CSE 321   Realtime and Embedded Operating Systems   Fall 2019

Course Description

Computers are embedded in countless real-world devices such as cell phones and remote controllers and in systems inside automobiles and aircrafts. These devices and systems are required to perform flawlessly and in real-time. This course will address fundamental challenges in the design, implementation, and validation of these real-time and embedded systems. Course topics include resource management, concurrency, secure coding practices, memory management, timeline design and analysis, schedulability tests, hardware interfacing, device driver programming, memory maps and boot kernels, firmware and ROM-resident system code, communications and networking, and debugging live systems. These concepts will be reinforced through C programming assignments using the Linux-based operating systems. Students will work on special devices such as a mobile phone, Internet of Things, small device controllers (Arduino, Raspberry Pi, mobile tablets and phones), drones and virtual reality (VR/AR) devices.
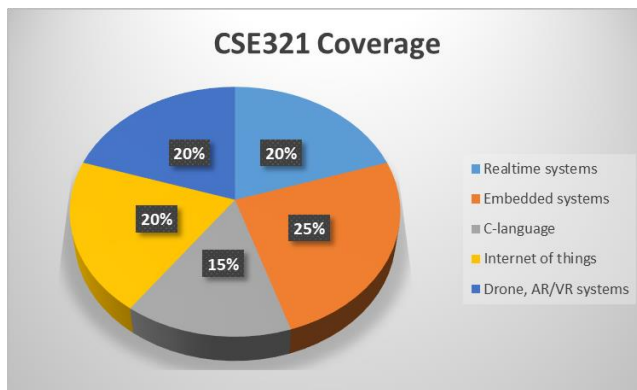
Learning Outcomes:

On completion of this course students will be able to (i) understand the components and working of a realtime and embedded operating systems, (ii) program devices using C programming language and (ii) design and implement various embedded systems functions. Students will also learn the regulations, privacy, security and safety issues related to designing and using drones.

Course Information

Website:	http://www.cse.buffalo.edu/~bina/cse321/fall2019
Instructor:	Bina Ramamurthy (bina@buffalo.edu)
Lecture Time:	MWF: 9.00-9.50AM
Lecture Location:	Cooke 121
Office Hours:	Mon and Tue: 2.00-3.30PM
Office:	345 Davis Hall

Recitations: All recitations in Bell 340 unless otherwise TA specifies other location.

11143	R1	F	12:00 PM - 12:50 PM	Bell 340
11410	R2	M	1:00 PM - 1:50 PM	Bell 340
11150	R3	F	1:00 PM - 1:50 PM	Bell 340
11558	R4	W	8:00 AM - 8:50 AM	Bell 340
18880	R5	T	4:00 PM - 4:50 PM	Bell 340
19915	R6	R	1:00 PM - 1:50 PM	Bell 340
19916	R7	R	12:00 PM - 12:50 PM	Bell 340

Recommended Textbooks

1. Real-Time Systems Development (Paperback) by Rob Williams
    a. Paperback: 320 pages
    b. Publisher: Butterworth-Heinemann (December 3, 2005)
    c. ISBN-10: 0750664711 ISBN-13: 978-0750664714
2. Systems Programming in C and Unix By Adam Hoover; Publisher: Addison-Wesley; 1 edition (February 23, 2009); ISBN-10: 0136067123

3. Debugging: The 9 Indispensable Rules for Finding Even the Most Elusive Software and Hardware Problems by David J Agans, Publisher: AMACOM; ISBN-10: 0814474578

Pre-requisites
You should have CSE241 and CSE250, its equivalent. Much of the lab work revolves around strong design foundation, which you have all been exposed to in Computer Science I and II and digital systems.

Grading Distribution (Tentative)
Grades will consist of the following components:

Component (Quantity)	Percentage
Labs (2) + in class work	10%+ 10% = 20%
C-language homework	20%
Exams (2)	25+ 25 = 50%
Term project (individual project) + demo presentation	20%
Total	100%

Point distribution guideline will be as follows:

Point Range	Letter Grade
95.00-100	A
90.00-94.99	A-
85.00-89.99	B+
80.00-84.99	B
75.00-79.99	B-
70.00-74.99	C+
65.00-69.99	C
60.00-64.99	C-
55.00-59.99	D+
50.00-54.99	D
0-49.99	F

I reserve the right to alter component weighting or provide a "curve" on an assignment as warranted.

Labs/Projects
Labs are short projects that lead to the major term-project. We'll discuss the details of the labs and projects in the opening week.

Exams
There will be a midterm that will be administered and graded before the resign date. Midterm material will cover all lecture and reading assignments before the exam, as well as concepts from the lab assignments. Midterms are closed book, closed notes, and closed neighbor. Please see the additional handout for exam taking policies for this course. The final is a comprehensive exam, covering all lecture, lab, and homework areas. The final is closed book, closed notes, and closed neighbor.
Mid-term Exam is on October 23, 2019 during the lecture time.
Final exam is on 12/11/2019, 8-11AM, at Cooke 121.

Attendance Policy

You are responsible for the contents of all lectures and recitations (your assigned section). If you know that you are going to miss a lecture or a recitation, have a reliable friend take notes for you. Of course, there is no excuse for missing due dates or exam days. We do, however, reserve the right to take attendance in both end of the course, especially if we see a lack of attendance and participation during lecture sessions. During lectures, we will be covering material from the textbook. We will also work out several of the problems from the text. Lecture will also consist of the exploration of several real world realtime and embedded systems problems not covered in the book. You will be given a reading assignment at the end of each lecture for the next class.

Office Hour Policy

If you can't meet during these hours, you will have to communicate with us via email. Office hours are intended to resolve questions about the material that could not be answered in lecture or recitation. Come to office hours prepared.

Grading Policy

All assignments will be graded and returned in a timely manner. When an assignment is returned, you will have a period of one week to contest any portion of the grade. The TA who graded your assignment will be the first person to resolve a grading conflict. If the conflict cannot be resolved, the instructor will mediate the dispute. The judgment of the instructor will be final in all such cases. When contesting a grade, you must be able to demonstrate how your particular solution is correct. Also, when contesting a grade, the instructor or TA reserves the right to re-evaluate the entire lab or exam, not just the portion in dispute.

Incomplete Policy

We only grant incompletes in this course under the direst of circumstances. By definition, an incomplete is warranted if the student is capable of completing the course satisfactorily, but some traumatic event has interfered with their capability to finish within the timeframe of the semester. Incompletes are not designed as stalling tactic to defer a poor performance in a class.

Academic Integrity Policy

UB's definition of Academic Integrity in part is, "Students are responsible for the honest completion and representation of their work". It is required as part of this course that you read and understand the departmental and university academic integrity policy.

There is a very fine line separating conversation pertaining to concepts and academic dishonesty. You are allowed to converse about general concepts, but in no way are you allowed to share code or have one person do the work for others. You must abide by the UB and Departmental Academic Integrity policy at all times. Remember that items taken from the Internet are also covered by the academic integrity policy! If you are unsure if a particular action violates the academic integrity policy, assume that it does until you receive clarification from the instructor. If you are caught violating the academic integrity policy, you will minimally receive a ZERO in the course.

Web Site

The CSE321 website should be checked frequently for important news. Course assignments, slides, grade reporting, and general hints and tips will be posted on the website.

Students with Disabilities

If you have special needs due to a disability, you must be registered with the Office of Disability Services (ODS). If you are registered with ODS please let your instructors know about this so that they can make special arrangements for you.

Accessibility Resources

There are many resources available help you navigate the UB system. Please see all the resources available for students at http://www.buffalo.edu/accessibility/