

ECE 4510: Microprocessors and Digital Logic

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| Instructor | Mohsin Jamil | Teaching Assistants: Mohammad Al Saaideh |
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| Office Location | CSF-3124 | |
| Office Hours | Monday, 10:00 am– 12:00 pm; Wednesday, 2:00 pm – 4:00 pm | |
| Communication | Brightspace (D2L) page on online.mun.ca (mjamil@online.mun.ca) | |
| Website | http://online.mun.ca (D2L) | |

CALENDAR ENTRY:

Microprocessors and Digital Logic include number systems, logic gates, and Boolean algebra. Karnaugh maps and combinational logic design. Sequential logic and state machines, microprocessor architectures, microprocessor programming, GPIO, analog input and output, and serial communication.

CR: ECE 3500 and ECE 4500

LH: Five 3-hour sessions per semester

OR: Twelve 1-hour tutorial sessions per semester

PREREQUISITES: ECE 3300 or the former ENGI 3821, ENGI 1040, ENGI 3424

SCHEDULE:

LECTURE: Tuesday and Thursday, 4:15–5:30 pm

Room: EN-2007

TUTORIAL: Wednesday, 4–5 pm (EN-2007)

LABORATORY: Monday, 2–5 pm (CSF 2103)

CREDIT VALUE: 3 credit hours

LABS AND PROJECT:

All labs will be a combination of software simulation and hardware. There will be five labs plus a project in total. All details and instructions related to the labs and project will be shared separately. Attendance is compulsory in all lab sessions.

CONTENT CATEGORIES: (expressed as %, no category can be $0 < c < 25$)

| Math | Natural science | Complementary Studies | Engineering Science | Engineering Design |
|------|-----------------|-----------------------|---------------------|--------------------|
| | | | 50% | 50% |

RESOURCES: TEXTBOOK AND REFERENCES

- John F. Wakerly, Digital Design: Principles and Practices, 5th ed., Prentice Hall, 2018.
- Digital Design, 5th Edition, M. Moris Mano, Prentice Hall, 2012.
- Thomas L. Floyd, Digital Fundamentals: A Systems Approach, Pearson 2013.
- Steven F. Barrett, Atmel AVR Microcontroller Primer: Programming and Interfacing, Morgan & Claypool Publishers, 2007
- Steven Barrett and Mitchell Thornton, Embedded Systems Design with the Atmel AVR Microcontroller (Synthesis Lectures on Digital Circuits and Systems), Morgan & Claypool Publishers, 2009
- Lecture Notes and Handouts

MAJOR TOPICS:

- 1) **Introduction:** why digital? history, concept of gates, binary representation
- (2) **Combinational Logic Design:** truth tables and gates, Boolean algebra, Karnaugh maps
- (3) **Combinational Logic Devices:** decoders and encoders, multiplexers, programmable logic devices
- (4) **Arithmetic Devices:** representations of numbers, addition and subtraction, codes, adders, parity circuits, comparators
- (5) **Sequential Logic Design:** flip-flops, analysis and design of state machines
- (6) **Microprocessors:** Introduction to microprocessors and microcontrollers, embedded system, microprocessor architectures
- (7) **Microcontroller Programming:** General purpose input-outputs (GPIO), analog input and output, programming, sensors interfacing, ADC, DAC, Timers, Counters, Hardware issues, serial communication. Practical design consideration with case studies.

ASSESSMENTS:

| | | Approximate Due Dates |
|-------------------|-----|----------------------------------|
| Short Quizzes (3) | 12% | |
| Quiz 1 | | Thursday, 23 May 2024 (Week 3) |
| Quiz 2 | | Thursday, 06 Jun 2024 (Week 5) |
| Quiz 3 | | Thursday, 18 July 2024 (Week 11) |
| Assignments (2) | 10% | |
| Assignment 1 | | Thursday, 20 Jun 2024 |
| Assignment 2 | | Thursday, 22 Jul 2024 |
| Midterm Exam | 18% | Thursday, 27 Jun 2024 (Week 8) |
| Labs and Project | 20% | Five Labs (Biweekly)+Project |
| Final Exam | 40% | TBA (Aug 5-Aug 10) |

ASSESSMENT POLICY:

There will be no makeup midterm exam or quiz. Late assignments will receive a score of zero. All assessment dates are tentative. Students are expected to stay informed about course announcements and materials, which will be disseminated via D2L or in-class sessions.

LEARNING OUTCOMES:

Course Level Graduate Attribute Focus: KB-I, Inv.-D, Des.-D

Upon successful completion of this course, the student will be able to:

| | LEARNING OUTCOMES | GRADUATE ATTRIBUTES. LEVEL OF COMPETENCE | METHODS OF ASSESSMENT |
|---|--|--|--------------------------|
| 1 | Demonstrate knowledge of number systems & codes, Boolean algebra. | KB.5-I | Tests, Exams |
| 2 | Demonstrate knowledge of combinational and sequential logic design methods. | KB.5-I, Des.3-D | Labs, Tests, Exams |
| 3 | Analyze digital systems with combinational and sequential logic parts and devices. | KB.5-I, PA.2-D, Des.3-D | Tests, Exam |
| 4 | Implement digital circuits using Software | Inv.2-D, Des.3-D Team.1-I | Labs, Assignments |
| 5 | Understand the hardware and software fundamentals of a microcontroller family. | KB.5-I | Tests, Exams |
| 6 | Demonstrate knowledge of programming microcontrollers | KB.4-I | Labs, Tests, Exams |
| 7 | Design and interface microcontrollers with I/O devices | Des.1-D, Tools.1-I | Assignments, Labs, Exams |
| 8 | Develop skills in troubleshooting digital circuits and microcontrollers using basic tools. | Des.3-D, Tools.1-I, Team.1-I | Assignments, Labs, Exams |

Each graduate attribute for each learning outcome is rated at a content instructional level of I=Introductory, D=Developed, or A=Applied.

See <http://www.mun.ca/engineering/undergrad/graduateattributes.pdf> for more information on the 12 Graduate Attributes you are expected to be proficient in upon graduation.

ACADEMIC INTEGRITY AND PROFESSIONAL CONDUCT:

Students are expected to conduct themselves in all aspects of the course at the highest level of academic integrity. Any student found to commit academic misconduct will be dealt with according to the Faculty and University practices. More information is available at <http://www.mun.ca/engineering/undergrad/academicintegrity.php>

Students are encouraged to consult the Faculty of Engineering and Applied Science Student Code of Conduct at <http://www.mun.ca/engineering/undergrad/academicintegrity.php> and Memorial University's Code of Student Conduct at <http://www.mun.ca/student/conduct/>.

INCLUSION AND EQUITY:

Students who require accommodations are encouraged to contact the Glenn Roy Blundon Centre, <http://www.mun.ca/blundon/about/index.php>. The mission of the Blundon Centre is to provide and coordinate programs and services that enable students with disabilities to maximize their educational potential and to increase awareness of inclusive values among all members of the university community.

The university experience is enriched by the diversity of viewpoints, values, and backgrounds that each class participant possesses. In order for this course to encourage as much insightful and comprehensive discussion among class participants as possible, there is an expectation that dialogue will be collegial and respectful across disciplinary, cultural, and personal boundaries.

STUDENT ASSISTANCE:

Student Affairs and Services offers help and support in a variety of areas, both academic and personal. More information can be found at www.mun.ca/student