Carleton University
Dept. of Systems and Computer Engineering

Microprocessor Systems—SYSC 3601
Course Syllabus

Instructor
Dr. Lawrence Dobranski, P.Eng.
Email: lawrence.dobranski@carleton.ca
Office hours: TBD and posted on cuLearn

Teaching Assistant
Zahra Ashouri Talouki,
Email: ZahraAshouriTalouki@cmail.carleton.ca

Dates, Times, and Locations

Lectures
Mondays 8:35AM – 11:25AM ME4342
Wednesdays 8:35AM – 11:25AM ME4342

Labs
Wednesdays 11:35 AM – 2:25 PM SYSC 3601A: ME4485
2:35 PM – 5:25 PM SYSC 3601B: ME4485

Students should consult cuLearn for any changes in the locations of the lectures and/or labs.

Communications
Please check the website (cuLearn) regularly; important announcements will be posted there as the course progresses.

Calendar Description
Course Objectives and Learning Outcomes
To familiarize students with microprocessor-based circuit design and embedded systems. The course deals with the applications, organization, architecture, and design of microprocessor systems. Topics covered include addressing, bus structures, memory and I/O interfacing, interrupt mechanisms, and related techniques at the hardware and assembly language levels.

Prerequisites
ELEC2607 and SYSC2003 or obtain a prerequisite waiver by visiting the Engineering Undergraduate Academic Support Office.

Students must satisfy the prerequisites in order to remain registered in the course. Students who have not completed the prerequisites are required to withdraw from the course or they may be deregistered from the course after the last day for course registration.

Students without the prerequisites or a prerequisite waiver will be deregistered from the course after the last day to register for courses in the Summer 2018 term.

Precludes additional credit for SYSC 3320 or ELEC 4601.

Instructional Resources
Zahra Ashouri Talouki will supervise and mark the labs. For help with the labs, you can arrange with Zahra Ashouri Talouki by email: ZahraAshouriTalouki@cmail.carleton.ca

Instructor: I will be available during my posted office hours on https://culearn.carleton.ca. Please reach me by email to schedule an appointment.

Textbooks


Note:
The course may not follow the textbooks closely.

Course Webpage
The course announcements, course syllabus, lecture slides, and other essential reference material used in class, assignments, and any material needed or used in the lab sessions can be found on cuLearn. It is the student’s responsibility to be aware of the information on cuLearn and to check it regularly for announcements.
Email Correspondence
To ensure that you receive a timely response to email that are sent to the instructor or TA(s), please begin the Subject with [SYSC 3601]. All emails will be filtered using this identifier.

Students are expected to show and maintain a high-level of professionalism in all email correspondence. This means that emails should include a proper salutation and sign-off/signature, and should refrain from using slang, texting abbreviations, and emojis/emoticons.

Note that email is not the best media for technical questions and exchanges. Technical questions submitted by email will be answered in the beginning of the next lecture.

Assessment
Laboratories (15%)
There will be three (3) laboratory exercises. Each exercise requires the completion of a pre-lab component. Lab manuals will be posted on the course website a week before each lab. The TA will discuss and assess your work in the lab. Late reports will not be accepted. A lab is considered late if submitted after 2:30 for laboratory section SYSC3601A or 5:30 for laboratory section SYS3601B on the day of the lab session.

Attendance at the scheduled laboratory periods is mandatory, except for reasons accepted by the Associate Dean's Office (see Academic Regulations of the University), will result in a grade of 0.

Mid-term (25%)
There will be one (1) midterm examination. It will be a closed book written examination. The midterm exam is worth 25% of the final grade and will take place on Wednesday, July 25th during the lecture time from 09:00AM – 11:00 AM. The location of the midterm exam will be announced on cuLearn in due time. The midterm exam will cover the material from the lectures, labs, assignments, and the required textbooks.

Final Exam (45%)
The final exam will be held during the University’s examination period in August and will be scheduled by the Registrar’s office in the usual way. It will be three (3) hours in duration and will cover the material from the lectures, labs, assignments, and the required textbooks. The final exam is for evaluation purposes only and will not be returned to students. The final exam counts for 50% of the final grade.

In-class participation & Quizzes (15%)
Students will be expected to participate in in-class discussions and to write 5-minute quizzes.

Grading Scheme
- Lab work: 15%
- In-class participation and quizzes: 15%
- Mid-term Exam: 25%
- Final Exam: 45%
Tentative Course Outline

Please note that this course outline is subject to change as circumstances dictate.

- **Background and Introduction**
  - Microprocessor history, types, applications and selection
  - General microprocessor architecture
  - Review of number systems

- **The Intel 80X86/88 Architectures and Programming**
  - Registers and Internal Architecture
  - Address generation and addressing modes
  - Instruction set and assembly language programming
  - The SDK-86 System Development Kit

- **The Intel 80X86/88 Bus and Buffering**
  - 80X86/88 Pin functions, states, bus cycles and signalling waveforms
  - Clock generators (Intel 8284) and bus controllers (Intel 8288)
  - Latches (74373) and bus transceivers (74245)
  - Wait states and bus timing

- **Memory Structures and Interfacing**
  - Memory types and characteristics (DRAMs, SRAMs, ROMs, EPROMs)
  - Address decoding
  - Memory interfacing

- **Input/Output Systems (I/O)**
  - Programmed I/O structures
  - I/O ports design and address decoding
  - Programmable Peripheral Interface Chips (Intel 8255A)
  - Keyboard/Display Interface (8279)

- **Interrupt Systems**
  - Interrupt Types (HW, SW and Exceptions)
  - Interrupt structures
  - Programmable Interrupt Controllers (Intel 8259 PIC)
  - Programmable Counters/Timers (8253)

- **Direct Memory Access**
  - Introduction to DMA structures
  - Intel 8237 DMA Controller

- **Introduction to Embedded Systems—The ARM processor**
- Introduction to ARM and philosophy.
- The ARM architecture.
- The ARM programmer's model.
- Pipelining and parallelism.
- 3-stage pipeline and 5-stage pipeline.
- ARM assembly language programming.
- Data processing instructions.
- Data transfer instructions.
- Control flow instructions.
- The ARM instruction set. The Thumb variant.
- ARM addressing modes.
- RISC vs. CISC architectures.
- ARM instruction format.
- Memory hierarchy.
- On-chip memory.
- Caches.
- The ARM development kit.

Instructor Expectations, Policies, and Notes

1. **Missed assignment, lab, or exam:** As stated in the Academic Regulations of the University, students who claim illness, injury, or other extraordinary circumstances beyond their control as a reason for missed term work are responsible for immediately informing the instructor and for making alternate arrangements with the instructor. This must occur no later than three (3) working days after the term work was due.

2. **Labs:** Each group will have a three (3) hour lab session per week. Attendance at lab sessions is compulsory. You must attend your assigned session of the lab.

3. The instructor reserves the right to assign extra grades for extra work done by willing students. However, the work subject to extra grades will be advertised during the lectures to provide the opportunity to all students.

4. A regrading request of an assignment, lab, or exam is considered by the TAs and the instructor only if it is made within the two weeks that follow the return date of the majority of the concerned assignment, lab, quiz, or exam.

5. **No responsibility for loss of assignments or labs** can be assumed by either the instructor or the TAs. Keep copies of your own assignments and labs.

6. Students are responsible for ensuring that their assignments and labs are submitted correctly and without corruption.
7. Calculators are not needed for this course and their use will not be permitted during exams.

8. The lectures will not necessarily follow the order in which the topics are presented in the detailed course outline. Regular class attendance is required.

9. Significant study, reading, and group discussions outside of class are required. Looking at, or only reading the slides that are provided may not be enough to achieve the level of understanding required for the assignments and exams.

10. Students are expected to show professional behaviour. This includes being on-time for lecture and lab sessions, meeting assignment deadlines, and maintaining a suitable level of professionalism in oral and written (email) correspondence with the instructor and TAs.

11. Students that are having difficulty with the course content are expected to seek help early. Students are encouraged to ask questions in class and/or seek help during the instructor’s office hours.

12. Suggestions on how to improve the course and the instructor’s teaching methods are always welcomed.

**Important Warning**

The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their Carleton email and cuLearn weekly during the term and to note any changes.

**Academic Accommodation**

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 the course 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 Student Guide to Academic Accommodation.

**Religious Obligation:** Write to the course 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 Student Guide to Academic Accommodation.

**Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and
impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send the course instructor your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with the course instructor to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).