

MECHTRON 3TA4 - Embedded Systems I

COURSE WEBSITE:

<http://elm.mcmaster.ca/>

INSTRUCTOR:

Dr. Mark Lawford
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Office Hours: TBA

Teaching Assistants:

Vera Pantelic & Lucian Patcas
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Office: ITB/205

LECTURES:

Location: JHE/A102 Time: Mon, Wed, Thur 17:30-18:20

TUTORIALS & LABS:

Location: ITB/238 (NOTE THESE MAY CHANGE FROM CURRENT TIMETABLE!)

	Section	Tutorial Time	Lab Time
Time:	1	Mon 12:30-14:20	Tues 08:30-11:20
	2	Fri 08:30-09:20	Wed 14:30-17:20

DESCRIPTION:

Interfacing to digital and analog systems, sensors and actuators. Signals and conditioning: data acquisition, active and passive filtering, optical and analog isolation, PWM, de/multiplexing. Architecture of micro-controllers and DSP. Embedded system design and documentation.

MISSION:

- To connect theory with practice in the design and development of embedded control systems
- To understand the importance of the “environment” (system under control - a.k.a. “the plant”) and how to interface to it
- Gain hands on experience in the design and development of micro controller based embedded systems
- Have fun!

GRADING:

Two marking schemes are provided. In order to have your assignments count in your final mark (Scheme A), you must pass (obtain $\geq 50\%$) on the combination of your midterm and final (Scheme B). Provided you pass by Scheme B *AND* you completed all of the labs, your final mark will be the max(Scheme A, Scheme B). Otherwise your mark will be min(Scheme A, Scheme B).

Scheme A			Scheme B	
Midterm exam (1-2 hours)	20%	or	Midterm exam (1-2 hours)	30%
Labs	30%		Labs	0%
Tutorial Exercises	5%		Tutorial Exercises	5%
Final exam (3 hours)	45%		Final exam (3 hours)	65%

The instructor reserves the right to conduct deferred examinations orally.

One lab report will be submitted and marked for each group and all team members will receive the same mark unless there is a demonstrable lack of participation/effort by a team member in performing and writing up the work. In that case the lab report grade will be assigned to individual team members based upon their contribution as judged by the TAs and Instructor.

TEXTS:

1. Frank Vahid Tony D. Givargis, *Embedded System Design: A Unified Hardware/Software Introduction*, John Wiley & Sons, 2002. ISBN: 978-0-471-38678-0 - AKA “Vahid”
2. Richard H. Barnett, P.E., Ph.D.; Sarah Cox; Larry O’Cull, *Embedded C Programming and the Atmel AVR*, 2nd Edition, Thomson, 2007. ISBN 13: 9781418039592, ISBN 10: 1418039594 - AKA “Barnett”
3. MECHTRON 3TA4 Course Pack (Available at the bookstore). - AKA “CP”

ADDITIONAL REFERENCES:

- Joe Pardue, *C Programming for Microcontrollers Featuring ATMEL’s AVR Butterfly and the free WinAVR Compiler*, Smiley Micros, 2005. ISBN-10: 0976682206 ISBN-13: 978-0976682202

CALCULATOR:

Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the McMaster Bookstore.

NOTES:

Announcements & Updates:

Announcements, updates and other important information will be done in class and via the course website. You may be informed of announcements via your McMaster email account. You are expected to attend classes, tutorials and labs where these announcements will be made. If you miss a class, lecture or lab, *it is your responsibility to check these resources and stay informed!*

Missed Lab Work:

Lab work missed due to illness or personal circumstances may be made up. You must submit appropriate documentation (e.g. note from physician) to your Faculty/Program office. It is your responsibility to follow-up with the lab supervisor. No mark will be entered for the missed work unless the Faculty/Program office gives its approval.

Academic Dishonesty:

You are expected to exhibit honesty and use ethical behavior in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behavior can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity> The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not ones own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

In case of discrepancy between the online and handout version of the course outline, the handout version shall be taken as correct.

Disclaimer

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes

BONUS MARKS

At the discretion of the instructor, a student will receive 1 to 2 “bonus marks” on their latest lab or quiz for being the first person to point out a technical error in the lecture slides or other course related material or providing a particularly useful course resource.

FORMAT:

- The class has lectures three times per week. Discussion is encouraged in class.
- There will be hands-on tutorials or labs alternate weeks.

- Discussion groups, links to resources, grading, lecture slides, lab handouts and other course related material will be available through WebCT.
- Students will submit their source code and lab reports via a course subversion version control repository unless otherwise indicated.
- Lab work will be done in groups of 2-3 students to be determined by the Instructor.

TENTATIVE SCHEDULE OF TOPICS:

The the following schedule of topics and labs is tentative. The instructor reserves the right to modify the schedule and lab topics depending up availability of equipment & progress of the class. *Please be sure to check the course website regularly for updates.*

Week		Topic	Reference	Lab Exercise
Num	Begins			
1	Sep 10	Intro	Vahid Ch 1	None
2	Sep 14	Architecture	Vahid Ch 2&3 Barnett Ch 1	None
3	Sep 21	A/D, D/A & Sensors	Vahid Ch 3, CP p. 179-197, 52-70	Blinking Lights
4	Sep 28	Peripherals & AVR	Vahid Ch 4 Barnett Ch 2 & 4	
5	Oct 5	Peripherals & AVR	Vahid Ch 4 Barnett Ch 2 & 4	LCD controller
6	Oct 12	Interfacing	Vahid Ch 6 Barnett Ch 2 & 3	
7	Oct 19	Actuators & Component Interconnection	Vahid 4.7 CP p. 1- 26, 74-100	MIDTERM
8	Oct 26	Component Interconnect & Signal Conditioning	CP p. 70-73, 26-43	Serial Interfacing
9	Nov 2	Isolation & PWM	Vahid 4.7 CP p. 199-202	
10	Nov 9	Signal Conditioning	CP p. 26-52	
11	Nov 16	Performance Spec & Anal	CP. 119-178	Stepper Motor?
12	Nov 23	Performance & PID	Vahid Ch. 9	
13	Nov 30	Design & Documentation	Barnett Ch 5 Lecture slides	None