

## University of Maine — ECE471: Embedded Systems — Fall 2020

### Instructor:

Vincent Weaver  
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Office: Barrows 203  
Office Hours: e-mail to arrange appointment

### Course Website:

[http://web.eece.maine.edu/~vweaver/classes/ece471\\_2020f/](http://web.eece.maine.edu/~vweaver/classes/ece471_2020f/)

**Lectures:** Monday/Wednesday/Friday 10:00am-10:50am, Barrows 228

In-person attendance is not necessary. Lectures will be streamed online and recorded. Due to limitations on class size, the class will be split into two cohorts which will alternate in-person attendance.

**Final Exam:** Wednesday 16 December 2020, 12:15pm-2:15pm, online

### Course Listing:

Application of micro-processors to the solution of design problems, including hardware characteristics, peripheral control techniques and system development. Lec 3. (Fall.)

### Content this Semester:

We will investigate modern embedded systems, with a focus on ARM processors.

### Pre-requisites:

ECE271 or permission

This course involves limited ARM assembly language and extensive C coding.

### Textbook:

None

### Hardware:

You will be required to have a Raspberry Pi device for homework assignments. Any model will do but I'd recommend getting a Model 3B or 3B+ if possible. If you are having trouble getting a Raspberry Pi by the start of class, please see me.

In addition certain devices will be loaned out for use in the homeworks and projects (such as LED displays and temperature sensors). It is expected that these will be returned at the end of classes, and this will factor into your class participation grade.

### By the end of the course you will:

- Learn the definition of “Embedded System”
- Program embedded C and Assembly Language
- Write C programs that are well commented, check for errors, and have no compiler warnings
- Understand Code density concerns, specifically with ARM/THUMB/THUMB2
- Understand Raspberry Pi Hardware
- Program Embedded Linux systems
- Understand Firmware and booting

- Program embedded interfaces: GPIOs, i2c, SPI, and 1-wire
- Understand the various tradeoffs of embedded busses
- Understand Embedded system computer security
- Understand Embedded system programming best practices
- Understand Real-life and ethical impact of poorly designed embedded systems
- Know the difference between hard and soft real time
- Understand Embedded power and energy considerations

### **Homework Assignments:**

Assignments will be announced in class and posted to the website. Announcements will be sent to your UMaine e-mail address. Homework submissions will be done via e-mail.

### **Final Project:**

A final project will be assigned that involves creating an embedded device using an embedded platform of your choice that does some manner of input and output. There will be a final presentation of your project in front of the class, as well as a final writeup. The project can be done in groups of two. More details on the project will be given out about halfway through the semester.

### **Grading:**

Class Participation (5%)

11 homework assignments (lowest one dropped) (50% total)

2 midterm exams (15% combined)

1 final exam (10%)

1 final project (20%)

**Late Work:** Late work is penalized at 10% a day.

**Regrade requests:** If you disagree with the grading of an assignment, please submit a regrade-request via e-mail.

## **University of Maine Required Statements**

### **Academic Honesty Statement**

Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University. Please see the University of Maine System's Academic Integrity Policy listed in the Board Policy Manual as Policy 314: <https://www.maine.edu/board-of-trustees/policy-manual/section-314/>

### **Students with disabilities statement**

If you have a disability for which you may be requesting an accommodation, please contact Student Accessibility Services, 121 East Annex, 581.2319, as early as possible in the term. Students

who have already been approved for accommodations by SAS and have a current accommodation letter should meet with me (the instructor of the course) privately as soon as possible.

### **Course Schedule Disclaimer (Disruption Clause)**

In the event of an extended disruption of normal classroom activities (due to COVID-19 or other long-term disruptions), the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.

### **COVID-19**

COVID-19 is an infectious disease caused by the coronavirus SARS-CoV-2. The virus is transmitted person-to-person through respiratory droplets that are expelled when breathing, talking, eating, coughing or sneezing. Additionally, the virus is stable on surfaces and can be transmitted when someone touches a contaminated surface and transfers the virus to their nose or mouth. When someone becomes infected with COVID-19 they may either have no symptoms or symptoms that range from mild to severe and can even be fatal. During this global pandemic, it is imperative that all students, faculty, and staff abide by the safety protocols and guidelines set forth by the university to ensure the safety of our campus. All students are encouraged to make the Black Bears Care Pact to protect the health of themselves, the health of others, and the college of our hearts always.

### **Observance of Religious Holidays/Events**

The University of Maine recognizes that when students are observing significant religious holidays, some may be unable to attend classes or labs, study, take tests, or work on other assignments. If they provide adequate notice (at least one week and longer if at all possible), these students are allowed to make up course requirements as long as this effort does not create an unreasonable burden upon the instructor, department or University. At the discretion of the instructor, such coursework could be due before or after the examination or assignment. No adverse or prejudicial effects shall result to a student's grade for the examination, study, or course requirement on the day of religious observance. The student shall not be marked absent from the class due to observing a significant religious holiday. In the case of an internship or clinical, students should refer to the applicable policy in place by the employer or site.

### **Sexual Discrimination Reporting**

The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell a teacher about an experience of sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct or any form of gender discrimination involving members of the campus, your teacher is required to report this information to Title IX Student Services or the Office of Equal Opportunity.

If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources:

For confidential resources on campus: Counseling Center: 207-581-1392 or Cutler Health Center: at 207-581-4000.

For confidential resources off campus: Rape Response Services: 1-800-871-7741 or Partners for Peace: 1-800-863-9909.

Other resources: The resources listed below can offer support but may have to report the incident to others who can help:

For support services on campus: Title IX Student Services: 207-581-1406, Office of Community Standards: 207-581-1409, University of Maine Police: 207-581-4040 or 911. Or see the OSAVP website <https://umaine.edu/titleix/> for a complete list of services.