employing an SoPC.
3. Developing a Real-time/Embedded Multitasking Embedded Application of your choice by using RTX (RTOS) and/or ARM Cortex Processor.
4. Embedded System Architecture for one of the following or any other industrial application of your interest:
   - Smart Home Controllers.
   - Multimedia Applications including MP3, MPEG and JPEG 2000.
   - RFID based Embedded Systems.
5. Codesign of a specific embedded system for a particular application including signal and image processing, image compression, multimedia, or any other interesting application.
6. Study and Implementation of a Real-time Scheduling Technique using an RTX for ARM Cortex M3/M4.
7. Multitasking Embedded Application of your choice by employing RTX for ARM Cortex M3 processor. .
8. Case study of a Fault-tolerant Embedded System of your choice. (such as aerospace, military, banking, or biomedical applications)
9. Modeling Embedded System of your choice or one of the following using SystemC or any other simulation environment:
   - JPEG 2000, MPEG-1, MPEG-2 or MP3 encoder and decoder
   - RFID based embedded systems.
10. Any project (approved by the instructor) on Hardware-software Codesign and System on Chip such as:
    - Embedded System Co-Specification and Using SystemC for Embedded System Modeling.
    - Embedded System Partitioning into Hardware and Software Modules.
    - Embedded System Co-synthesis.

Timeline of Independent Project Selection, Design and Development

- Submit Title of the Project before or start of week-5
- Submit (1-2 pages) summary of the approach to the project during week-5
- Demo and or submit your project progress report in week-9.
  The interim project report should be 4-6 typed pages.
- Final project demo and/or presentation due by the end of Last week of the semester.
- Final project report due by the final exam day.
- The final project report should be 10-15 pages and in a typical IEEE paper style (single column).
- Late submission will be charged with a late submission penalty for the final project demo as well as interim project report/demo. There will be no late submission for the final project report.

Short Presentations of selected projects will be scheduled in the last two weeks.