



GUJARAT TECHNOLOGICAL UNIVERSITY
Syllabus for Integrated MSc, 8th Semester
Branch: Computer Science
Subject Name: Advanced Operating System
Subject Code: 1380301

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Teaching Hours	Module Weightage (%)
1	UNIT-I: Introduction Overview of modern operating systems, OS architectures: microkernel, monolithic	05	10
2	UNIT-II: Concurrency and Synchronization Multithreading, concurrency models, Synchronization: semaphores, mutexes, Deadlock detection and prevention	09	20
3	UNIT-III: Distributed Systems Principles of distributed computing, Distributed file systems (NFS, HDFS), Fault tolerance and consistency models	09	20
4	UNIT-IV: Virtualization and Containers Virtual machines, hypervisors, Docker and Kubernetes	06	15
5	UNIT-V: Memory Management Techniques Virtual memory, paging, segmentation, Memory allocation strategies	06	15
6	UNIT-VI: Operating System Security Security models (ACLs, RBAC), Authentication and encryption	05	10
7	UNIT-VII: File Systems and Storage management File system architecture and design , Journaling, RAID, and caching techniques	05	10

Reference Books:

1. "Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne
2. "Modern Operating Systems" by Andrew S. Tanenbaum
3. "Distributed Systems: Concepts and Design" by George Coulouris, Jean Dollimore, and Tim Kindberg
4. "The Design and Implementation of the FreeBSD Operating System" by Marshall Kirk McKusick and George V. Neville-Neil. An in-depth case study of the FreeBSD OS, this book offers insights into practical aspects of modern operating systems.



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Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
1	Demonstrate knowledge of advanced operating system architectures and evaluate design trade-offs.	UN, EL
2	Implement and analyze concurrency and synchronization techniques for efficient process management.	AP, AN
3	Understand and apply concepts of distributed systems and communication protocols.	UN, AP
4	Learn and implement virtualization and containerization technologies in OS.	UN AP
5	Examine and optimize memory management strategies for performance.	AN, EV
6	Implement and understand security mechanisms in modern operating systems.	UN, AP
7	Design and optimize file systems for performance and reliability.	CR, EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

- Implement a simulation for process scheduling algorithms (e.g., Round Robin, Priority Scheduling) and analyze their performance.
- Develop a multithreaded application using semaphores and mutexes for synchronization to solve the producer-consumer problem.
- Implement deadlock detection and avoidance algorithms (e.g., Banker's algorithm) and simulate different scenarios.
- Develop a basic distributed file system using RPC (Remote Procedure Call) for file storage and retrieval.
- Set up and configure a virtual environment using VirtualBox/VMware and implement a container-based application using Docker.
- Create a simulation for virtual memory management, including paging and segmentation, and evaluate performance metrics.
- Implement basic security features such as user authentication and access control lists (ACLs) within a simulated OS environment.
- Develop a small file system with journaling capabilities and optimize it for performance using caching mechanisms.
- Write and load a basic kernel module in Linux, demonstrating system call handling and memory management operations.
- Analyze and benchmark the performance of a distributed system setup, measuring latency and throughput using different consistency models.