FALL 2017

ECE 7440 – Real-Time Interfacing

COURSE DESCRIPTION:

This 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 with and without microprocessors, data communications, transmission and logging with embedded computers

COURSE OBJECTIVE:

- To master interfacing techniques of real time systems;
- To understand bus architectures digital synchronization, signal conversions, data communications; and
- To apply those techniques in engineering.

PRE-REQUISITES:

- Electronics (e.g., ECE 2160)
- Microprocessing Systems (e.g., ECE 3610)

CONTACT HOURS:

3-hours per week

- Monday, Wednesday, Friday
- 12:30 p.m. to 1:20 p.m.

COURSE CONTENT:

The following topics will be covered:

1. Overview on computing, architectures, processors, and technologies for real-time (RT) stems
2. Review of bus architectures (internal, external peripheral, system)
   - High-speed bus considerations
3. Synchronization in RT digital I/O
   a) Interrupts and their handling
   b) Priority arbitration (hardware and software)
   c) Major classes of DMA
   d) Critical buffering schemes (for isolation and desynchronization)
4. D/A and A/D signal conversions and converters
   a) Major classes of converters with concepts, implementations
   b) Error budget and design considerations
   c) Design considerations
5. Interfacing aspects in RT data communications
   a) Encoding (power-bandwidth design considerations)
   b) Construction of major codes (self-clocking, differential)

c) Digital modulation scheme for memoryless channels and channels with memory)

6. Interfacing aspects in RT error detection and correction
   a) Principles of block and convolutional codes
   b) Construction of 2D detecting and correcting codes
   c) Construction of Hamming (7,3) and (7,4) codes
   d) Construction of optimal CRC codes
7. Updates on new concepts, technologies, protocols, and software
   a) Demos: Examples of bus architectures, modules, systems, and new devices.
   b) Updates on new computer concepts, technologies, protocols, and software.

Additional advanced research topics as determined by the instructor.

HOMEWORK:

1. Assignments/MiniLabs: (Distributed in class. Reports required.)
2. Project (Select one or propose one (a sample list will be distributed in class). Completion of a project requires:
   a) Submission of a project proposal three weeks after the commencement of this course;
   b) Submission of a written project report in the IEEE format (as used in The Proceedings of the IEEE main journal) one week before the end of this course; and
   c) (iii) Oral project presentation at the end of the course (date set in class).

TEXTBOOK & OTHER REFERENCES:

TEXTBOOK

1. W. Kinsner, Microcontroller, Microprocessor, and Microcomputer Interfacing for Real-Time Systems. Lecture Notes, 2016, 643 pp.
2. W. Kinsner, Laboratories for Microcontroller, Microprocessor, and Microcomputer Interfacing for Real-Time Systems. Lab Notes; 2016, 92 pp. (Major Revision)

OTHER REFERENCES

1. Jonathan W. Valvano, Embedded Microcomputer Systems: Real Time Interfacing. Stamford, CT: Cengage Learning, 2012 (3rd ed.), 793 pp. & CD-ROM. This book covers design methodologies with examples, using Motorola 6805, 6808, 6811 (no longer in the third edition), and focuses on the 9S12 machines. The book includes many practical examples.
   The CD-ROM includes a complete editor/assembler, and simulator for the MC9S12 machine. {ISBN 978-1-111-42625-2}
2. Alan Clements, Microprocessor Systems Design: 68000 Hardware, Software, and Interfacing. Boston, MA: PWS Computer Science, 1998 (3rd ed.), 978 pp & CD-ROM. In addition to the material covered in the second edition (the 68000; memories; exception handling; serial I/O; buses, designing systems), this third edition includes a chapter on the C programming and its relationship to assembly language, as well as new examples and applications, better representation of timing diagrams, and a CD-ROM with a 68000 cross-assembler

EVALUATION:

Your final course grade is determined by your performance in assignments, term test, and a final examination. The weighting of each of these components is as follows::

COMPONENT	NO	TOTAL VALUE	DETAILS / ADDITIONAL INFO
Homework / Assignments	4	10	Four assignments and one mini-project
Project	1	40	One major project. Proposal in two weeks from commencement of course
Term Tests	2	20	Both tests will be conducted during class time • Friday, October 14, 2016 • Monday, November 21, 2016
Final Examination	1	30	• Closed book • two-hour exam
TOTAL		100	

INSTRUCTOR INFO:

Name:..... W. Kinsner, PhD, PEng, FEIC, FEC, FCAE
Office:..... EITC E3-415
Tel:..... 204-474-649
Email:..... witold.kinsner@umanitoba.ca

Office Hours: ..... After each lecture or by appointment

VOLUNTARY WITHDRAW:

Friday, 17 November 2017

REQUIREMENTS/REGULATIONS

Student Responsibilities: It is the responsibility of each student to contact the instructor if he/she is uncertain about his/her standing in the course and his/her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with, among others, incomplete term work, deferred examinations, attendance and withdrawal, etc..

Lectures: Attendance at lectures is essential for successful completion of this course. Students must satisfy each evaluation component in the course.

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 and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism* or any other form of cheating is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university) regardless of media

- examinations
- assignments

- laboratory reports
- term exams

A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty

Please refer any questions regarding Academic Integrity to your course instructor.

***Plagiarism:** to steal and pass off (the ideas or words of another) as one's own; use (another's production) without crediting the source