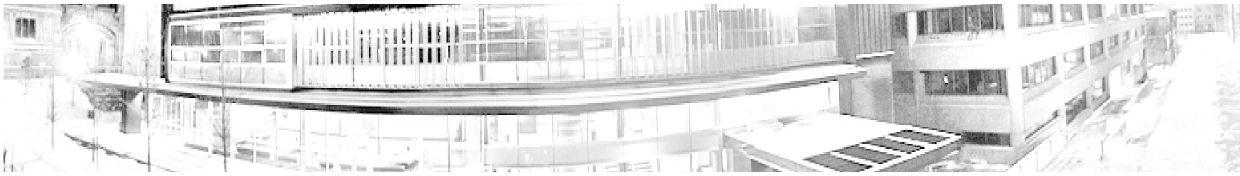
McGill
Faculty of Engineering



Course Outline

ECSE 426

Course Title:	**Microprocessor Systems**
Credits:	**3**
Contact Hours:	**(1-5-3)**
Course Prerequisite(s):	**CCOM 206 or EDEC 206, ECSE 323**
Course Corequisite(s):	**N/A**
Course Description:	**Introduction to current microprocessors, their architecture, programming, interfacing and operating systems. The course includes lectures, use of crossassemblers, and simulators as well as laboratory experiments on actual microprocessor hardware.**

Canadian Engineering Accreditation Board (CEAB) Curriculum Content

CEAB curriculum category content	Number of AU's	Description
Math	**0**	Mathematics include appropriate elements of linear algebra, differential and integral calculus, differential equations, probability, statistics, numerical analysis, and discrete mathematics.
Natural science	**0**	Natural science includes elements of physics and chemistry, as well as life sciences and earth sciences. The subjects are intended to impart an understanding of natural phenomena and relationships through the use of analytical and/or experimental techniques.
Complementary studies	**0**	Complementary studies include the following areas of study to complement the technical content of the curriculum: engineering economics; the impact of technology on society; subject matter that deals with central issues, methodologies, and thought processes of the arts, humanities and social sciences; management; oral and written communications; healthy and safety; professional ethics, equity and law; and sustainable development and environmental stewardship.
Engineering science	**22.75**	Engineering science involves the application of mathematics and natural science to practical problems. They may involve the development of mathematical or numerical techniques, modeling, simulation, and experimental procedures. Such subjects include, among others, applied aspects of strength of materials, fluid mechanics, thermodynamics, electrical and electronic circuits, soil mechanics, automatic control, aerodynamics, transport phenomena, elements of materials science, geoscience, computer science, and environmental science.
Engineering design	**22.75**	Engineering design integrates mathematics, natural sciences, engineering sciences, and complementary studies in order to develop elements, systems, and processes to meet specific needs. It is a creative, iterative, and open-ended process, subject to constraints which may be governed by standards or legislation to varying degrees depending upon the discipline. These constraints may also relate to economic, health, safety, environmental, societal or other interdisciplinary factors.

Accreditation units (AU's) are defined on an hourly basis for an activity which is granted academic credit and for which the associated number of hours corresponds to the actual contact time: one hour of lecture (corresponding to 50 minutes of activity) = 1 AU; one hour of laboratory or scheduled tutorial = 0.5 AU. Classes of other than the nominal 50-minute duration are treated proportionally. In assessing the time assigned to determine the AU's of various components of the curriculum, the actual instruction time exclusive of final examinations is used.

Graduating Student Attributes

This course contributes to the obtention of the following attributes:

Graduating student attribute	KB	PA	IN	DE	ET	IT	CS	PR			EP	LL

KB *- Knowledge Base for Engineering: Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.*

PA *- Problem Analysis: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.*

IN *- Investigation: An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.*

DE *- Design: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, economic, environmental, cultural and societal considerations.*

ET *- Use of Engineering Tools: An ability to create, select, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.*

IT *- Individual and Team Work: An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.*

CS *- Communication Skills: An ability to communicate complex engineering concepts within the profession and with society at large. Such abilities include reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.*

PR *- Professionalism: An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.*

EP *- Economics and Project Management: An ability to appropriately incorporate economics and business practices including project, risk and change management into the practice of engineering, and to understand their limitations.*

LL *- Life-Long Learning: An ability to identify and to address their own educational needs in a changing world, sufficiently to maintain their competence and contribute to the advancement of knowledge.*

Policies

Academic Integrity

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures.
(see www.mcgill.ca/students/srr/honest/ for more information).
(approved by Senate on 29 January 2003)

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.
(approved by Senate on 21 January 2009)

Grading Policy

In the Faculty of Engineering, letter grades are assigned according to the grading scheme adopted by the professor in charge of a particular course. This may not correspond to practices in other Faculty and Schools in the University.

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

ECSE 426 Course Outline

Instructor

Name: Mark Coates
Email: mark.coates@mcgill.ca
Phone: 514-398-7137
Office: McConnell Engineering, Room 759
Office Hours: By appointment (email in advance)

Teaching Assistants

Ashraf Suyyagh, Zaid Al-bayati, Harsh Aurora, Andrey Tolstikhin, Loren Lugosch

General Information

Lectures: Monday, 10:05 AM - 11:25 AM, Trottier 0060
Tutorials: Friday, 11:35 PM - 12:55 PM, Trottier 0060

All materials, assignments, and discussion boards for the course will be hosted on myCourses. In all course-related email correspondence with the instructor, please make sure the subject line includes "ECSE-426". (This will be inserted automatically if sent from within myCourses.)

Evaluation

- Laboratory Exercises (48%): There are four laboratory exercises, which are conducted in pairs. Each pair must submit one report and participate in a demonstration of their work.
- Project (40%): A project is conducted in a group of 4. Each group submits a report and participates in a demonstration of their work.
- Quizzes (12%): Four 15 minute quizzes held at the start of lectures (short answer and multiple choice)

Textbooks

There is no textbook for the course. The book by Yiu is the most closely related to the course material.

Recommended Reading:

J. Yiu, *The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors*, Newnes, 2013.

A. Tanenbaum and T. Austin, *Structured Computer Organization*, sixth edition, Prentice Hall, 2012.

C. Hamacher, Z. Vranesic, S. Zaky and N. Manjikian, *Computer Organization*, 6th edition, McGraw-Hill, 2012

B. Shriver and B. Smith, *The Anatomy of a High-Performance Microprocessor - A Systems Perspective,* IEEE Computer Society Press, 1998.

Articles and Manuals:

Supplementary documents will be posted on the myCourses course page (manuals for hardware, articles on example microarchitectures).

Course Policies

Late Assignments: Without pre-arranged extension (i.e., communication with the instructor before the due date) or a valid excuse, late assignments are subject to a penalty of 5% of the maximum available marks per day late. (Friday to Monday counts as 1 day)

Missed Demos: Without pre-arranged re-scheduling (i.e., communication with the instructor or TA well before the scheduled demo time) or a valid excuse, you will have an opportunity to reschedule the demo for 65 percent of the grade.

Lab Groups and Room Access: The experiments will be conducted in pairs. Pairs will be assigned lab hours and will reserve time slots for lab demonstrations. Further instructions concerning access to the lab and access to the hardware will be provided during the semester.
The project will be conducted in groups of 4.

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L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site http://www.mcgill.ca/students/srr/honest/).

Right to Submit Written Work in English or French

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

Course Content

The objective of this course is to provide the necessary understanding and skills for students to design and build microprocessor systems. By the end of the course, you should:

(1) understand the organization and design principles of modern microprocessor-based systems;

(2) be proficient in assembly and high-level (C language) programming for embedded systems; (3) understand the performance impact of the embedded software, including the energy and memory-limited design techniques;

(4) know how to connect peripheral devices and networking interfaces, and how to write programs for the efficient interface use;

(5) have experience in developing a realistic embedded system solution through teamwork;

Schedule of Lectures and Labs

There are (on average) per week 1 lecture hour, 1 tutorial hour, 4 lab hours, and 3 preparation hours associated with this course. Over the course of the semester there will be 10 lectures, 5 tutorials, 4 labs and a project.

Week	Lecture Material	Tutorials	Labs and Project
1 (Sep 7)	Introduction	Tutorial A Assembly and C	Form lab groups
2 (Sep 14)	Assemblers, Lab Intro	Tutorial 1 Introduction to IDE and assembly	
3 (Sep 21)	Linker, loader, processor architecture		Lab 1
4 (Sep 28)	Processor Microarchitecture; Q1	Tutorial 2 - Introduction to embedded C, IDE and drivers	Lab 1 and Demo
5 (Oct. 5)	Embedded Processors		Lab 2
6 (Oct 12)	IO/Processor Interfacing; Q2	Tutorial 3 - Introduction to timers, interrupts and MEMS	Lab 2 and Demo
7 (Oct 19)	Buses, Networking, Operating System; Q3		Lab 3
8 (Oct 26)	Embedded OS Services	Tutorial 4 – Real time Operating Systems	Lab 3 and Demo
9 (Nov 2)	Real-time processing; Q4	Tutorial 5 – Wireless and writing drivers	Lab 4 and Demo
10 (Nov 9)	Project Intro		Project
11 (Nov 16)			Project
12 (Nov 23)			Project
13 (Nov 30)			Project
14 (Dec 7)			Project Demo

As with any plan, this schedule is subject to some change.