EE4311 Embedded Microcontroller Systems
EE5314 Embedded Microcontroller Systems
Fall 2019

Instructor Information

Instructor:
Jason Losh, Ph.D.

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ERB 649

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Faculty Profile:
https://mentis.uta.edu/explore/profile/jason-losh

Office Hours:
Monday 10-10:50am, Tuesday 5-5:20pm, Thursday 12-12:30pm., Thursday 5-5:20pm, and by appointment. Additional hours will be added as needed as the semester proceeds.

Graders:
Grader contact information will be sent to the course listserv after assignments are made.

Course Information

Section Information:
001, 10x (EE5314 only)

Time and Place of Class Meetings:
Lecture: MW 5:30-6:50pm, WH 404 (Section 001)
Laboratory: M or T or W or Th or F 7-9:50pm, NH 148 or NH 129A (Section 10x)

Description of Course Content:
Hardware/software development techniques for microcontroller systems with an emphasis on hardware-software interactions, programming internal peripherals, interfacing with external sensors and devices, and real-time control applications. Prerequisite: EE3310 or equivalent.

Student Learning Outcomes:
Upon successful completion of this course, students will have knowledge of:

- Proficiency in C programming
- Differences between Harvard and von Neuman architectures
- Differences of microcontroller and microprocessor architectures
- Comparison of standard microprocessor and digital signal processor memory bus and ALU architectures
- Study of microcontroller peripherals including timers, PWM, interrupts, GPIO ports, and ADCs
- Determining microcontroller memory, speed, and capabilities to solve a task
- Interfacing with SPI and serial buses

- Measurement and instrumentation applications
- Digital filtering applications
- Device control: Motors, servos, relays, heavy AC and DC loads
- Real-time control applications

Class Web Page:
Additional files will be provided as needed on the course web site at http://omega.uta.edu/~jlosh/.

Communication:
All class-wide communication by the instructor, including distribution of homework sets, will occur via the class listserv. Please sign up for the EE5314-L listserv by sending an e-mail from your UTA e-mail account to listserv@listserv.uta.edu from your UTA e-mail account (no subject line needed) and the command SUBSCRIBE EE5314-L as the message body. You will then receive an e-mail from the listserv server to which you must acknowledge to join the listserv with "OK" in an e-mail.

Canvas will only be used for Echo360 access.

Textbooks and Other Course Materials:
No textbook will be required for this course. Extensive references, datasheets, application notes, and class notes will be provided on the course web site at http://omega.uta.edu/~jlosh/.

All students are required to own a TM4C123GXL evaluation kit. The cost is $12.99. Information on this board is available at http://www.ti.com/tool/EK-TM4C123GXL. You will also need a prototyping board with donut rings for soldering your project. These are available in the IEEE office in NH for $2 or from other sources.

Lab Safety Training:
Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities. Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., Fall through Summer II) and must be completed anew in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned. The safety website for EE is http://www.uta.edu/ee/current-students/UG-lab/safety.php. You must complete this form at this link and submit it to be able to work in the lab.

Major Assignments and Examinations:
Test 1: Monday, October 14
Test 2: Monday, November 25
Project: Wednesday, December 4
(the leveling exam has been removed from the rubric)

Grading Information

Grading:
- Grade scale: A (90-100), B (80-89), C (70-79), D (60-69), and F (0-59)
- Grade calculation: Test 1 (33.3%), Test 2 (33.3%), Project (33.3%)
- The instructor reserves the right to make reasonable changes in performance evaluation as needed.
- Any request for re-grading must be submitted to the Grader within one week of the completion of grading.

Tests:
- Tests are open-book, open-notes, calculators allowed.
- No makeup will be provided for any test missed.

Project:

- The project will consist of hardware construction and firmware development and it is expected that it will take approximately 80 hours to complete.
- Projects are individual assignments. You can help each other with concepts, but no sharing of code is allowed.
- Interim deadlines for hardware construction and some software milestones will be announced as the class progresses.

Course Schedule

- Architecture (3 hrs)
- Important C Language Details (e.g. C99 stdbool/stdint, volatile keyword) (0.5 hrs)
- Basic I/O cell design, application with port masking, bitbanding (4 hrs)
- Clocks (1 hr)
- Assembly/C mixed code, register and calling conventions (2.5 hrs)
- Pipeline operation and cycle-exact functions (1.5 hrs)
- UART theory and application (2 hrs)
- SPI bus theory and application to graphics LCD, graphics drivers (3 hrs)
- Exam 1 (1.5 hrs)
- Pulse-width modulation theory and application (1.5 hrs)
- Analog-to-digital theory (SAR) and application (2 hrs)
- Interfacing to signal conditioning and measurement techniques (3 hrs)
- Finite and infinite impulse response digital filtering, ring buffers (1.5 hrs)
- Keyboard interfacing (debouncing theory, open-drain outputs) (0.5 hr)
- Interrupt theory and application to a keyboard driver (1.5 hrs)
- Timer and CCP theory and application to frequency and time measurement (1.5 hrs)
- PID controller theory and application (3 hrs)
- Project support lecture content (7 hrs)
- Exam 2 (1.5 hrs)

The instructor reserves the right to make changes in the schedule as needed as the class progresses.

The official dates for registration, census, and dropping are available at www.uta.edu/acadcal.

Academic Integrity

This information is copied from http://www.uta.edu/conduct/academic-integrity/index.php.

The University of Texas at Arlington strives to uphold and support standards of personal honesty and integrity for all students consistent with the goals of a community of scholars and students seeking knowledge and responsibility. Furthermore, it is the policy of the University to enforce these standards through fair and objective procedures governing instances of alleged dishonesty, cheating, and other academic/non-academic misconduct.

Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, and collusion on an examination or an assignment being offered for credit. Each student is accountable for work submitted for credit, including group projects.

- Cheating
    - Copying another's test or assignment (added note: remember this includes homework!)
    - Communication with another during an exam or assignment (i.e. written, oral or otherwise)
    - Giving or seeking aid from another when not permitted by the instructor

    - Possessing or using unauthorized materials during the test
    - Buying, using, stealing, transporting, or soliciting a test, draft of a test, or answer key
- Plagiarism
    - Using someone else's work in your assignment without appropriate acknowledgement
    - Making slight variations in the language and then failing to give credit to the source
- Collusion
    - Without authorization, collaborating with another when preparing an assignment

Institution Information

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the Institutional Information page (http://www.uta.edu/provost/administrative-forms/course-syllabus/index.php) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

Additional Information

Attendance:
At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report must the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

Emergency Exit Procedures:
Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Success Programs:
UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring by appointment, drop-in tutoring, etutoring, supplemental instruction, mentoring (time management, study skills, etc.), success coaching, TRIO Student Support Services, and student success workshops. For additional information, please email resources@uta.edu, or view the Maverick Resources website.

Emergency Phone Numbers

In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381