

Program Objective (condensed form)	CO01	CO02	CO03	CO04	CO05	CO06	CO07	CO08	CO09	CO10
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	✓			✓		✓				✓
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:

- introduction: OS1(1)
 - What is an operating system?
 - functions and goals of an operating system
 - principal components
- review of relevant topics in computer hardware, architecture, and organization AR2(0.5),AR3(1.5),AR4(2),AR5(0.5)
- evolution of operating systems OS1(1)
 - resident monitors (single-user systems)
 - multiprogramming
 - time-sharing
 - networks and distributed processing AR9(0.5)
 - multiprocessing AR7(1)
- operating system structures
 - system services, system calls
 - interrupts and interrupt handling OS2(1)
 - kernel of an operating system OS2(0.5)
 - layered structure OS2(0.5)
 - virtual machines
- evaluation of system performance OS11(1)
- protection and security mechanisms OS7(2)
- process management and threading
 - the process concept OS2(0.5)
 - representation of processes OS2(0.5)
 - concurrent processes OS3(1)
 - CPU scheduling and scheduling algorithms OS4(4)
 - multiprocessor scheduling OS4(1)
 - threading models
 - threading libraries
- process coordination and thread synchronization
 - classical synchronization problems OS3(2)
 - Critical Section Problem, Bounded Buffer Problem, Readers & Writers Problem, etc.
 - synchronization mechanisms OS3(3)
 - hardware
 - semaphores
 - language constructs
 - interprocess communication, message systems OS3(0.5)
 - thread synchronization in Java
- deadlocks OS3(1.5)
 - characterization, detection, prevention, avoidance, recovery
- storage management OS5(8)
 - memory management
 - swapping
 - paging

- segmentation
- virtual memory
 - demand paging
 - page replacement algorithms
 - frame allocation algorithms
 - thrashing
- secondary storage management **OS6(3)**
 - disk structure
 - allocation methods
 - scheduling algorithms
- file management **OS8(1)**
 - file systems
 - access methods
 - file protection
- distributed systems **AR9(0.5)**
 - network topologies and types
 - coordination and deadlock in distributed systems
 - distributed file systems

The focus of the course is on a general discussion of the nature and functionality of operating systems. Extended treatment of specific case studies is not appropriate to the course, although examples drawn from specific systems are used to illustrate major concepts.

Assignments: Weekly reading assignments in the text and in other books and journals provide the background for lecture topics. It will be assumed that the reading has been done *before* the class discussion of the associated material.

Approximately eight written assignments with specific deadlines cover such topics as development, analysis, and comparison of scheduling and allocation algorithms, synchronization of concurrent processes, multi-threading issues, resource allocation graphs, problems in paging and virtual memory systems, disk scheduling, etc. Depending on the availability of appropriate hardware and software, some of the written assignments may be replaced by projects (including programming projects) on the same topics.

Examinations: A mid-term examination and a comprehensive written final examination are given..

The course grade is determined using the following approximate weights:

written assignments	30%
projects	30%
midterm examination	10%
final examination	30%

Course Objective / Assessment Mechanism matrix

	Written Assignments	Projects	Examinations
CO01	✓		
CO02	✓		✓
CO03	✓	✓	✓
CO04	✓	✓	✓
CO05	✓	✓	✓
CO06	✓	✓	✓
CO07	✓	✓	✓
CO08	✓		✓
CO09	✓		✓

Bibliography:

Bacon, Jean. **Concurrent Systems: An Integrated Approach to Operating Systems, Database, and Distributed Systems. Second Edition.** Addison-Wesley, 2002.

Bryant, Randal E.; O'Halaron, David R. **Computer Systems: A Programmer's Perspective. Second Edition.** Addison Wesley, 2010.

Doeppner, Thomas W. **Operating Systems In Depth: Design and Programming.** Wiley, 2010.

Goetz, B; Peierls, T.; Bloch, J.; Bowbeer, J.; Holmes, D.; Lea, D. **Java Concurrency in Practice.** Addison Wesley, 2006.

Herlihy, Maurice; Shavit, Nir. **The Art of Multiprocessor Programming.** Morgan Kaufmann, 2008.

Hoover, Adam. **System Programming with C and Unix.** Addison Wesley, 2009.

Kerrisk, Michael. **The Linux Programming Interface: A Linux and UNIX System Programming Handbook.** No Starch P:ress, 2010.

McHoes, Ann; Flynn, Ida M. **Understanding Operating Systems. Seventh Edition.** Course Technology, 2010.

Newham, Cameron. **Learning the bash Shell: Unix Shell Programming (In a Nutshell). Third Edition.** O'Reilly Media, 2005.

Nutt, Gary J. **Operating Systems: A Modern Perspective. Third Edition.** Addison-Wesley, 2004.

Robbins, Kay A.; Robbins, Steve. **UNIX Systems Programming: Communication, Concurrency and Threads.** Prentice Hall, 2003.

Roscoe, A. W. **Understanding Concurrent Systems.** Springer, 2010.

Siever, Ellen; Figgins, Stephen; Love, Robert; Robbins, Arnold. **Linux in a Nutshell. Sixth Edition.** O'Reilly Media, 2009.

Silberschatz, Abraham; Galvin, Peter Baer. **Operating System Concepts. Eighth Edition.** Addison-Wesley, 2008.

Silberschatz, Abraham; Galvin, Peter Baer. **Operating System Concepts Essentials.** Addison-Wesley, 2011.

Silberschatz, Abraham; Galvin, Peter; Gagne, Greg. **Operating System Concepts with Java. Eighth Edition.** Addison-Wesley, 2010.

Stallings, William. **Operating Systems: Internals and Design Principles. Seventh Edition.** Prentice-Hall, 2011.

Tannenbaum, Andrew S. **Modern Operating Systems. Third Edition.** Prentice Hall, 2008.

Tannenbaum, Andrew S.; Woodhull, Albert S. **Operating Systems. Design and Implementation. Sixth Edition.** Prentice Hall, 2008.

Academic Integrity Statement:

"Salem State University assumes that all students come to the University with serious educational intent and expects them to be mature, responsible individuals who will exhibit high standards of honesty and personal conduct in their academic life. All forms of academic dishonesty are considered to be serious offences against the University community. The University will apply sanctions when student conduct interferes with the University primary responsibility of ensuring its educational objectives." Consult the University catalog for further details on Academic Integrity Regulations and, in particular, the University definition of academic dishonesty.

The Academic Integrity Policy and Regulations can be found in the University Catalog and on the University website (http://catalog.salemstate.edu/content.php?catoid=13&navoid=1295#Academic_Integrity). The formal regulations are extensive and detailed - familiarize yourself with them if you have not previously done so. A concise summary of and direct quote from the regulations: "Materials (written or otherwise) submitted to fulfill academic requirements must represent a student's own efforts". *Submission of other's work as one's own without proper attribution is in direct violation of the University's Policy and will be dealt with according to the University's formal Procedures. Copying without attribution is considered cheating in an academic environment - simply put, **do not do it!***

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."

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.