Price Faculty of Engineering
Department of Electrical and Computer Engineering

Course Outline

Instructor
- Prof. Dean McNeill, P.Eng (he/him)
  E2–390J EITC
  (204) 474–8963
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Office Hours
- By appointment

Teaching Assistant
- Chandan Saha
  sahac@myumanitoba.ca
- David Stewart
  stewar43@myumanitoba.ca
- Zachary Louttit
  louttitz@myumanitoba.ca

Contact Hours
- 4 credit hours
- Lectures:
  3 hours x 13 weeks = 39 hours
- Laboratories:
  3 hours x 5 weeks = 15 hours

Prerequisites:
- ECE 2160 Electronics 2E
- ECE 3610 Microprocessing Systems

Traditional Territories Acknowledgement

The University of Manitoba campuses are located on the original lands of the Anishinaabeg, Ininiwak, Anisininewuk, Dakota Oyate and Dene, and on the National Homeland of the Red River Métis.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

ECE 4240 – Microprocessor Interfacing

Fall 2024

Course Objectives

The course presents real-time wired and wireless interfacing of microcontrollers, microprocessors, and microcomputers to the external world, including interfacing of I/O devices with minimum hardware and software, data acquisition, and some aspects of data communications, transmission and logging with embedded systems.

Course Content

The following topics will be covered:

- Overview of computing, architectures, processors, and technologies
- Bus architectures
- Digital input and output (I/O) architectures and organization
- Digital-to-analog (D/A) and A/D signal conversions and converters
- Interfacing aspects in data communications related to real time
- Updates on new concepts, technologies, protocols, and software
  - Demos: Examples of bus architectures, modules, systems, and new devices.
  - Updates on new computer concepts, technologies, protocols, and software.

Textbook

Embedded Systems: Real-Time Interfacing to ARM Cortex M Microcontrollers. Volume 2. Jonathan W. Valvano. Middletown, DE: CreateSpace Independent Publishing Platform, 2016 (5th ed.), 589 pp. ISBN: 978-1-4635-9015-4

Learning Outcomes

1. Describe the role of the essential elements of interfacing in real-time systems.
2. Analyze the best techniques for synchronization in digital systems.
3. Analyze and design the best techniques for analog-to-digital conversion (ADC).
4. Analyze and design the best techniques for digital-to-analog conversion (DAC).
5. Analyze and design modern data transmission systems in the presence of noise.
6. Analyze and design simple error detection and correction systems.
7. Solve open-ended problems of data transmitting data in the presence of noise.

Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1	I											I
2	D	D		A			I					I
3	A	D	D	A	D	D	I					I
4	A	D	D	A	D	D	I					I
5	D	D	D	A	D	D	I					I
6	D	I	D	A	D	D	I					I
7	D			D								I

Important Dates

- **Quizzes**
  September 27th, 2024
  October 11th, 2024
  November 8th, 2024
  November 29th, 2024

- **Term Test**
  October 24th, 2024
  6:00PM – 8:00PM

- **Voluntary Withdrawal Deadline**
  November 19th, 2024

- **National Day for Truth and Reconciliation**
  September 30th, 2024
  No classes or examinations

- **Thanksgiving Day**
  October 14th, 2024
  No classes or examinations

- **Remembrance Day**
  November 11th, 2024
  No classes or examinations

- **Fall Term Break**
  November 12th –15th, 2024
  No classes or examinations

Accreditation Details

Accreditation Units
- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 50%
- Engineering Design: 50%

Graduate Attributes
KB: A knowledge base for engineering
PA: Problem analysis
IN: Investigation
DE: Design
ET: Use of engineering tools
IT: Individual and team work
CS: Communication skills
PR: Professionalism
IE: Impact of engineering on society/ environment
EE: Ethics and equity
EP: Economics and project management
LL: Life-long learning

Competency Levels
I - Introduced (Introductory)
D - Developed (Intermediate)
A - Applied (Advanced)

Evaluation

The final course grade is determined by the student's performance on assignments, in laboratories, in two midterm tests, and on the final examination. Students must complete all the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Laboratories	15	F, S	1, 2, 3, 4, 5, 6, 7
Quizzes (best 3 of 4)	10	F, S	1, 2, 3, 4, 5, 6, 7
Term Test	25	F, S	2, 3, 4
Final Examination	50	S	1, 2, 3, 4, 5, 6, 7

∗ Method of Feedback: **F** - Formative (written comments and/or oral discussion), **S** - summative (numerical grade)

CEAB Graduate Attributes Assessed

IN.3 – Interprets results and reaches appropriate conclusions.

DE.3 – Develops/implements possible solutions to an open-ended design problem, leading to an appropriate recommendation.

Student Absences

Attendance in lectures, tutorials, and laboratories is mandatory. For short-term absences due to illness or other extenuating circumstances of 120 hours (5 days) or less, students are required to complete a *Self-Declaration Form for Brief or Temporary Absence* available on the University website. 🔗 This form must be submitted to the course instructor within 48 hours of the absence. (No additional documentation is required.)
Note that students are responsible to complete any missed work and must consult with the instructor to make appropriate arrangements.
For absences longer than 120 hours, students must contact the instructor and ECE Undergraduate Advisor, Tammy Holowachuk (Tammy.Holowachuk@umanitoba.ca) for further instructions.

Deferred Final Examinations

Students who miss the regular scheduled writing of a final examination, for valid medical or compassionate reasons, may be given the opportunity to write a deferred examination, subject to approval by the Associate Dean (Undergraduate). All requests for a deferred examination must be made within 48 hours of the missed examination, and must follow the procedure described on the Faculty website, without exception. Course instructors do not have the discretion to grant deferred final examinations.
(https://umanitoba.ca/engineering/student-experience#engineering-student-policies)

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.

Copyright Notice

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

Requirements and 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, 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.

Supplemental Resources

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.