Digital Systems Design
ECSE 323 Fall 2015

Instructors:

Prof. Warren Gross
Department of Electrical and Computer Engineering
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Office Hours: Thursday, 3:00 PM – 4:00 PM. Prof. Gross is also available outside of office hours. Please contact to arrange a time.

Prof. James J. Clark
Department of Electrical and Computer Engineering
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Office Hours: Monday, Friday, 2:30 – 3:30 PM.

Lectures: Tuesday, Thursday: 1:05 PM – 2:25 PM, Arts Building W-120 (ARTS W-120)

The first lecture will be Tuesday September 8 and the last lecture will be Thursday December 3.

Midterm: Thursday October 22, 1:05 PM – 2:25 PM, rooms TBD.

Laboratories: Information about the laboratory location and times will be provided in the first few lectures.

Tutorial: Monday 9:35 AM - 11:25 AM Trottier 0070
or Friday 12:35 PM to 2:25 PM McConnell 11

- The first tutorials start September 14 (M) or September 18 (F) and the last tutorials are on November 30 (M) and December 4 (F).

- **Students must only attend the tutorial for which they are registered. Quizzes written in the other tutorial will not be graded.**

Teaching Assistants:

Tutorial:
Mehdi Rezagholizadeh (mehdi.rezagholizadeh@mail.mcgill.ca)

Lab: TBA

Credits: 5. **Course Hours: (3,6,6) (**Lectures, Labs and tutorials, outside work**).**

Prerequisites: ECSE 211 Design Principles and Methods, ECSE 291, Electrical Measurements Lab, ECSE 221, Introduction to Computer Engineering, CCOM 206 or EDEC 206, Communication in Engineering.

Required Textbook: Stephen Brown and Zvonko Vranesic, **Fundamentals of Digital Logic with VHDL Design** 3rd edition, McGraw-Hill, 2009

Web page: Information for the course will be posted on the course myCourses web page. The myCourses page for the course should be the first place you look to get information about the course. The use of email for communication with the instructors or the teaching assistants is encouraged. You must send email from myCourses or from your McGill Email address. **Please put "323" in the subject line.**

Calendar Course Description: Minimization and synthesis of combinational logic and finite state machines. Synthesis of synchronous and asynchronous sequential circuits. Principles of control design. Basic concepts in design for testability. The laboratory experiments involve the design and testing of digital systems using small and medium scale integrated circuits. CAD software is used in the design process.

Laboratory: At the completion of this course, students should be able to prototype and test digital systems based on Altera Gate Array integrated circuits. Programming of programmable logic devices using industry standard software. Use of VHDL to specify and verify combinational and sequential digital circuits of varying levels of complexity. Design and documentation of reusable IP cores and their application to building of complex digital systems.

Assumed Knowledge: The following knowledge is assumed to have been acquired through previous studies by the student:

- Basics of Boolean algebra.
- Function of elementary digital logic gates such as AND, OR, NOT, and flipflops.
- Binary integer arithmetic, e.g. 2's complement addition.
- Use of the Microsoft Windows operating system.
- Use of Web browsers and search engines.

Instructional Method:

- There will be two 1-1/2 hour class lectures every week throughout the term.
- There will be two 2-hour tutorial sessions each week. Each student is expected to attend one of these two sessions each week. The purpose of the tutorials is threefold: (1) to go over the last quiz and discuss its solution, (2) to answer questions on class related material, (3) to administer a quiz, based on the material of the preceding week's lectures. There will be a quiz in every tutorial unless otherwise announced beforehand. Of those quizzes, 5 will be chosen at random and graded. The top 4 marks of the graded quizzes will be used to compute the quiz grade. The tutorials comprise an important aspect of this course, and each student is expected to attend them.
- Students must only attend the tutorial for which they are registered. Quizzes written in the other tutorial will not be graded.
- Each instructor will hold weekly office hours. The purpose of these sessions is to go over class material that students may be having problems with, and also to handle any administrative issues that may arise.
- The laboratory activity will be divided into five components, each directed towards the completion of the lab project. Each of these lab modules will be carried out in two- or three-week intervals.
- The laboratory is located in Trottier and will be open every weekday from 9 to 6. If you want to work in the morning and the lab is locked, please ask one of the technicians in the 4th floor shop to open the door. Don't ask the T.A.s to open the door, because they don't have the key!
- The students will work in groups of two and will be allocated 4 hours of lab per week in two hour blocks of supervised time. Details on the procedure for signing up for your timeslots will be given in the second week of lectures. The lab time should be utilized primarily for testing and demonstration. All the design and assembly should be done outside of regular laboratory hours.
- Some of the lab experiments will use an Altera University Program prototyping board. This board contains an Altera Field Programmable Gate Array chip along with various LEDs and switches. The lab computers have the Altera Quartus software installed that allows students to simulate, and download to the development boards, circuits that they have designed.

Evaluation Procedures:

The overall course grade will be based on the results of 4 quiz grades, one midterm exam, a final exam, the demonstrations of laboratory experiments, and the documents written for the laboratory experiments. The relative weighting of each of these evaluation components will be as follows:

Laboratory Demonstrations	20%
Laboratory Documentation	20% (reports for labs 1 to 4 are 3% each, and lab 5's report is worth 8%)
Quizzes	10%

Midterm examination **(October 22, 2015)**	15%
Final examination	35%

*** Please note that, in order to get a passing grade for the course, the student must achieve a passing grade in both the lecture component (quizzes, midterm, final) and the lab component of the course. Students who receive a failing grade will be required to repeat the entire course, including the lab, even if they received acceptable grades for one of the course components. Some students may be given a "D" grade in the course if they do well in one component but fail in the other. In this case the course instructor may recommend that such students will only be required to redo the component that they failed. However, the decision as to whether one or both components of the course need to be retaken is solely that of the instructor at the time the course is retaken.**

Grade points for the laboratory demonstrations will be determined by the fraction of the lab module successfully completed and demonstrated. In addition to the lab demonstrations, each group will be required to submit lab reports for each experiment. *It is required that each group develop these documents themselves. Copying is quite easy to detect and will not be tolerated. Offenders will be referred to the Associate Dean for Undergraduate Education for disciplinary action.*

Extensions are generally not granted for laboratory demonstrations and module documents.

With the exception of quizzes (**see quiz absence policy below**), if an evaluation component is missed due to a medical reason, then either 1) there will be a makeup evaluation given or 2) the missed component of the course grade will be added into the final exam component. This choice is at the discretion of the instructor. In the case of illness, you must inform the instructor as soon as possible. Medical notes will only be accepted for up to a maximum of one-week passed the missed date. The decision as to whether to accept a medical note is at the discretion of the instructor. **No allowance will be made for individual students due to absence from quizzes for any reason, other than dropping the quiz with the lowest grade as described above.**

Instructor generated course materials (e.g., handouts, notes, summaries, exam questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that infringements of copyright can be subject to follow up by the University under the Code of Student Conduct and Disciplinary Procedures.

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 - see also the section in this document on Assignments and evaluation.)

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.

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	**22.2**	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	**51.8**	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.