Computer Science Department
cs.salemstate.edu

**CSC 795 Computer Systems** **3 cr.**

**Catalog Description**:

This course examines the principles of computer systems and how these principles relate to the design of such systems. Both hardware and software concepts and the interdependence between them are studied. This course presents the functionalities, current design and implementation techniques of the operating system. The relationship between the operating system and computer architecture is discussed. Major topics include: processor architecture, processor implementation, computer memory, multithreading, multicore, and multiprocessor systems. Three lecture hours per week.

**Course Prerequisites**: graduate status or permission of graduate program coordinator.

**Course Goals:**
The purpose of this course is to introduce the concepts of organization and architecture of computer systems and operating systems. The goals of this course are:

CG01: to present the concept of a computer system as a hierarchical levels of components;
CG02: to present a descriptive overview of processor architecture and implementation;
CG03: to give students an understanding of fundamental technical issues in the implementation of an operating system;
CG04: to give students an experience designing an ALU based on specific requirements

**Course Objectives**:
Upon completion of the course, the student will have:

CO01: demonstrated knowledge of the concepts of computer systems;
CO02: gained an understanding of pipelined processor design;
CO03: gained an understanding of memory management and memory hierarchy;
CO04: demonstrated knowledge of an I/O subsystem supporting processor programmed I/O, direct memory access and interrupt structures;
CO05: gained an understanding of the concepts of process, thread and the behavior of multithreaded systems;
CO06: gained an understanding of deadlocks.

**Topics Agenda:**

The course topics will be covered in the class in one semester (fifteen weeks) as follows:
Week01: Review of important topics covered in undergraduate courses Operating Systems and Computer Architecture.
Week02: Processor Architecture.
Week03: Processor Implementation, Finite State Machine.
Week04: Interrupts, Traps and Exceptions.
Week05: Performance of Pipelined Processor Design and Processor Scheduling.
Week06: Memory Hierarchy.
Week07: Memory Management: Virtual Memory, Page Replacement Algorithms.
Week08: Input/output and Stable Storage.
Week09: File Systems.
Week10: Multithreaded Programming and Multicore/Multiprocessors.
Week11: Multicomputer Systems.
Week12: Fundamentals of Networking in Computer Systems.
Week13: Introduction to Distributed Systems
Week14: Deadlocks.
Week15: Presentations, reviews, and Final exam.

**Testing and Grading:**
The course consists of lectures, homework assignments, term paper and two exams – a midterm and a final. Homework assignments will be given every two to three weeks covering different topics from the course. Students will be asked to

write a term paper after reviewing some latest research papers on the advanced topics. This will help them to learn the art of reading, understanding and writing research papers. Two comprehensive exams, midterm and final exam will be conducted to evaluate their understanding of the concepts learnt in this course.

The final grade will be determined using the following weights:

- Written Homework 30%
- Midterm Exam 20%
- Final Exam 25%
- Term Paper 25%

**Bibliography:**


- Uma Kishore Ramachandra and William D. Leahy Jr. **Computer Systems: An Integrated Approach to Architecture and Operating Systems. First edition**, Prentice Hall Publishers 2010.
- Andrew Tanenbaum. **Modern Operating Systems**. **Fourth edition**, Prentice Hall Publishers 2014.
- Baer Jean-Loup. **Microprocessor Architecture: From Simple Pipelines to Chip Multiprocessors**. **First edition**, Cambridge University Press, 2010.
- Bryant Randal E and O'Hallaron David R. **Computer Systems: A Programmer's Perspective. Second edition**, Addison Wesley, 2011.
- Hamacher Carl, Vranesic Zvonko and Zaky, Safwat. **Computer Organization and Embedded Systems**. **Sixth edition**, McGraw-Hill, 2012.
- Doeppner Thomas W. **Operating Systems In Depth: Design and Programming**. **First edition**, Wiley, 2010.
- McHoes Ann and Flynn Ida M. **Understanding Operating Systems**. **Seventh edition**, Course Technology, 2013.
- Stallings William. **Operating Systems: Internals and Design Principles**. **Seventh edition**, Prentice Hall, 2011.
- John Paul Shen and Mikko H. Lipasti. **Modern Processor Design : Fundamentals of Superscalar Processors. First edition**, Waveland Press, 2013.
- Linda Null and Julia Lobus. **The Essentials of Computer Organization and Architecture. Fourth edition**, Jones and Bartlett Learning, 2014.
- David A. Patterson and John L. Hennessy. **Computer Organization and Design: The Hardware and Software Interface. Fifth edition**, Morgan Kaufmann, 2013.
- John L. Hennessy and David A. Patterson. **Computer Architecture: A Quantitative Approach. Fourth Edition**, Morgan Kaufmann, 2006.