EE 234 (Microprocessor Systems)
Catalog Description:

Microprocessor system architecture, instruction sets, and interfacing; assembly language programming.

Semester: Fall 2020

Instructor: Dae Hyun Kim

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Phone: 509-335-3067

Office Hours: MWF 3:10 – 4pm (zoom) or by appointment

TA: TBD

TA's email: TBD

TA Office: TBD

TA's office hours:

Credits: 3

Structure:

Three one-hour lectures per week, one three-hour lab per week, 5~7 lab assignments, homework assignments, one project, two midterm exams, and one final exam.

Overview and course goals:

This course presents concepts and hands-on learning for understanding modern and cutting-edge microprocessors and microcontrollers. You will learn about the internals of a microcontroller/microprocessor. Internal components such as control unit, ALU, memory, and I/O units will be studied. Some of the microprocessor and microcontroller concepts explored in the course include, but not limited to, the following topics:

1. System and computer architecture
2. Data and program memory accessing and interfacing
3. Timing and synchronization including the use of interrupts
4. Instruction sets
5. Serial communication

6. Assembly code efficiency
7. Interfacing with on-chip and external devices, i.e., motors, timers, SPIs, LEDs, switches, buttons, sensors, etc.

Assembly language & C programming is introduced. The ARM family of microcontrollers is covered with emphasis on the ZYNQ 7007s ARM Cortex 9 based system. At times, the differences between other microcontrollers and microprocessors are discussed. The underlying applications for this class will include hands on laboratory assignments and a project.

At the conclusion of this course, you should be able to:

1. Develop well designed and documented assembly & C languages to solve engineering problems.
2. Describe the architecture and operation of modern embedded systems.
3. Identify the differences between microprocessors and microcontrollers.
4. Discuss the central components of ARM Cortex microcontrollers.
5. Determine appropriate modules to interface with a microcontroller.
6. Draw and analyze timing diagrams.
7. Apply and discuss tradeoffs between interrupts and polling.
8. Complete a semester project.

Topics:

1. Introduction to microprocessors and microcontrollers
2. Digital circuits and data types
3. Architecture and addressing modes
4. Interrupts, timers, counters, and comparators
5. Programming model
6. Instruction sets
7. Subroutines, modules, and macros
8. Testing and debugging
9. Development tools and C programming
10. Hardware specifications

11. Memory, I/O, and bus interfaces
12. High-speed memory interface and cache

Textbooks: ARM Assembly Language Programming & Architecture, M. A. Mazidi, S. Naimi, S. Naimi, and S. Chen, MicroDigitalEd, 2016. ISBN 978-0997925906. Recommended.

Other References:

Grading:

Homework assignments	10%
Lab assignments	25%
Project	15%
Midterms	30% (15% each)
Final exam	20%

Must complete all lab experiments and present a working demo to the TA or instructor to have a final passing grade.

Late submission: -5%/day, maximum -50%.

Grades dispute: Grades will be posted on blackboard as soon as they are completed. You need to check your grades regularly and there should not be any surprises at the end of the semester. If you find a mistake with grading an assignment or exam, please speak with the instructor or TA within a week of the assignment or exam being returned. Do not wait until the end of the semester to discuss any grade changes.

Blackboard: http://learn.wsu.edu/webapps/login

No Makeup exam will be given without an approved and documented excuse that is approved by the university regulations and the department. Other documented excuses will be acceptable as follows:

Acceptable documents for makeup exams: Court order, police report, official university activities, official scholarship activities, military activities, doctor note, etc.
Unacceptable Excuses for makeup exams: Family reunion, attending marriage ceremony, attended engagement parties, hangover, oversleeping, not ready for the exam, having other exams (less than three final exams on the same day), etc.

Labs and Projects: You will be given between 7 and 10 lab projects to complete. You are expected to learn by "hands-on" using state-of-the-art tools, hardware and software programming. Those projects include XILINX SDK Tools, ARM Cortex A9 assembly and C language to run and control the ZYNQ chip on board named BLACKBOARD. Please purchase the board from FIZ before the first lab.

You must present a demo to the TA and show that the experiment is working during the lab session. If you could not finish the project during the lab, you have a week to finish it before the following lab session. You will have to do the demo with me and in my office. Lab reports will be submitted electronically via blackboard. All Lab reports are due before your lab session on the due date. Please give yourself extra time (at least 15 minutes) to upload your lab report before the due deadline. No late submission will be accepted. It is mandatory that you email yourself the report before the due date and time as a proof of any technical difficulties that you may encounter.

Laboratory Report Format:
A template for Lab report is provided on blackboard. You will also be incrementally guided to improve your writing skills in every report. So, a write-up requirements section will be included in every lab assignment, where new writing requirements will be added in every new lab project. You will be able to write an excellent technical report by the end of the semester.
Every report must have

1. Title page
2. Purpose
3. Introduction

4. Theoretical design
5. Procedure
6. Results
7. Conclusion
8. Appendix

Students with Disabilities

I am committed to provide assistance to help you be successful in this course. Reasonable accommodations are available for students with a documented disability. Please visit the Disability Resource Center (DRC) during the first two weeks of every semester to seek information or to qualify for accommodations. All accommodations MUST be approved through the Access Center (https://www.drc.wsu.edu/home/) or Call 509-335-3417 to make an appointment with a disability counselor.

Academic integrity policy

Academic integrity is the cornerstone of higher education. As such, all members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Academic integrity will be strongly enforced in this course. Students who violate WSU's Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(3) and -404) will receive a failing final grade of F in the course, will not have the option to withdraw from the course pending an appeal, and will be reported to the Office of Student Conduct.

Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). You need to read and understand all of the definitions of cheating available at https://www.academicintegrity.wsu.edu If you have any questions about what is and is not allowed in this course, you should ask course instructors before proceeding.

Safety Procedure

The Campus Safety Plan, which can be found at http://safetyplan.wsu.edu, contains a comprehensive listing of university policies, procedures, statistics, and information relating to campus safety, emergency management, and the health and welfare of the campus community. I Visit the University office emergency management web site at http://oem.wsu.edu/ to become familiar with the campus safety and emergency information provided.