

Course Syllabus

Course Information

(course number, course title, term, any specific section title)

Course Prefix, Number, Section

CS 4397, 81324, 001

Course Title

Embedded Computer Systems

Term

Fall, 2016: TuTh 10:00 a.m. – 11:15 a.m. ECSN 2.120

Professor Contact Information

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Office hours: Tuesday/Thursday, 11:30 a.m. -12:30 p.m.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

CS 4348 (Operating Systems Concepts) or equivalent.

Course Description

Catalogue Description.

- Introduction to embedded computer applications and concepts;
- Real-time operating systems and resource management;
- Real-time scheduling and communication;
- Sensor data acquisition, processing, and fusion;
- Error handling, fault tolerance, and graceful degradation;
- System performance analysis and optimization techniques; and
- Project to develop and analyze a small embedded computer application.

Topics. The course will cover the following topics:

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- Overview of embedded applications and concepts with emphasis on the distinguishing characteristics of embedded systems and the constraints that they must satisfy.
 - Distinguishing features of embedded software development process, including host/target environments and linking and memory mapping requirements.
 - Brief review of the features of real-time operating systems and how they differ from general purpose operating systems.
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- Real-time scheduling and schedulability analysis, including clock-driven and priority-driven scheduling.
 - Resource management in real-time systems, including potential problems and their resolution as well as practical issues in building real-time systems.
 - Real-time operating system threads, tasks, kernel structure, timer functions, and other services; capabilities and overview of commercial real-time operating systems.
 - Fault tolerance methods for embedded systems, distributed embedded systems, and real-time communication (if time permits).
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Student Learning Objectives/Outcomes

- Ability to design and implement real-time embedded systems {c,e,j,k; se2,se5,se6,se11}
- Ability to design schedules and perform schedulability analysis for periodic and non-periodic systems {a,c,e,k; se2}
- Understanding of real-time operating systems {j; se11}
- Understanding of resource management issues in real-time systems {a,e,k; se1}
- Understanding of dependability issues for real-time embedded systems {j; se3}

ABET a-k Objectives:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments as well as to analyze and interpret data.
- An ability to design a system, component or process to meet desired needs.
- An ability to function on multidisciplinary teams.
- An ability to identify, formulate and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global/societal context.
- A recognition of the need for and ability to engage in lifelong learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Software Engineering Objectives:

- se1: Ability to analyze software systems.
 - se2: Ability to design software systems.
 - se3: Ability to verify software systems.
 - se4: Ability to validate software systems.
 - se5: Ability to implement software systems.
 - se6: Ability to apply software systems.
 - se7: Ability to maintain software systems.
 - se8: Ability to appropriately apply discrete mathematics to complex software systems.
 - se9: Ability to appropriately apply probability and statistics to complex software systems.
 - se10: Ability to appropriately apply relevant topics in Computer Science and supporting disciplines to complex software systems.
 - se11: Ability to work in one or more significant application domains.
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Required Textbooks and Materials

- J.W.S. Liu, *Real-Time Systems*, Prentice Hall, 2000 or later.
- Q. Li with C. Yao, *Real-Time Concepts for Embedded Systems*, CMP Books, 2003 or later.

Suggested Course Materials

- On-line references, including conference and journal papers.

Assignments & Academic Calendar

(Topics, Reading Assignments, Due Dates, Exam Dates)

- First mid-term test will be on Thursday, September 29, 2016.
- Second mid-term test will be on Thursday, Nov. 3, 2016.
- Final examination will tentatively be on Thursday, Dec. 15, 2016, from 11:00 a.m. to 1:45 p.m.
- There will be 4 group assignments during the semester.

Grading Policy

(including percentages for assignments, grade scale, etc.)

Three examinations: 50% of the overall grade.

Programming assignments and project: 50%. The assignments will focus on the embedded system development process and real-time scheduling. The project will target an application in process-control systems or telecommunication systems. It will use actual embedded systems devices, including TI 3200 Launchpads, TI RTOS, Analog Continuous or Standard Servo, and other embedded devices and will include design/implementation/analysis of the system and its documentation. The final project will be a group project.

Course & Instructor Policies

(make-up exams, extra credit, late work, special assignments, class attendance, classroom citizenship, etc.)

- Cheating, plagiarism, collusion, and falsifying academic records will not be tolerated and will result in an "F" grade on the course. The tests and the exam are open notes. However, you must not discuss the questions and/or answers with anyone else nor copy or look at anyone else's answers nor seek help with the tests or exam from anyone in any way.
- There are no make-up dates for missed examinations. Late assignments will not be accepted.
- Please note: Please look at the course schedule and catalogue for information on withdrawals, incompletes, and academic honesty.
- Attendance policy:
 - Three consecutive absences will lead to one letter grade drop.
 - Four consecutive absences will lead to an F grade.

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.