
CIS 4930:**Real-Time Systems**

Credit Hours: 3.0

COURSE SYLLABUS

Semester: Spring 2026

Class Meeting Days: M W

Class Meeting Time: 3:30pm - 4:45pm

Class Meeting Location: SOC 150

Instructor: Shareef Ahmed

Office Location: ENB 367

Office Hours: MW 1:30pm - 3:00pm

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Teaching Assistant: Ahmed Shahabaz

Office Location: LIB 6th floor (ask the front desk for TA location)

Office Hours: F 9am-12pm

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I. Welcome!

Welcome to the graduate course on Real-Time Systems! A real-time system includes different computations that are required to satisfy timing constraints. For example, an autonomous vehicle needs to detect obstacles within a certain time limit after receiving sensor data. Other examples of such systems are airplanes, industrial robots, medical robots, etc. Many real-time systems are also safety-critical, which should undergo stringent certification process before their real-world deployment. Such certification is only possible when the system is designed to be time-predictable.

However, to satisfy timing constraint, it is not sufficient to only devise efficient algorithms and implementation for the application. The underlying computing hardware should be allocated to different computations in a way that each computation provably respects its timing constraint. This course covers design and analysis of such resource-allocation algorithms such as scheduling algorithms, synchronization algorithms, memory-management algorithms that are central components of a real-time operating system. This course also covers topics related to autonomous systems such as hardware accelerator management, middleware such as Robot Operating System, and real-time AI.

II. University Course Description

Special topics in computer science and computer engineering.

III. Course Prerequisites

Students are expected to be familiar with operating systems, algorithms, and C programming.

IV. Course Objectives

The course illustrates design and analysis of real-time systems.

Students will:

1. Learn about different real-time scheduling algorithms and their analyses.
2. Learn about different real-time synchronization algorithms and their analyses.
3. Learn about memory-management techniques for predictable timing.
4. Learn about basics of a real-time operating system.
5. Develop an understanding about different components of autonomous cyber-physical systems.
6. Learn about recent research regarding autonomous real-time systems.

V. Required Texts and/or Readings and Course Materials

- Hard Real-Time Computing Systems, Giorgio Buttazzo, Springer New York, NY (online accessible through USF library)
- Some research papers and blogs provided and covered in the class

Additional Readings will be provided as necessary for the purposes of this course.

VI. Supplementary (Optional) Texts and Materials

Real-Time Systems, Jane Liu, Prentice Hall, 2000.

VII. Academic Continuity

Any form of academic disruption will be addressed in accordance with the guidelines provided by the University of South Florida.

VIII. Communication

All course-related communication will be conducted through Canvas. Class announcements, updates, and important reminders will be posted in the Announcements section on Canvas, which students are expected to check regularly. Class-related discussion will be conducted in Canvas discussion forum. When communicating with the instructor, teaching assistants, or peers, please use a professional and respectful tone.

IX. Grading Scale

<u>Grading</u>	<u>Scale (%)</u>
≥ 90 – 100	A
86 - < 90	A-
82 – < 86	B+
78 – < 82	B
74 – < 78	B-
70 – < 74	C+
66 – < 70	C
62 – < 66	C-

58 – < 62	D+
54 – < 58	D
50 – < 54	D-
< 50	F

X. Grade Categories and Weights

Graded Items	Percent of Final Grade
Quizzes	10%
Written Homework	25%
Midterm	15%
Final Exam	20%
Project	30%

Participation and Engagement

The instructor reserves the right to reward students based on participation in class and online discussions by increasing final grade by up to half a letter grade.

XI. Grade Dissemination

All grades will be disseminated through Canvas.

XII. Course Schedule.

Week	Date	Chapters	Topic
1	Jan 12, 14	1, 2	Introduction to real-time systems
2	Jan 21	5 (J. Liu book)	Uniprocessor scheduling (static scheduling)
3	Jan 26, 28	4.4, 4.6	Uniprocessor scheduling (dynamic scheduling)
4	Feb 2, 4	4.3, 4.5	Uniprocessor scheduling (fixed-priority scheduling)
5	Feb 9, 11		Uniprocessor scheduling (arbitrary deadlines and summary), Resource access protocols
6	Feb 16, 18		Resource access protocols
7	Feb 23, 25	7	Resource access protocols, Midterm
8	Mar 2, 4	7	Multiprocessor scheduling
9	Mar 9, 11	5.3, 5.4	Multiprocessor scheduling, Reservations
10	Mar 23, 25	6.9, 10	Reservations (cont'd), Kernel design issues
11	Mar 30, Apr 1	10	Kernel design issues (cont'd)
12	Apr 6, 8	11, 13	Application design issues, RTOSs
13	Apr 13, 15		Dealing with overheads, memory management techniques
14	Apr 20, 22		Advanced topic: hardware accelerator management
15	Apr 27, 29		Advanced topic: ROS, AI application

16			Final Exam
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* Note: The Schedule is tentative.

Homeworks

Number	Due
1	Feb 4
2	Feb 25
3	Mar 25
4	Apr 15

* Note: The number of homeworks and due dates are tentative.

Project:

There will be a course project. Maximum two students can form a group to do the project. There are two options for the project. The first option is doing a set of given assignments provided in the class that involves programming on a microcontroller and RTOS. The assignments will be communicated via Canvas. Each student group is responsible for buying a (cheap) development board that they will use to complete the assignments. The second option is to do a self-defined project (subject to approval from the instructor). The project must include some real-time concern. A deadline will be communicated by which students need to decide which form of the project they are doing.

XIII. USF Core Syllabus Policies

USF has a set of central policies related to student recording class sessions, academic integrity and grievances, student accessibility services, academic disruption, religious observances, academic continuity, food insecurity, pregnancy and related conditions, and sexual harassment that **apply to all courses at USF**. Be sure to review these online: usf.edu/provost/faculty-success/resources-policies-forms/core-syllabus-policy-statements.aspx

XIV. Course Policies

Late Work Policy: No late homework and programming assignment submission will be accepted.

Medical Excuses:

Students should not attend class if they are ill, particularly if they have fever and/or gastrointestinal symptoms and/or respiratory symptoms such as sneezing, runny nose, sore throat or coughing. Students experiencing any of these symptoms should contact immediately the Student Health Services (813-974-2331) on the Sarasota-Mantatee and Tampa campus or the Wellness Center (727-873-4422) on the St. Petersburg campus for appropriate medical guidance and to obtain a verification of care letter. Students may turn to other health providers as well. To be approved for missed classes, late assignments or missed examinations a verification of care letter must be presented by the student to the faculty member upon return to class.

Midterm and Final Exam: Each student must inform course instructor about any potential conflict in the posted exam schedule and assignment dates due to any religious or university-sponsored activities by the first week of the Fall semester. You will receive a zero on any exam missed without an acceptable, documented, valid reason. Midterm and final exams are closed book and no use of electronic device during the exam is allowed.

Extra Credit Policy: Extra credit may be given at the instructor's discretion for extraordinary projects that go far beyond the requirements for full credit. This is entirely up to the instructor, and they reserve the right to refuse the awarding of extra credit for any reason whatsoever.

Grades of "Incomplete": Students who are unable to complete all requirements of the course for circumstances beyond their control may request to receive an "I" grade to allow for completion of the remaining course work the next semester(s).

Attendance and In-Class Quiz Policy: Students are required to attend the first-class meeting. Students are expected to attend all lectures. Should a missed class result from a medical excuse, religious observances, university expectation, etc. the instructor will accommodate excused absences by making arrangements ahead of time (when possible).

There will be approximately 5-7 in-class quizzes (biweekly). Each quiz is on topics covered between prior quiz to the last lecture before the quiz. Each student's final quiz grade will exclude their lowest two quiz scores.

Exam Retention Policy: The exams will be retained for one semester following the current one, and then they will be destroyed.

Final Examinations Policy: All final exams are to be scheduled in accordance with the University's final examination policy.

Academic dishonesty: Academic dishonesty will not be tolerated. The student involved in cheating will be dealt with in accordance with the university policies. Examples of academic dishonesty include but not limited to copying solutions from another student, buying ready-made solutions, plagiarizing or copying verbatim from solutions manuals, similar websites, or GenAI tools.

Keeping assignments and solutions private: Students are required to keep the assignment copies and their solutions private. Communicating the assignment and solutions to any person other than those involved in grading them is an honor code violation.

GenAI Policy: You are not allowed to get help from GenAI during in-class quizzes and exams. GenAI can be used to learn course materials. You are not allowed to upload or copy homework question directly to a GenAI tool. All written homework should be written by you, GenAI can only help you with grammar editing (if needed) and learning course materials related to the homework.

XV. Course Policies: Technology and Media

Canvas: This course will be offered via USF's learning management system (LMS), Canvas. If you need help learning how to perform various tasks related to this course or other courses being

offered in Canvas, please view the following videos or consult the Canvas help guides. You may also contact USF's IT department at (813) 974-1222 or help@usf.edu.

Class Recordings: The instructor will not record any class lectures.

WhatsApp, GroupMe, and Student-to-Student Communication: While students may use digital communication tools (WhatsApp, GroupMe, etc.) to communicate with fellow students, it is important to remember that academic integrity policies still apply in these environments. Informing others about the contents of tests is prohibited by [the official regulation](#), as is receiving unauthorized information about an examination. Students are expected and required to immediately report instances of such violations to the instructor.

Electronic Device Usage: Non-academic electronic device use in class, including texting or surfing the Internet, is prohibited. Students are allowed to use devices for recording lectures for their personal use, though students must still adhere to classroom behavioral expectations while recording. Usage of mobile devices for classroom activities at the direction of instructor is allowed.

XVI. Course Policies: Student Expectations

Health and Wellness: Your health is a priority at the University of South Florida. We encourage members of our community to look out for each other and to reach out for help if someone is in need. If you or someone you know is in distress, please make a referral at www.usf.edu/sos so that the Student Outreach & Support can contact and provide helpful resources to the student in distress. A 24-hour licensed mental healthcare professional, offered through the counseling center, is available by phone at 813-974-2831, option 3. Please remember that asking for help is a sign of strength. In case of emergency, please dial 9-1-1.

Title IX Policy: USF is committed to fostering a safe and respectful learning environment, free from sex discrimination and sexual harassment, in accordance with Title IX and [USF Policy 0-004](#). If a student shares an experience of sexual harassment, sexual assault, stalking, or relationship violence with a USF employee (including faculty), that employee will notify the Title IX Office. This allows the Title IX Office to send the student an email with information about support resources and options—if it is safe to do so. Students are not required to respond to this email. The Title IX Office is a private resource. Information is shared only on a need-to-know basis to provide students with support measures. To speak to a confidential resource, students may contact [USF Center for Victim Advocacy](#) at 813-974-5757. Confidential resources do not notify the Title IX Office unless the student requests it. For more information about Title IX, available resources, or to make a report, please visit www.usf.edu/title-ix.

Professionalism Policy: Per university policy and classroom etiquette; mobile phones, iPods, etc. **must be silenced** during all classroom and lab lectures. Those not heeding this rule will be asked to leave the classroom/lab immediately to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade.

Netiquette Guidelines

1. Act professionally in the way you communicate. Treat your instructors and peers with respect, the same way you would do in a face-to-face environment. Respect other people's ideas and be constructive when explaining your views about points you may not agree with.
2. Be sensitive. Be respectful and sensitive when sharing your ideas and opinions. There will be people in your class with different linguistic backgrounds, political and religious beliefs or other general differences.
3. Proofread and check spelling. Doing this before sending an email or posting a thread on a discussion board will allow you to make sure your message is clear and thoughtful. Avoid the use of all capital letters, it can be perceived as if you are shouting, and it is more difficult to read.
4. Keep your communications focused and stay on topic. Complete your ideas before changing the subject. By keeping the message on focus you allow the readers to easily get your idea or answers they are looking for.
5. Be clear with your message. Avoid using humor or sarcasm. Since people can't see your expressions or hear your tone of voice, meaning can be misinterpreted.

Plagiarism-detecting tools: The instructor reserves the right to use any plagiarism-detecting tool.

End of Semester Student Evaluations: All classes at USF make use of an online system for students to provide feedback to the University regarding the course. These surveys will be made available at the end of the semester, and the University will notify you by email when the response window opens. Your participation is highly encouraged and valued.

XVII. Learning Support and Campus Offices

Academic Accommodations

Students with disabilities are responsible for registering with Student Accessibility Services (SAS) in order to receive academic accommodations. For additional information about academic accommodations and resources, you can visit the SAS website.

[SAS website for the Tampa and Sarasota-Manatee campuses.](#)

Academic Support Services

The USF Office of Student Success coordinates and promotes university-wide efforts to enhance undergraduate and graduate student success. For a comprehensive list of academic support services available to all USF students, please visit the [Office of Student Success website](#).

Canvas Technical Support

If you have technical difficulties in Canvas, you can find access to the Canvas guides and video resources in the "Canvas Help" page on the homepage of your Canvas course. You can also contact the help desk by calling 813-974-1222 in Tampa or emailing help@usf.edu.

[IT website for the Tampa campus.](#)

Center for Victim Advocacy

The [Center for Victim Advocacy](#) empowers survivors of crime, violence, or abuse by promoting the restoration of decision making, by advocating for their rights, and by offering support and resources. Contact information is available online.

Counseling Center

The Counseling Center promotes the wellbeing of the campus community by

providing culturally sensitive counseling, consultation, prevention, and training that enhances student academic and personal success. Contact information is available online. [Counseling Center website for the Tampa campus.](#)

XVIII. Important Dates to Remember

All the dates and assignments are tentative and can be changed at the discretion of the instructor. For important USF dates, see the [Academic Calendar](#) at <http://www.usf.edu/registrar/calendars/>

*The instructor reserves the right to modify the document.

Document History:

11/18/2025: Document Created.

1/8/2026: 1st revision

1/12/2026: TA hours updated