

Course Syllabus

Course Information

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

Course Prefix, Number, Section

CS 4397, 84449, 001

Course Title

Embedded Computer Systems

Term

Fall, 2022: TuTh 10:00 a.m. – 11:15 a.m.

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.

- 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 Exam will be in September, 2022.*
- *Second Exam will be in October, 2022.*
- *Third Exam will be in November or December, 2022.*
- *There will be 3 to 4 assignments during the semester.*

Grading Policy

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

Three examinations: 70% of the overall grade.

Programming assignments: 30%. 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 include design/implementation/analysis of the system and its documentation.

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.*

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.