

# Syllabus

Welcome to Single-Chip Microcomputers. In this course you will be introduced to the principle of a microcontroller, which comprises all elements of a basic computer system on a single chip, i.e. microprocessor, memory, and I/O devices. Unlike the embedded system you used in ECE 350 where you could rely on Linux as an operating system, in this course you learn how to use and program a microcontroller “bare-metal” and how to interface it with other devices, such as sensors, keypads, and displays. This course also covers real-time control issues, assembly language programming for control, design of control software, input/output methods, design tools, and available single-chip microcomputers. In the associated lab you will be designing and constructing special purpose microprocessor controlled systems including games, measurement devices, etc., comprised of a microcontroller and ancillary hardware. This course is highly recommended for ECE 492/493 students interested in using microcontroller technology in their senior design projects.

## Instructor

Jens-Peter Kaps

[jkaps@gmu.edu](mailto:jkaps@gmu.edu)

<http://ece.gmu.edu/~jkaps>

Office Hours: Tuesday 10:00am–11:00am, Thursday 1:00pm–2:00pm, or by appointment. Office hours will be conducted via Blackboard Collaborate Ultra through our myMason course page.

## Teaching Assistants

Joseph David (Joe) Coffin

[jcoffin2@gmu.edu](mailto:jcoffin2@gmu.edu)

Office Hours: Tuesday 5:00pm–7:00pm, Wednesday 5:00pm–7:00pm

Jay Bakul Deorukhkar

[jdeoruk2@gmu.edu](mailto:jdeoruk2@gmu.edu)

Office Hours: Wednesday 12:00pm–2:00pm, Friday 2:00pm–4:00pm

Athrav Dixit

[adixit4@gmu.edu](mailto:adixit4@gmu.edu)

Office Hours: Tuesday 1:00pm–2:00pm, Wednesday 2:00pm–3:00pm

Office hours will be conducted via Blackboard Collaborate Ultra through our myMason course page.

## Date & Time & Place

Tuesdays & Thursdays, 3:00pm–4:15pm, Blackboard Collaborate Ultra through our myMason course page.

## Course Web Page

The course web page is accessible via <http://ece.gmu.edu/~jkaps/courses/ece447> The latest announcements, handouts, assignments, source code and useful/interesting web links will be posted on the course page on myMason.

## Textbooks

- M. Jiménez, R. Palomera, and I. Couvertier, *Introduction to Embedded Systems, Using Microcontrollers and the MSP430*, Springer-Verlag New York, 2014, ISBN 978-1-4614-3142-8. Available also online through the GMU library <https://link-springer-com.mutex.gmu.edu/book/10.1007%2F978-1-4614-3143-5>.
- J. H. Davies, *MSP430 Microcontroller Basics*, Burlington, MA: Newnes, 2008, ISBN 978-0-7506-8276-3 .
- B. W. Kernighan, and D. M. Ritchie, *The C Programming Language*, 2nd Ed., Englewood Cliffs, NJ:Prentice-Hall, 1998, ISBN: 978-0-13-110362-7 (paperback). Available also online through the GMU library, requires Mason e-mail <https://learning-oreilly-com.mutex.gmu.edu/library/view/c-programming-language/9780133086249/?ar>.

## Hardware

Each student is required to purchase a lab kit. They can be purchased from the ECE shop, Nguyen Engineering Building, room 3916. Note: The ECE shop only accepts Mason Money. If you are unable to come to campus due to being out of state, sick, in quarantine, etc., you can ask to have the kit mailed to you.

## Software

Each student is required to download and install Code Composer Studio v10 (CCS) on their own computer. CCS is available for free for Windows, Linux, and Mac from <https://www.ti.com/tool/CCSTUDIO>.

## Course Schedule

The course schedule is provided in a separate document on MyMason and the class website.

## Prerequisites

Knowledge of computer programming in C or C++, knowledge of embedded system design, and recommended is also knowledge of digital system design and computer organization as well as programming in assembly language.

- CS 222 or CS 262 with a grade of C or better.
- ECE 350 with a grade of C or better.
- Recommended: ECE 445 with a grade of C or better.

## Reading Assignments

The reading assignments are shown in the class calendar in the rightmost column and in the homework. They refer to sections in the Jiménez et.al or the Davies text that need to be read by the beginning of the week.

## Homework

There will be weekly homework assignments. These will include reading assignments, questions, and

programming exercises. The homework will not be collected or graded. The homework questions will be posted on Tuesdays, the solutions will be posted on Fridays. The following Tuesday, will be an inclass quiz based on the homework. The quizzes will be collected and graded. For maximum benefit of these homework assignments you are encouraged to try to solve the questions before the solutions are published. You should discuss your work with other students in the class. Once the solutions are published, try to learn from them and see where you went wrong.

### **Quizzes**

There will be up to 12 quizzes during the course. The quizzes will be given on Tuesdays at the beginning of class and take approximately 15 minutes. No extra time will be given for late arrivals. The questions will be similar to the previous weeks homework. The quizzes will be closed book and closed notes.

### **Participation**

Participation in class discussions and answering questions on the discussion board will be noted and lead to points toward the participation grade.

### **Discussion Board**

All questions about the material covered in this course, including questions about the class, homework assignments, exams, and laboratory experiments, will be addressed using the discussion board on myMason.

Please subscribe to each of the forums – you will then receive an email each time a question or response is posted to one of the forums.

Class-related questions will not be addressed via email. Instead, all questions should be posted to the appropriate forum of the discussion board. Always check the forum before posting your question. The same, or a similar, question may have already been posted (and answered). Furthermore, you may post a “follow-up” question to an existing thread to foster additional discussion and/or to request a more detailed answer.

The GTAs and the Instructor will do their best to respond to all questions posted on the discussion board forums. In addition, you may provide a response to any question posted on one of the forums (participation points). Any questions or concerns regarding a personal matter should be emailed to the instructor directly. Do not post such comments on the discussion board.

### **Examinations**

There will be two exams during the course, a midterm exam and a final exam. The questions will be similar to the homework questions and will contain software problems in C and assembly language, hardware problems and short answer problems including calculations. Part of the test will taken on myMason, similar to the quizzes, part on paper. The final exam is cumulative.

The exams will be open book and open notes, however, you may not get help from any person or any online resource. That would be considered cheating. If cheating is discovered, an honor code violation will be reported. If you fail one or both of the exams, I reserve the right to give you a failing grade for the course.

- **Midterm Exam:** October 8th, 3:00pm–4:15pm

- **Final Exam:** December 10th, 1:30pm–4:15pm

### Labs

This course features a senior lab component. More information about the labs can be found in a separate lab syllabus. General suggestions:

- Write a simple test program for every hardware component you attach to debug the hardware. Keep these programs to test the hardware again when something goes wrong.
- Then write the main program, step by step, and test each step.
- Don't miss the sign-off deadlines and demonstrate your project, even if you have not completed it.

### Grading

The following weight distribution will be used to calculate the final grade:

- 5% Participation
- 10% Quizzes
- 15% Midterm Examination
- 20% Final Examination
- 10% In-lab Exercises
- 40% Lab Assignments

### Honor Code

All rules of the GMU Honor Code system will be in effect. You must review the rules and be familiar with them. You are encouraged to discuss homework problems and projects with other students and/or obtain the assistance of the instructor. Nevertheless, you must write down your own homework solutions which represent your understanding of the material. Projects must be completed individually. No part of a project submission can be copied from another person of the class or any other source. Duplicating someone else's work such as but not limited to quiz solutions, hardware/software designs, diagrams, source code, project reports, and exam notes, is considered cheating. If you use material from other sources such as but not limited to the web, books, journals, data sheets, etc. you must reference the source. Honor code violations will be followed up with full force.

For more information about the Mason Honor Code and about the Honor Committee, please visit the website for the Office of Academic Integrity (<http://oai.gmu.edu/>).

### Classroom Etiquette

You may ask questions and answer questions at any time using the chat feature in Blackboard Collaborate. You can also raise your hand and when called upon speak your question or answer.

**GMU E-mail Accounts**

Students must use their Mason email account to receive important University information, class-related messages, and to communicate with the professor and the teaching assistants. See <http://masonlive.gmu.edu/formoreinformation>.

**Students with Disabilities**

If you are a student with a disability and require special accommodations, please contact the instructor and the Office of Disability Services as soon as possible. All special accommodations must be arranged through ODS.

Office of Disability Services (ODS): (703) 993 – 2474; <http://ods.gmu.edu>

**Other Useful Campus Resources**

- Writing Center: A114 Robinson Hall; (703) 993-1200; <http://writingcenter.gmu.edu>
- University Libraries: “Ask a Librarian” <http://library.gmu.edu/mudge/IM/IMRef.html>
- Counseling and Psychological Services (CAPS): (703) 993-2380; <http://caps.gmu.edu>
- The University Catalog: <http://catalog.gmu.edu>
- University Policies: <http://universitypolicy.gmu.edu>

The course syllabus is subject to change