Advances in Operating Systems

Course Code: PGMTH3C009T

Course Title: Advances in Operating Systems

Semester: III

Credits:04

Course Overview

This course covers general issues of design and implementation of advanced modern operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, sharing and replication of data and files. Approximately one third of the course will be devoted to basic concepts and techniques, and the remaining two third will be on assorted current topics in modern operating systems and distributed systems.

Course Objectives

- To introduce the students with the basic features in distributed operating systems.
- To make the students understand the necessary message and Stream-Oriented communication.
- To familiarize students with advanced paradigms associated with code migration and scheduling in various operating systems.
- To provide a platform for students to understand and develop hands-on knowledge of advanced operating systems.

Course Outlines

Contents	**No of Lectures**
Unit-I Operating System Introduction, Structures - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, System services, System Calls, Virtual Machines, System Design and Implementation. Process and CPU Scheduling - Process concepts and scheduling, Operation on processes, Threads, and Inter-process Communication, Scheduling Criteria, Scheduling Algorithm, Multiple -Processor Scheduling, Real-Time Scheduling.	**10**
Unit-II Memory Management and Virtual Memory - Paging, Segmentation, Segmentation with Paging. Demand Paging, Performance of Demand Paging, Page Replacement, Page Replacement Algorithm, Allocation of Frames, Thrashing. Deadlocks - Methods for Handling Dead locks Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock.	**10**

Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, Critical Regions, Monitors.	
Unit-III Introduction to Distributed systems: Goals of distributed system, hardware and software Concepts, design issues. Lamport's logical clocks, vector clocks, causal ordering of messages.	**10**
Unit-IV Distributed mutual exclusion: Lamport's algorithm, Ricart-Agrawala Algorithm, Distributed deadlock detection: centralized algorithms	**10**
Unit-V Failure recovery and fault tolerance: classification of failures, Checkpoints, Synchronous and asynchronous check-pointing and recovery Operating System Security Issues- Introduction to the topic of Security in Operating Systems, Access Control Fundamentals and Generalized Security Architectures.	**10**

Course Outcomes

After completion of course, students would be able to:

- Have strong hands-on grasp of operating systems at the level of distributed operating system
- Analyze the security parameters in case of distributed systems.
- Implement a real/simulated operating system

Teaching Plan

S.no	Topic	No. of Lectures	References
	UNIT-I		
1.	Operating System Introduction, Structures	**1**	**eLink 1-Chapter 1**
2.	Simple Batch, Multi programmed, time- shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems,	**1**	**eLink 1-Chapter 1**
3.	System components, System services, System Calls,	**2**	**eLink 2-Chapter 1**
4.	Virtual Machines, System Design and Implementation	**1**	**eLink 2-Chapter 1**
5.	Process and CPU Scheduling - Process concepts and scheduling	**1**	**eLink 1,2-Chapter 3**
6.	Operation on processes, Threads, and Inter-process Communication	**1**	**eLink 1,2-Chapter 3**
7.	Scheduling Criteria, Scheduling Algorithm	**2**	**eLink 1,2-Chapter 3**
8.	Multiple -Processor Scheduling, Real-Time Scheduling	**1**	**eLink 1,2-Chapter 3**
	UNIT-II		
9.	Memory Management and Virtual Memory - Paging	**1**	**eLink 2,3-Chapter 7,8**
10.	Segmentation, Segmentation with Paging. Demand Paging, Performance of Demand Paging,	**2**	**eLink 2,3-Chapter 7,8**
11.	Page Replacement, Page Replacement Algorithm, Allocation of Frames, Thrashing.	**2**	**eLink 2,3-Chapter 7,8**
12.	Deadlocks - Methods for Handling Dead locks Deadlock Prevention	**1**	**eLink 2,3-Chapter 7,8**
13.	Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock	**1**	**eLink 2,3-Chapter 7,8**
14.	Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware	**2**	**eLink 2,3-Chapter 7,8**
15.	Semaphores, Critical Regions, Monitors	**1**	**eLink 2,3-Chapter 7,8**
	UNIT-III		
16.	Introduction to Distributed systems: Goals of distributed system	**2**	**eLink 4-Chapter 1,2**
17.	Hardware and software Concepts	**2**	**eLink 4-Chapter 1,2**
18.	Design issues	**2**	**eLink 4-Chapter 1,2**
19.	Lamport's logical clocks	**2**	**eLink 4 -Chapter 4**
20.	vector clocks, causal ordering of messages	**2**	**eLink 4 -Chapter 3,4,6**
	UNIT-IV		
21.	Distributed mutual exclusion: Lamport's algorithm,	**2**	**eLink 4-Chapter 9**
22.	Ricart-Agrawala Algorithm	**2**	**eLink 4-Chapter 9**
23.	Distributed deadlock detection: centralized algorithms	**6**	**eLink 4-Chapter 9**

UNIT-V			
24.	Failure recovery and fault tolerance: classification of failures	**2**	**eLink 3-Chapter 13,14**
25.	Checkpoints, Synchronous and asynchronous check-pointing and recovery	**3**	**eLink 3-Chapter 13,14**
26.	Operating System Security Issues- Introduction to the topic of Security in Operating Systems	**2**	**eLink 3-Chapter 13,14**
27.	Access Control Fundamentals and Generalized Security Architectures	**3**	**eLink 3-Chapter 13,14**

Evaluation Scheme

S.No	Exam	Marks	Duration of Exam	Coverage/Scope of Examination
1.	Mid Term Exam	25	2 hours	Two to three Units
2.	End Term Exam	50	3 hours	Complete Syllabus (5 units)
3.	Teacher Continuous Internal Assessment	25	Entire Semester	Assignments, Quizzes, Tests, Projects, Presentations etc.

ONLINE BOOKS AVAILABLE

eLinks (Due to COVID-19, the following ebooks and references can be used)

1. https://www.pdfdrive.com/abraham-silberschatz-operating-system-concepts-e45162438.html
2. https://www.pdfdrive.com/operating-system-concepts-e158325105.html
3. https://www.pdfdrive.com/operating-system-concepts-essentials-e37911056.html
4. https://eclass.uoa.gr/modules/document/file.php/D245/2015/DistrComp.pdf

OTHER ONLINE LINKS
1. https://www.geeksforgeeks.org/
2. http://www.freebookcentre.net/
3. https://edu.gcfglobal.org/
4. https://www.tutorialspoint.com/

Text/Reference Books

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, JohnWiley.
2. Singhal, M and Shivaratri, N. Advanced Concepts in Operating Systems. Tata McGraw Hill., 2001.
3. Kskhemkalyani, A and Singhal, M. Distributed computing: Principles, Algorithms, and systems.Cambridge University Press, 2011.
4. Silberschatz & Galvin, Operating System Concepts, 6th ed.

5. Coulouris et al., Distributed Systems: Concepts and Design, 3rd ed., - Lynch.
6. Ananda & Srinivasan, Distributed Computing Systems: Concepts and Structures Mullender, Distributed Systems.
7. Filman & Friedman, Coordinated Computing: Tools and Techniques for Distributed Software, - Andrews.
8. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
9. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
10. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

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