Saint Leo University

COM 405
Operating Systems

Course Description:
The use of operating systems to facilitate reliable and safe execution of software: process execution and scheduling; process synchronization and deadlock avoidance/resolution; memory management; file systems; I/O systems and device management; protection and security.

Prerequisite:
None

Textbook:
Student Note: Students ordering from our online bookstore will access the materials from the links in the course. There is nothing to receive from the bookstore once the order has been placed. This class has direct digital access within the course.

Garrido, J.M, Schlesinger, R., & Hoganson, K. (2013). *Principles of modern operating systems.* (2nd ed.). (eBook) Burlington, MA: Jones and Bartlett Publishers. ISBN-13: 9781284030648 (Custom for Saint Leo)

Created from the National textbook content:

Garrido, J.M, Schlesinger, R., & Hoganson, K. (2013). Principles of modern operating systems-With CD (2nd ed.). Burlington, MA: Jones and Bartlett Publishers. ISBN-13: 987-1-4496-2634-1

Learning Outcomes:
1. Describe and evaluate the objectives and functions of modern operating systems, how these have been achieved over the evolution from primitive batch systems to sophisticated multi-user systems, and analyze the tradeoffs inherent in operating system design.
2. Explain and justify the use of layers, kernel modes, APIs, drivers, and interrupts, in Operating System design.
3. Describe the need for concurrency within the framework of an operating system, compare and contrast the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating systems, and access the potential run-time problems arising from the concurrent operation of many separate tasks.
4. Evaluate and select storage options using the memory hierarchy and cost-performance trade-offs, and mitigate potential hazards, such as thrashing.
5. Compare and contrast different approaches to file organization, recognizing the strengths and weaknesses of each; and summarize how hardware developments have led to changes in our priorities for the design and the management of file systems.
6. Identify the relationship between the physical hardware and the virtual devices maintained by the operating system; explain buffering and describe strategies for implementing it; and differentiate the mechanisms used in interfacing a range of devices to a computer and explain the implications of these for the design of an operating system.
7. Defend the need for protection and security and the role of ethical considerations in computer use; summarize the features and limitations of an operating system used to provide protection and security; and explain the mechanisms available in an OS to control access to resources.
8. **VALUES OUTCOMES**: In this class we will study how to make most efficient use of computer resources, practicing Saint Leo University's core value of **Responsible Stewardship.**

Core Value:

Responsible Stewardship: Our Creator blesses us with an abundance of resources. We foster a spirit of service to employ our resources to university and community development. We must be resourceful. We must optimize and apply all of the resources of our community to fulfill Saint Leo University's mission and goals.

Evaluation:
This class contains both a great deal of theory and but also has a “hands on”, authentic task laboratory component in which students will create software to use API calls and also to simulate operating system components using algorithms taught in the class.

Assignment	**Points**	**Weight**
Discussions (8)		10%
Writing Assignments (8)		20%
Labs (5)		20%
Exams (2)		30%
Term Paper		20%
Total		**100**

Description of Assignments

The **Midterm** and **Final Exams** will consist of multiple-choice questions.

Lab projects may consist of a variety of activities. Students are asked to perform simulations in the textbook.

Term papers will consist of 1,250 words on a unique, operating system specific topic. The term paper will be done in three installments: (1) Proposal and Annotated Bibliography; (2) First Draft; (3) Final Draft;

This term paper will help you study a particular feature of a contemporary operating system. You are required to do the following:

1. Pick a feature of any contemporary operating system of choice (a list of features is given below).
2. Research the feature using literature or the Internet, and write in your own words a detailed description of the feature and explanation on how it works.
3. Compare the feature implementation in your operating system of choice to implementations in **two** other contemporary operating systems.

List of features:

- Processes
- Threads
- Multiprogramming
- Processor Scheduling
- Synchronization
- Deadlocks
- File Management
- I/O System
- Memory Management
- Security
- Protection
- Networking

- Distributed System
- Virtual Machines

Schedule:

Module 3: Provide instructor your topic selection.
Module 6: Submit your first draft (You will receive feedback from your instructor. After you submit, the feedback should be incorporated in your Final Draft of the Term paper)
Module 8: Submit your Final Draft
Submission: no later than **Sunday 11:59 PM EST/EDT** of the noted module.

Writing guidelines:

- Paper length: 5 pages
- Provide references for citations where needed.
- Writing reflects your ideas and communicates your understanding of the topic to the instructor.
- Successful writing should demonstrate:
    - Proofreading skills
    - Correct grammar and punctuation
    - Logical organization
- Your paper should be structured as follows:
    - Name of topic
    - Description
    - How it works
    - Implementation comparison
    - Summary

Exercises from the textbook will be assigned to reinforce the concepts taught. In addition, questions should be included that explore optimal use of resources (**Responsible Stewardship**) and preserving confidential and privileged information (**Integrity**).

Discussion/Participation encourages students to participate in online discussion. Points are given to each discussion. For each module, a student needs to post one discussion topic and two responses.

Grading Scale:

Grade	Score (%)
A	94-100
A-	90-93
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	74-76
C-	70-73
D+	67-69
D	60-66
F	0-59

Assessment of the Learning Outcomes:

Learning Outcome	Assessment Method(s)
1, 8	Lab exercises
2, 3	Writing Assignment
4	Assignments
5	Discussion
6, 7	Term Paper

Course Schedule:

Module 1 **Introduction to Operating Systems**

Objectives

When you complete this module, you should be able to:

- Identify software components.
- Distinguish operating system interfaces and views.
- Outline contemporary operating systems.
- Summarize the fundamentals of network security.

Assignments

Items to be Completed:	**Due No Later Than:**
Post an introduction to the class	Thursday 11:59 PM EST/EDT
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 1	Sunday 11:59 PM EST/EDT
Read the Term Paper Guidelines and Expectations	Sunday 11:59 PM EST/EDT

Module 2 **Processes and Threads**

Objectives

When you complete this module, you should be able to:

- Define processes and process states.
- Identify threads.
- Describe basic synchronic of Pthreads.
- Describe multi-programming.

Assignments

Items to be Completed:	**Due No Later Than:**
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 2	Sunday 11:59 PM EST/EDT
Continue search for Term Paper topic	Sunday 11:59 PM EST/EDT of Module 3

Module 3 **System Performance and Models, and Systems with Multiprogramming**

Objectives

When you complete this module, you should be able to:

- Describe system performance and models.
- Identify simulations models.
- Analyze multiprogramming.
- Compare system models

Assignments

Items to be Completed:	**Due No Later Than:**
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 3	Sunday 11:59 PM EST/EDT
Submit Lab 1	Sunday 11:59 PM EST/EDT
Email Term Paper topic selection for instructor approval	Sunday 11:59 PM EST/EDT

Module 4 **Processor Scheduling**

Objectives

When you complete this module, you should be able to:

- Describe processor scheduling concepts.
- Describe CPU scheduling policies.
- Analyze process scheduling.
- Identify scheduling shortcomings.
- Explain multiprocessor systems.

Assignments

Items to be Completed:	**Due No Later Than:**
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 4	Sunday 11:59 PM EST/EDT
Submit Lab 2	Sunday 11:59 PM EST/EDT
Complete the Midterm Exam	Sunday 11:59 PM EST/EDT
Continue working on Term Paper draft	Sunday 11:59 PM EST/EDT of Module 6

Module 5 **Synchronization Principles**

Objectives

When you complete this module, you should be able to:

- Describe the synchronization principles.
- Demonstrate implementation synchronization.
- Analyze semaphores.
- Demonstrate the use of synchronization in solving problems.
- Describe monitors.
- Evaluate inter-process communications.

Assignments

Items to be Completed:	**Due No Later Than:**
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 5	Sunday 11:59 PM EST/EDT
Submit Lab 3	Sunday 11:59 PM EST/EDT
Continue working on the Term Paper draft	Sunday 11:59 PM EST/EDT of Module 6

Module 6 **Deadlocks**

Objectives

When you complete this module, you should be able to:

- Describe the principles of deadlock.
- Analyze the resources allocation graph.
- Demonstrate methods of handling deadlock.
- Explain deadlock prevention.
- Develop deadlock avoidance.
- Solve and utilize deadlock detection and recovery.

Assignments

Items to be Completed:	**Due No Later Than:**
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 6	Sunday 11:59 PM EST/EDT
Submit first draft of Term Paper	Sunday 11:59 PM EST/EDT

Module 7 **File Management and I/O System**

Objectives

When you complete this module, you should be able to:

- Describe file management.
- Explain access methods.
- Classify directory functions.
- Describe real-world systems.
- Describe the I/O system.
- Design I/O performance optimization.
- Configure system parameters.

Assignments

Items to be Completed:	**Due No Later Than:**
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 7	Sunday 11:59 PM EST/EDT
Submit Lab 4	Sunday 11:59 PM EST/EDT

Module 8 **Memory Management**

Objectives

When you complete this module, you should be able to:

- Describe process address space.
- Evaluate and distinguish memory allocation.
- Describe virtual memory.
- Describe and evaluate paging with virtual memory.

Assignments

Items to be Completed:	**Due No Later Than:**
Read assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Writing Assignment 8	Sunday 11:59 PM EST/EDT
Submit Lab 5	Sunday 11:59 PM EST/EDT
Complete the Final Exam	Sunday 11:59 PM EST/EDT
Submit Final Draft of the Term Paper	Sunday 11:59 PM EST/EDT