

CSC 230 Real-Time Computer Interfaces

3 cr.

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Office: location
Office Hours: days and times

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Section	Time	Room	Final Exam
nn	days and times	location	date and time

Catalog description:

This course deals with the technical aspects of using a computer to sense data from a real world environment and subsequently to control conditions in that environment. The techniques of breadboarding and experimental electronic circuit construction will be used in the laboratory. The construction and interfacing of robotic devices which sense and react to real-world conditions will be emphasized. Three lecture hours per week plus laboratory work outside of class.

Prerequisites: CSC 115 or CSC 202J, and PHS 205.

Goals:

The purpose of this course is to introduce the student to the hardware and software necessary to do real-time computing.

Specific goals:

- CG01: to develop the ability to perform sensory breadboarding and achieve desired results;
- CG02: to develop the skills necessary to identify eligible operating systems and languages for real-time systems;
- CG03: to develop the ability to analyze and design real-time systems;
- CG04: to give students the ability to perform full verification of real-time systems.

Objectives:

Upon successful completion of this course, students will have:

- CO01: demonstrated the ability to set up and construct a breadboarding environment for sensor testing and response generation;
- CO02: applied the standards necessary to evaluate real-time applicability of various operating systems and programming languages;
- CO03: demonstrated the ability to analyze and develop real-time applications based on written specifications;
- CO04: demonstrated the ability to completely test an application against written specifications.

Program Outcome vs. Course Objectives matrix

Program Objective (condensed form)	CO01	CO02	CO03	CO04
PO-A: apply knowledge of computing and math	✓	✓	✓	
PO-B: analyze a problem and define its computing requirements	✓	✓	✓	✓
PO-C: design, implement and evaluate applications		✓	✓	✓
PO-D: function effectively in teams to accomplish a common goal				
PO-E: professional, ethical, and social responsibilities				
PO-F: communicate effectively with a range of audiences				
PO-G: local and global impact of computing on people and society				
PO-H: need for continuing professional development				
PO-I: use current techniques, skills, and tools	✓		✓	✓

Program Objective (condensed form)	CO01	CO02	CO03	CO04
PO-J: apply theory and principles to model and design systems	✓			
PO-K: apply design and development principles in constructing software				
note - full statements of the Program Outcomes (program objectives) for the Computer Science Major can be found in the document <i>Computer Science Major Program Educational Objectives and Program Outcomes</i> on the Assessment page of the Computer Science Major (cs.salemstate.edu)				

Topics:

- fundamentals of electronic circuits
- techniques of bread-boarding and experimental circuit construction
- sensory devices and RTOS technology **SP5(1)** OS6(2), OS7(1), OS8(9) (not core)
- motion control devices **SE3(3), SP6(1)** IS10(4), SP9(1) (not core)
- serial and parallel signal transmission CN4(1) (not core)
- mobile platforms NC9(1), SP8(1) (not core)
- on-board computational devices **SP4(1), CN3(1)** OS9(1), OS10(3), IM11(1) (not core)
- programming of micro-computing devices **AR5(4)**
- state diagrams and state processing **PF5(3)**
- Petrie loop control **DS5(1)**

Assignments:

There will be approximately ten laboratory assignments to be completed outside of scheduled class hours. The work includes limited hardware configuration, wiring, and equipment setup. The assignments are primarily of a programming nature. The language will vary with the equipment available but may include an assembly language, FORTRAN, BASIC, C, and some proprietary languages.

- basic wiring and bread-boarding
- sensors as input devices
- real time processing techniques
- motion controlling
- motion sensing
- control computer programming
- interface construction and design
- multiple event handling, including error handling
- parallel control
- control optimization

Grading:

The course grade will be determined using the following approximate weights: laboratory reports - 40% total; written homework - 10%; midterm exam - 20%; final examination - 30%.

Course Objective / Assessment Mechanism matrix

	Test/Quiz	Homework	Projects	Lab Exercises
CO01			✓	✓
CO02	✓	✓	✓	✓
CO03	✓	✓	✓	✓
CO04			✓	✓

Bibliography:

- Agrawala, Gordon, Hwang. **Mission Critical Operating Systems**. IOS Press, 2006
- Butazzio, Lipardi, Coaccamo, **Soft Real-Time Systems: Predicted vs. Effective**. Kluwer Academic Press, 2001
- Butazzio, **Hard Real-Time Systems: Predictability of Scheduling Algorithms and Applications**. Kluwer Academic Press, 2004
- Herman, Kopetz. **Real-Time System Design Plans for Distributed Embedded Applications**. Kluwer Academic Press, 2005

Quing Li with Caroline Yao **Real-Time Concepts for Embedded Systems**. CMP Books 2003
Sakamura. **An Open and Portable Operating System for Embedded Systems: Concepts and Specifications**.
Computer Systems Press, 2004
Sheppard, Tom. Real-time Operating System Fundamentals. Kindle Edition, Amazon Digital Services, 2011
Venkateswara, Chowdaryre. Simple Real-time Operating System: A Kernel Inside View for a Beginner.
Trafford Publishing, 2007
Volvano, Jonathan W. Embedded Microcontroller Systems: Real-time Interfacing. CL Engineering 2nd Edition, 2006
Walls, Colin. **Building a Real-time Operating System: RTOS from the ground up**. Newes-Elsevier, 2011

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University-Declared Critical Emergency Statement:

In the event of a university-declared emergency, Salem State University reserves the right to alter this course plan. Students should refer to www.salemstate.edu for further information and updates. The course attendance policy stays in effect until there is a university-declared critical emergency.

In the event of an emergency, please refer to the alternative educational plans for this course, which will be distributed via standing class communication protocols. Students should review the plans and act accordingly. Any required material that may be necessary will have been previously distributed to students electronically or will be made available as needed via email and/or Internet access.

Equal Access Statement:

"Salem State University is committed to providing equal access to the educational experience for all students in compliance with Section 504 of The Rehabilitation Act and The Americans with Disabilities Act and to providing all reasonable academic accommodations, aids and adjustments. **Any student who has a documented disability requiring an accommodation, aid or adjustment should speak with the instructor immediately.** Students with Disabilities who have not previously done so should provide documentation to and schedule an appointment with the Office for Students with Disabilities and obtain appropriate services."

<p>Note: This syllabus represents the intended structure of the course for the semester. If changes are necessary, students will be notified in writing and via email.</p>
