COE718: Embedded Systems Design
Course Management – Fall 2026

Introduction:
This document provides a summary of the course while complete details are available at COE718 course http://www.ecb.torontomu.ca/~courses/coe718/. D2L is also used for posting marks and restricted material as well as submission of Lab/Project reports & Exams (if required).

Course Objectives:
This course will cover the basics of embedded system organization, system on programmable-chip technologies and real-time systems. It provides the advanced knowledge required for embedded computer design and development as well as real-time operating systems. Students are introduced to software development concepts applicable to real-time and embedded systems. Particularly ARM Cortex M3/M4 will be studied as a representative embedded CPU and embedded software development are carried out for ARM Cortex CPUs. The students will be able to grasp the main principles of embedded system design and understand the concept of hardware-software codesign, RTOS and real-time scheduling techniques. Embedded system co-specification and partitioning is also introduced in the course. SystemC or other languages (e.g. UML, C, etc.) can be employed to present a unified view of the embedded systems. SystemC is introduced as a representative Co-specification language. Embedded hardware-software design and development tools (such as Keil MDK and RTX as well as Altera Quartus II and SOPC builder) will be employed in the labs and project.

Contact Hours (3+2), Pre-Requisite: COE538

Text Book:
Daniel W. Lewis, Fundamentals of Embedded Software with the ARM Cortex M3, 2nd Edition Pearson 2013, ISBN 978-0-13-291654-7 (Paperback cost $93.77 on Amazon)

Reference Books and Related Material: (optional/not-required)
T. Martin, The Designer's Guide to the Cortex-M Processor Family: A Tutorial Approach, Elsevier, 2013, ISBN 978-0080982960

M. Wolf, Computer as Components: Principles of Embedded Computing System Design, 4th Edition Morgan Kaufman Publishers 2016, ISBN 978-0-12-805387-4

J. Yiu, The Definitive Guide to the ARM Cortex-M3, 2nd Edition, Elsevier, 2010, ISBN 978-1856179638

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

Some relevant review articles may be identified by the instructor and will be available at the course web page.

Course Evaluation and Marking Scheme:
Labs/Project: Labs: 20% (4+4+4+4+4)
Project: 15%
Theory: Mid-Term Exam: 25% (Week 7 during Lecture Hours)
Final Exam: 40%

To pass the course students need to pass Theory (Midterm/Final Exams) and Lab (Labs/Project) components.

Lab Instructors/Supervisors:
Consult COE718 course webpage: https://www.ecb.torontomu.ca/~courses/coe718/index.html

Additional Information:
- Labs and projects are based on embedded system design using uVision, RTX and MDK. Labs and project also involve ARM Cortex M3 CPU based multitasking, real-time scheduling and an application design.
- There is a 5% per day penalty of marks for late submission of labs and projects.
- The students must follow and adhere to the senate policy 60 on Student Code of Academic Conduct.

Tentative Course Topics and Schedule

Week	Lecture Venues DSQ14 (Sec 1-6), DCC208 (Sec 7-14)	Labs/Project Venue - ENG411
1	Introduction to Embedded Systems Embedded Processor Architecture (ARM7 and M3)	
2	ARMv7 and Cortex M3 Architecture	**Lab-1:** Introduction to uVision and ARM Cortex M3
3	ARM Cortex M3 for Multitasking Applications	**Lab-2:** Exploring ARM Cortex-M3 Features **Due: Lab-1**
4	RTOS: Real time Operating Systems. RTX operating system environment	**Lab-3a:** RTX based Task Scheduling and Multitasking. **Due: Lab-2**
5	Introduction to Real-time Scheduling. Pre-emptive and Non-pre-emptive Scheduling.	**Lab-3a**: RTX based Task Scheduling and Multitasking.
6	Real-time Scheduling Techniques.	**Lab-3b:** Real-time Scheduling **Due: Lab-3a**
7	***Mid-term Exam*** (During Lecture Hours)	**Lab-3b:** Real-time Scheduling (Start of Course Project)
8	Rate-Monotonic (RMS) and Earliest-Deadline-First (EDF) Scheduling. Priority Inversion	**Lab-4:** Priority Inversion **Due: Lab-3b** **Due:** Course Project Summary 1-2 pages
9	Priority Inversion Problem and its Solutions.	**Due: Lab-4** Project Progress
10	Hardware Software Co-design and Embedded SoPC (System on Programmable Chips)	**Project Progress**
11	Accelerator based Embedded System.	**Due:** Project Interim Report
12	Fault-tolerant Embedded Systems.	**Project Demo and Presentation**
13	Catching up; and course review.	**Project Demo, Final Project Report**

Note: The above topics and the schedule is tentative. There may be some minor changes in the topics schedule that will be announced in the class and posted at the course website.

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