

EE 2361 - Introduction to Microcontrollers Fall 2014

Course Prerequisites, Basic Content, and Outcomes

Catalog Description:

(4.0 cr; Prereq - 2301, [1301 or CSCI 1113 or CSCI 1901]; fall, spring, summer, every year)

Computer organization, assembly language programming, arithmetic/logical operations, parallel/serial input/output. Exception handling, interrupts, using special-purpose features such as A/D converters, DSP operations. Integral lab.

Contact Hours:

3 hours of lecture, 1 hour of discussion, and 2 hours of lab per week.

Workload and Outcomes:

Students are expected to work on 8-9 labs throughout the semester. Five to seven homework assignments are given. The course involves non-trivial amount of software programming both in assembly and C languages, as well as wiring hardware and debugging and testing. After successfully completing all course requirements students will be comfortable programming any micro-controllers and implementing simple-to-medium embedded system designs.

Personnel:

Instructor: Kia Bazargan kia@umn.edu

Textbooks

No required textbooks!

We will use the manufacturer's datasheets and some notes (notes mostly written by Charles Rennolet)

Recommended books:

- "Learning to Fly the PIC24" by Lucio Di Jasio.
- "Embedded Design with the PIC18F452 Microcontroller", by Peatman.

Course Outline: (on a fall/spring semester basis. During summer, time compresses by a factor of 2)

Topics	"hours"
Introduction, History of Processors	1.5
The PIC24 Architecture	1
Introduction to Assembly, opcodes	2
Basic I/O and timing	2
Loops in assembly	3
Indirect addressing	3
Introduction to Embedded C Language	2

Basic Timers (delay generation, counting instructions, event counting), PPS	4
Simple Interrupts	3
Intermediate Timing, counting, input capture	3
Midterm Exam	2
Interrupt priorities, how interrupts work internally	3
Output Compare (single/continuous pulse, PWM)	3
Serial Interfaces (buffers, handshaking, UART, SPI)	5
Analog to Digital Conversion	3
Advanced Parallel I/O (configuration, interrupts)	0.5
Interface between C and Assembly	1
Miscellaneous topics (e.g., floating point, CORDIC)	3

Note: The exact hours will vary from the syllabus depending on class interest and understanding. Even the order of topics may change slightly.

Grading:

Each student has a 72-hour grace period to be used cumulatively on homework assignments (not labs). For example, if a student submits HW1 4 hours late, only 68 hours would be left for future submissions. The grace period is not to be used only on exceptional cases when unanticipated events keep the student from submitting the assignment on time. If the grace period is used up, any late submissions would get a grade of zero.

To pass the course, a student must get at least 50% on the midterm and at least 50% on the final exam.

Laboratory	20%
Homework	20%
Mid-Term	30%
Final Exam	30%

Student Conduct Code:

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected to adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see:

http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student

learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom:

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference:

<http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

Scholastic Dishonesty:

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code:

http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see:

<http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html>.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <http://www1.umn.edu/oscai/integrity/student/index.html>. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Makeup Work for Legitimate Absences:

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include **verified** illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see:

<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy:

<http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf>

Equity, Diversity, Equal Opportunity, and Affirmative Action:

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy:

http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations:

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course.

For more information, please see the DS website, <https://diversity.umn.edu/disability/>.

Mental Health and Stress Management:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website:

<http://www.mentalhealth.umn.edu>.

Academic Freedom and Responsibility:

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost. *[Customize with names and contact information as appropriate for the course/college/campus.]*

** Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".*