

## Syllabus

<b>Course Number</b>	EECE.3170
<b>Course Title</b>	Microprocessor Systems Design I
<b>Credits</b>	3
<b>Semester/Class</b>	Spring 2024 Tue/Thu 11:00AM-12:15PM Ball 214
<b>Faculty Name</b>	Prof Paul Robinette (he/him)
<b>Office Hours</b>	Tue/Thu 1:00-2:30PM Ball 311
<b>Phone/Email</b>	Email is preferred: paul_robinette@uml.edu

### **Course Description**

This course introduces microprocessors. It uses assembly language to develop a foundation on the hardware, which executes a program. Memory and I/O interface design and programming. Study of microprocessor and its basic support components, including CPU architecture, memory interfaces and management, coprocessor interfaces, bus concepts, serial I/O devices, and interrupt control devices. Laboratories related to microprocessor functions and their interfaces.

Prerequisites: EECE.2160 (ECE Application Programming) and EECE.2650 (Logic Design). Note) COMP.1010 Computing I is equivalent to EECE.2160.

### **Course Learning Outcomes**

Upon completion of this course, the students will demonstrate the ability to use the following:

1. Microprocessor Software Architecture: Data formats, types, and alignment. Memory addressing and organization. Stack operation.
2. Microprocessor Instructions: Instruction formats and types: data transfer, arithmetic, logical, shift/rotate, conditional execution, program control, and functions.
3. Assembly Language Programming: Ability to write, modify, and debug programs written in assembly language. Translation of high-level code to assembly language. Programs that integrate assembly and high-level code.
4. Microprocessor Interfacing: Memory and I/O interfacing. Bus cycles.
5. Interrupt Processing: Hardware and software interrupts.
6. Microcontroller-based Systems: Microcontroller architecture and instruction set. Microcontroller programming using both assembly language and high-level code. Design and debug microcontroller-based circuits.

### **Fulfills the following ABET Student Outcomes:**

Outcome 1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Outcome 2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

Outcome 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

### **Textbook/Readings**

No textbooks are required for this course. Relevant reading material will be posted on the course schedule page.

You will be required to use a hardware development kit for this course. Links to purchase and details about the kit will be presented in class and on Blackboard. If you cannot purchase a kit yourself, please talk to the instructor about alternatives. All software used in this course will be free to the student.

### **General Information**

#### **A. Teaching Methods:**

All course meetings will be held in person.

#### **B. Attendance and Participation:**

You are responsible for all materials discussed or announced in class. Therefore, students are expected to attend class regularly, as regular attendance is one of the most important contributors to student success. However, students may occasionally need to miss class due to illness, emergency, or caring for a sick family member. You may also need to take a Wellness Day for personal reasons. In such cases, you are responsible for notifying the instructor about your absences and working with me to arrange to make up any missed work. I try to be very accommodating to students who are experiencing attendance challenges, but you must communicate your situation with me regularly and at timely as possible.

Likewise, if I should need to miss class, I will communicate with you via Blackboard or Email as soon as possible with clear instructions.

#### **C. Assessment and Evaluation Methods:**

#### **How You Will Be Graded**

Your final course grade will be based on the following:

<b>Requirement</b>	<b>Number</b>	<b>% Total Grade</b>
Quizzes	12 (drop lowest two grades)	30%
Assignments	10	30%
Midterm	1	20%
Final	1	20%
<b>Total:</b>		<b>100%</b>

#### **Quizzes**

Quizzes will take the form of traditional in-class questions and check-offs for lab assignments. The quiz schedule will be posted in advance and any changes will be announced with as much notice as possible. Traditional quizzes will need to be taken during class time as scheduled unless prior arrangements are made. Some check-offs for lab assignments MAY be allowed outside of class time, at instructor or TA discretion. Your lowest two quiz grades will be dropped at the end of the semester.

## Assignments

Your assignments will be a mix of typical homework problems, programming assignments, and labs that involve both programming and hardware interfacing. All assignments and their associated due dates will be posted on Blackboard.

Assignment policies include the following:

- All assignments must be completed individually unless explicitly specified. You may be allowed to work in groups for some lab assignments.
- Late assignments are penalized at a rate of 10% per calendar day for up to 5 calendar days. Late submissions past that point will not be accepted.
- Some programming assignments may require an instructor to check off the completion of one or more milestones within the assignment.

## Midterm

Your midterm will be a combination of traditional questions, programming, and demonstration of hardware. Details will be announced at least one week prior to the scheduled class period.

## Final

Your final will contain some traditional questions but will be more focused on a final project demonstrating your knowledge of the material presented in this class.

**Your final course letter grade, if no grading curve is applied, will be determined as follows:**

<b>Numeric Grade:</b>	<b>Letter Grade:</b>
94-100	A
90-93	A-
87-89	B+
84-86	B
80-83	B-
77-79	C+
74-76	C
70-73	C-
67-69	D+
64-66	D
0-63	F

A grading curve may be used at the instructor's discretion, depending on the overall course average at the end of the term.

### D. Tutoring Resources and Centers for Learning and Academic Support Services:

NO tutoring services are available for this course.

### E. Student Mental Health and Well-being

We are a campus that cares about your well-being and success. Your health and well-being are of utmost importance to faculty and campus administrators. As a university, we recognize that students have a multitude of needs and commitments outside of campus, which is why I am offering you Wellness Days for your general well-being. Please know that I'm available to talk about your stresses or concerns related to your coursework in my class.

Here are some resources to support your well-being:

[Counseling Services](#) provide crisis intervention, assessment, referrals, short-term individual counseling, and group therapy. Call to book an appointment at (978) 934-6800.

[UMatter2](#) is a university-wide initiative to support students and promote mental health, they can be reached at (978) 934-6617. You will find information on how to access Togetherall, an online community, a peer-to-peer platform dedicated to mental health support.

[Centers for Learning and Academic Support Services \(CLASS\)](#) provides advising services, including goal setting, course selection, SIS functions, changing majors/minors, and course deletions. (978) 934-2936 or [Advisement@uml.edu](mailto:Advisement@uml.edu).

The mission of the [Office of Student Life & Wellbeing](#) is to advance the holistic concept for student success by infusing health promoting actions and collaboration into campus culture. They can be reached at 978-934-4342 or [Wellbeing@uml.edu](mailto:Wellbeing@uml.edu).

#### F. Disability Services

If you are registered with Disability Services and will require course accommodations, please notify me via the Accommodate [semester request process](#) as soon as possible so that we might make appropriate arrangements. It is important that we connect to discuss the logistics of your accommodations; please speak to me during office hours or privately after class as I respect and want to protect your privacy. If you need further information or need to register for academic accommodations, please visit the [Disability Services Website](#).

Additionally, Student Disability Services supports software for ALL students. The university has literacy software that allows you to read on-screen text aloud, research and check written work, and create study guides. You can download the software from the IT Software webpage on the [UML assistive technologies website](#).

#### G. Diversity, Inclusion, and Classroom Community Standards:

UMass Lowell—and your professor—value human diversity in all its forms, whether expressed through race and ethnicity, culture, political and social views, religious and spiritual beliefs, language and geographic characteristics, gender, gender identities and sexual orientations, learning and physical abilities, age, parenting status, and social or economic backgrounds. Enrich yourself by practicing respect in your interactions, and enrich one another by expressing your point of view, knowing that diversity and individual differences are respected, appreciated, and recognized as a source of strength.

[The Office of Multicultural Affairs \(OMA\)](#) supports and advocates for students while leading diversity-related programming. At the same time, working to create an inclusive environment for LGBTQ+ individuals via the LGBTQ+ Resource Center. (978) 934-4336 or [Multicultural\\_Affairs@uml.edu](mailto:Multicultural_Affairs@uml.edu)

#### H. Academic Integrity Policy:

All students are advised that there is a [University policy regarding academic integrity](#). Students are responsible for the honest completion and representation of their work. If you choose to remain on this course, you must agree that you will neither give nor receive any unauthorized help with your homework, papers, exams, or other work.

#### I. Cell Phones and Other Devices:

- Mute cell phones and other devices.

#### J. Credit Hour Policy

The federal definition of a credit hour requires that for every course credit awarded, a course must offer 15 hours of instructor-led course activities and 30 hours of out-of-class student work. This means that a standard 3 credit hour course requires 45 hours of instructor-led course activities and 90 hours of out-of-class student work.

#### K. University Privacy Statement

UMass Lowell recognizes the importance of mutual trust between students and faculty. Neither faculty nor students may record video or audio of a course or private conversation without all parties' consent. Massachusetts is a two-party consent state, which means it is illegal to record someone without their permission. Recordings of classroom lectures are the intellectual property of the instructor. Instructors have the right to prohibit audio and video recording of their lectures unless the requesting student is registered with Disabilities Services and recording of class sessions is an approved accommodation. In addition, sharing or selling recordings of classroom activity, discussions, or lectures with any other person or medium without permission of the instructor is prohibited.

#### L. Health and Safety

The safety and health of the UMass Lowell community is our shared priority. In seeking to provide the fullest academic and campus life experience possible, UMass Lowell will rely on all members of our community to act responsibly. Do not come to class if you are feeling ill.

**Course Outline & Class Schedule:**

This schedule contains a tentative schedule of topics we will cover throughout the term; Blackboard and the course website will contain the most up-to-date version. This schedule—including dates on which material is covered, topics to be covered, and exam dates—is subject to change.

Date	Topic	Assigned	Due	Quiz
1/16/24	Course Introduction, History of Computing			
1/18/24	Instruction Set Architecture, Data Types	HW1		
1/23/24	Data storage and addressing, stack			
1/25/24	Arithmetic, logical, and shift instructions	HW2	HW1	Q1
1/30/24	Conditional Execution			
2/1/24	Deep Dive: How Processors Work	HW3	HW2	Q2
2/6/24	Function Calls and Interrupts			
2/8/24	Assembly Overview	HW4	HW3	Q3
2/13/24	Deep Dive: Compilation Pipeline			
2/15/24	Midterm Review		HW4	Q4
<b>2/20/24</b>	<b>NO CLASS Monday Schedule</b>			
2/22/24	<b>MIDTERM EXAM</b>			
2/27/24	Microcontroller Programming			
2/29/24	Interrupts and Timers	HW5		Q5
<b>3/5/24</b>	<b>NO CLASS Spring Break</b>			
<b>3/7/24</b>	<b>NO CLASS Spring Break</b>			
3/12/24	Peripheral Interfacing			
3/14/24	In-class debugging and check-off	HW6	HW5	Q6
3/19/24	Analog to Digital Conversion			
3/21/24	In-class debugging and check-off	HW7	HW6	Q7
3/26/24	Comparators			
3/28/24	In-class debugging and check-off	HW8	HW7	Q8
4/2/24	Serial transmission: UART and I2C			
4/4/24	In-class debugging and check-off	HW9	HW8	Q9
4/9/24	Assembly and C			
4/11/24	In-class debugging and check-off	HW10	HW9	Q10
4/16/24	Microcontrollers in Use Today			
4/18/24	In-class debugging and check-off		HW10	Q11
4/23/24	Course Wrap-Up, Final Review			
4/25/24	In-class debugging and check-off			Q12
<b>TBD</b>	<b>FINAL EXAM</b>			