CSCI 4287: Embedded System Programming
Department of Computer Science and Engineering
College of Engineering and Applied Sciences
University of Colorado Denver
Course Syllabus

Instructor: Dr. Tam Vu   Term: Spring, 2015
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COURSE OVERVIEW:

I. **Welcome** to Embedded System Programming - *an insight into the less visible side of computing*. This course is designed to bring students to the design and analysis of computational systems that pervasively present in our everyday life. Applications of such systems include medical devices and systems, consumer electronics, toys and games, assisted living, traffic control and safety, automotive systems, process control, energy management and conservation, environmental control, aircraft control systems, communications systems, instrumentation, critical infrastructure control (electric power, water resources, and communications systems for example), robotics and distributed robotics (telepresence, telemedicine), defense systems, manufacturing, and smart structures. The course will focus on the interplay of practical design with models of systems and its analysis.

II. **University Course Catalog Description:** This course will focus on two specific Embedded Systems Programming contexts. Embedded Systems Programming in the Small (ESPiS) and Embedded Systems Programming in the Large (ESPiL).

III. **Course Goals and Learning Objectives:** It is the goal of this course that at the completion of the semester you would have gained the following knowledge:

- Skills in modeling a small cyber-physical system.
- Skills in embedded system programming.
- Skills in design a small cyber-physical system.
- Skills using a shell that interacts with a kernel.
- Skills in presenting completed work.

The learning objectives of this course are:

- Learning the basics of principles in modeling, designing, and analyzing an embedded system.
- Learning the basics of design, code, and test embedded software with C, C++, Java and Python, where applicable, programming languages

IV. **Course Prerequisites:** It is expected that at the beginning of this course that you have the knowledge of *CSCI 3453 Operating Systems* course or equivalents is required. Students should understand general mechanisms by which computer platforms and structured and manipulated.

V. **ABET Assessment Criteria:** This course is designed to address ABET Assessment Criteria c and d. Criteria c is an ability to design and conduct software and/or hardware experiments, as well as an ability to analyze and interpret data. Criteria d is an ability to design software to meet desired needs. These Criteria will be addressed in an Embedded Systems context. ABET Assessment Criteria c and map to Program Educational Outcome 1,2, and 3, which are " 1- Advance professionally as productive, practicing professionals in computer science and related careers through the continued

development of their expertise and skills", "2- Further develop their knowledge, skill set, and career opportunities through graduate education and/or professional studies", and "3 - Function effectively as a part of a team to succeed in their professional careers."

VI. **Course Credits:** This course has three (3) credits associated with it.

VII. **Required Texts and Materials:** This course requires the following textbook:

Introduction to Embedded Systems, by E. A. Lee and S. A. Seshia, 2011-2012.
Downloadable version of the textbook is available without fee at http://leeseshia.org/

VIII. **Course Schedule:** The following is the tentative schedule for this course and it is subject to change. If there are any changes to this schedule they will be reflected on the course' website.

Week	Topic
1	Introduction to the course and logistics
2	Sensors and Actuators
3	Memory Architectures
4	Interfacing to Sensors and Actuators
5	Interrupts
6	Multitasking
7	Scheduling - Midterm
8	Model-Based Design
9	Dynamic modeling
10	State Machines
11	Quantitative analysis
12	Reachability Analysis
13	Execution Time Analysis
14	Security Analysis - Final
15	Project presentation and demo

EVALUATION:

I. **Course Grade:** Course grades are a weighted average of the grades earned on all graded material. The final grade is ***Min(100, actual grade)***. The weights for the different categories are:

- Assignments:…………………………………40%
- Quizzes …………………...…………………… 10%
- Participation (in class and online discussion)… 5%
- Attendance ………………………………………5%
- Project presentation and report………………… 10%
- Midterm:...20%
- Final:...20%

Letter Grades are as follows:
- 94% – 100% .... A
- 90% – 93.9% .... A-
- 87% – 89.9% .... B+
- 84% – 86.9% .... B
- 80% – 83.9% .... B-
- 77% – 79.9% .... C+

- 74% – 76.9% C
- 70% – 73.9% .... C-
- 67% – 69.9% .... D+
- 64% – 66.9% .... D
- 60% – 63.9% .... D-
- 00% – 59.9% .... F

II.   **Programming Assignments:** The Programming Assignments will be in the C, C++, Java, Python, or combined depending on the project you select.   The grading of the Programming Assignments is a combination of completeness (all specifications are covered), correctness of results, and style. All programming assignments are due at the beginning of class on the due date. Submissions will be made via Canvas. I do not allow late work to be submitted unless there is **prior written approval** by me based on **special circumstances.**

III. **Exams:** Exams are closed book. **One two-sided cheat sheet of hand-writing is allowed**. Makeup exams are not normally given; in **special circumstances**, arrangements should be made **prior** to the exam date if at all possible.

IV.   **Quizzes:** There will be numerous in class quizzes, some of which will not be announced. These quizzes will be brief, taking approximately ten minutes to complete.   The quizzes will be a combination of multiple-choice, short answer/fill in the blank, and short essay questions.

V.   **Grade Dissemination:** I will be utilizing the Canvas system to record your grades. You can check on Canvas for all of your current grades.

COURSE PROCEDURES:

I.   **Attendance and participation:** Attendance is required for this course. As with all science courses, you will have easier time learning the material if you attend the lectures and participate in class.

II.   **Late Work Policy:** All programming assignments are due at the beginning of class on the due date. Submissions will be made via Canvas. I do not allow late work to be submitted unless there is **prior approval** by me based on **special circumstances.** Makeup exams and quizzes are not normally given; in **special circumstances**, arrangements should be made **prior** to the exam date if at all possible.

III. **Grades of "Incomplete":** The current university policy concerning incomplete grades will be followed in this course. Incomplete grades are given only in situations where unexpected emergencies prevent a student from completing the course and the remaining work can be completed the next semester. I am the final authority on whether you qualify for an incomplete. Incomplete work must be finished by the end of the subsequent semester or the "I" will automatically be recorded as an "F" on your transcript.

IV.   **Canvas:** I will be utilizing Canvas in this course to assign all of the course work and for you to submit your solutions. I will also be utilizing it to communicate with you and to provide you with your current grade. It is recommended that you check it frequently.

V.   **Classroom Devices:** Out of respect for everyone in the classroom, if you would like to record the lectures you must first receive my approval. I generally will approve the request, but I first would like to speak with you concerning the scope of the recording.

STUDENT EXPECTATIONS:

I.   **Civility:** My commitment is to create a climate for learning characterized by respect for each other and the contributions each person makes to class. I ask that you make a similar commitment.

II. **Professionalism:** Since mobile devices can be a distraction during class, I ask that all devices be put into "silent" mode and not utilized during class; this includes checking Facebook, sending a Tweet, or checking email. If I feel that your mobile device is becoming a distraction for either other students, you, or myself I will ask you to leave the classroom.

III. **Religious Observations:** I understand that an individual's religion plays a large part in their lives and I do not want this course to interfere with that aspect of their lives. If you find that your religion's holiday(s) falls on a class day and you can not attend due to this, please notify me within two weeks of that date by email (or Canvas mail) and we will work together to come to a mutually acceptable solution.

COLLABORATION AND CHEATING:

I encourage you to review material and discuss ideas together for projects and other assignments, and to work on problems you encounter. It is a characteristic of computing that discussions often help to clarify problems and resolve difficulties — feel free to take advantage of this to improve your understanding of the material, and to complete projects, but **make sure you then create your own work**. It's important that you go through the program design, coding, and debugging processes yourself, or you will not be developing your own programming skills and understanding. "Working together" does not mean that one student does the majority of the work and other students put their names on it! If you have any questions about what this means, please see me. **Every student must create their own work on their own!**

Any instances of cheating will result in either a **zero** for the assignment, a grade of **zero** in the course, or sanctions determined by the college (including suspension and expulsion).

UNIVERSITY POLICIES:

I. **Access:** The University of Colorado Denver is committed to providing reasonable accommodation and access to programs and services to persons with disabilities. Students with disabilities who want academic accommodations must register with Disability Resources and Services (DRS) in North Classroom 2514, Phone: 303-556-3450, TTY: 303-556- 4766, Fax: 303-556-4771. I will be happy to provide approved accommodations, once you provide me with a copy of DRS's letter. [DRS requires students to provide current and adequate documentation of their disabilities. Once a student has registered with DRS, DRS will review the documentation and assess the student's request for academic accommodations in light of the documentation. DRS will then provide the student with a letter indicating which academic accommodations have been approved.]

II. **Academic Honesty and Student Code of Conduct:** Students are expected to know, understand, and comply with the ethical standards of the university, including rules against plagiarism, cheating, fabrication and falsification, multiple submissions, misuse of academic materials, and complicity in academic dishonesty. For more information on Academic Honesty and the Student Code of Conduct please see: http://www.ucdenver.edu/academics/colleges/Engineering/student-services/policies-forms/Documents/Student%20Honor%20Code.pdf

III. **Other University Policies:**

- Academic Freedom:
  http://www.ucdenver.edu/policy/pages/academic-Freedom.aspx
- Family Educational Rights and Privacy Act (FERPA):
  http://www.ucdenver.edu/student-services/resources/registrar/students/policies/Pages/StudentPrivacy.aspx
- Attendance:
  http://www.ucdenver.edu/faculty_staff/employees/policies/Policies%20Library/OAA/StudentAttendance.pdf
- Discrimination and Harassment Policy and Procedures:
  http://www.ucdenver.edu/about/WhoWeAre/Chancellor/ViceChancellors/Provost/Stu

dentAffairs/UniversityLife/sexualmisconduct/DenverPolices/Pages/DenverWelcome.a spx
- Grade Appeal Policy:
http://www.ucdenver.edu/policy/Documents/Process-for-Grade-Issues.pdf

THE LAST WORD

Since you will be spending time on this class anyways (after all, it is a core course), why not make it an awesome experience during which you will create something worth mentioning? I am here to help you **do well in this course** and, more importantly, **prepare you well for your career**. More specifically, ***I want to help you to land a great engineering job in your dream company or get admitted to a graduate program of your choice even before you graduate from here.*** To that end, if you have any problems that interfere with your academic work, see me as soon as possible so we can look for a solution.