Course Objective
As the use of computing systems for signal processing and control becomes more widespread, and their operation and inter-device interactions become more complex, it is important that a principled design methodology be followed in the development of such systems. The goal of this course is to provide a logical framework for the design of digital systems with specific emphasis on embedded computing applications.

Course Content
The following topics will be covered:
• The design process as it applies to digital systems;
• Development of a system architecture;
• Modeling of embedded software/firmware;
• Estimating system performance;
• Inter-component communication;
• Multi-processor systems and caching;
• Introduction to security.

Laboratories
Laboratory work may be performed in groups of not more than two students. Each student is required to use a laboratory notebook in which to record information relevant to the conduct of the five laboratories. This includes answers to assigned laboratory questions, working notes, results obtained during the laboratories, and answers to any pre-laboratory assignments.

The laboratory notebook must be brought to each laboratory session and must be presented to the laboratory demonstrator for inspection at the completion of each laboratory. The demonstrator will sign the laboratory notebook, indicating that all assigned tasks have been completed. Each student will be required to submit two detailed and individual laboratory reports during the course as assigned by the course instructor.

Textbook

Reference (optional)

Academic Integrity
Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Retention of Student Work
Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University’s Intellectual Property Policy and the protection of privacy provisions of The Freedom of Information and Protection of Privacy Act (Manitoba). Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.
Learning Outcomes

1. Demonstrate the ability to formulate a system architecture composed of microprocessor, FPGAs and supporting components.
2. Demonstrate the ability to design and develop basic embedded software for digital systems.
3. Demonstrate the ability to estimate system performance and resource use, and use this information to evaluate and improve a design.
4. Acquire a working understanding of common inter-component communication protocols for embedded applications.
5. Acquire a basic understanding of multiprocessing systems and caching.

Expected Competency Levels

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<th>Outcome</th>
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Evaluation

The final course grade is determined by the student’s performance on assignments, in laboratories, and on tests and examinations.

Students must complete all laboratories in order to be eligible to receive a passing grade.

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<th>Component</th>
<th>Value (%)</th>
<th>Method of Feedback</th>
<th>Learning Outcomes Evaluated</th>
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<tr>
<td>Assignments</td>
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<td>Laboratories</td>
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<td>Final Examination</td>
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* Method of Feedback: F - Formative (written comments and/or oral discussion), S - summative (numerical grade)

Requirements/Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University’s General Academic Regulations, as well as Section 3 of the Faculty of Engineering Academic Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, smart watches, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.