

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

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

Office Hours: Monday 1:00pm–2:00pm, Wednesday 11:00am–12:00pm. Office hours will be conducted in-person in my office and via Zoom (link on our myMason course page).

Teaching Assistants

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Office Hours: Tuesday TBA, Friday TBA

Room: TBA

Rupal Gupta

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Lecture Date & Time & Place

Monday & Wednesday, 3:00pm–4:15pm, Arts and Design Building 2003. If we have to switch to on-line learning, we will be using Blackboard Collaborate Ultra which will be linked on our myMason page as “Online Lectures.” All **on-line** lectures will be recorded and available on myMason.

Course Web Page

The course web page is accessible via <https://people-ece.vse.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. Available also online through the GMU library, requires Mason e-mail <https://www-oreilly-com.mutex.gmu.edu/library/view/msp430-microcontroller-basics/9780750682763/?ar>.
- 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.

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 Mondays, the solutions will be posted on Fridays. The following Monday, 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 Mondays 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.

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. 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. 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 13th, 3:00pm–4:15pm
- **Final Exam:** December 13th, 1:30pm–4:15pm

Labs

This course features a senior lab component. Students in ECE 447 will be granted access to the ENGR Room 3208 computer lab to complete their projects. 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:

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

Safe Return to Campus

All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (<https://www2.gmu.edu/safe-return-campus>). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, Red, or Blue email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class.

Students are required to follow Mason's current policy about facemask-wearing. As of August 11, 2021, all community members are required to wear a facemask in all indoor settings, including classrooms. An appropriate facemask must cover your nose and mouth at all times in our classroom. If this policy changes, you will be informed; however, students who prefer to wear masks either temporarily or consistently will always be welcome in the classroom.

Course Materials and Student Privacy

All course materials posted to Blackboard or other course site are private to this class and must not be shared with anyone not enrolled in this class. That applies to lecture slides, homework, quizzes, exams, labs as well as to material posted by students.

Videorecordings – whether made by instructors or students – of class meetings that include audio, visual, or textual information from other students are private and must not be shared outside the class.

Live video conference meetings (e.g. Collaborate or Zoom) that include audio, textual, or visual information from other students must be viewed privately and not shared with others in your household or recorded and shared outside the class.

If we have to switch back to on-line learning, then all of our synchronous meetings in this class will be recorded to provide necessary information for students in this class. Recordings will be stored on Blackboard and will only be accessible to students taking this course during this semester.

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, hard-ware/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

Cellphones, pagers have to be put into silent mode. If you have an emergency need to answer a call please quietly leave the room BEFORE answering the call. Lectures may not be recorded without express written permission from the instructor.

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://mail.gmu.edu> for more information.

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://ds.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/ask>
- 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