Course Code	Course name	L	T	P	C
	Operating Systems	3	0	0	3
Total Units to be Covered: 6	**Total Contact Hours: 45**				
Prerequisite(s):	Computer Organization and Architecture.	**Syllabus version: 1.0**			

Course Objectives

To equip students with a deep understanding of operating system design and implementation, enabling them to analyze, evaluate, and apply concepts such as process management, concurrency, memory management, and storage in real-world scenarios.

Course Outcomes

CO1: Demonstrate a comprehensive understanding of operating systems.

CO2: Evaluate and analyze process and thread scheduling techniques, discerning their benefits and challenges.

CO3: Demonstrate an understanding of inter-process communication (IPC) mechanisms, process synchronization and deadlocks.

CO4: Evaluate and analyze memory and storage management techniques.

CO-PO Mapping

Program Outcomes / Course Outcomes	PO 1	PO2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1		1					2	3		
CO 2	1	2	1	3	3		1					2	3		
CO 3	2	2	1	2	3		1					2	3		
CO 4	2	2	1	2	2		1					2	3		
Average	1.5	1.75	1	2	2.25		1					2	3		

1 – Weakly Mapped (Low) **2 – Moderately Mapped (Medium)**

3 – Strongly Mapped (High) **"_" means there is no correlation**

Syllabus

Unit I: Introduction to Operating System **6 Lecture Hours**

Computer Hardware Review; Computer System; Introduction to Operating System: Definition, Operating System view, History, Types of Operating Functions of Operating System, Services of Operating System, Computing Environments, Virtualization and Containerization, Operating System Structures, Operating System Operations, System boot. System Calls, Types of System Calls (Windows and Unix System Calls examples), Open Source Operating Systems

Unit II: Process and Thread Management **8 Lecture Hours**

Process: Program and Process concept, Process in memory, Process Control Block, Process States, Process Context Switching, Process Scheduling Queues, Process Schedulers, Process Context Switching, Process Scheduling Criteria, Process Scheduling: Non preemptive and Preemptive Schedulers, FCFS, Shortest Job First, Shortest Remaining Time First, Non Preemptive Priority scheduling and Preemptive Scheduling, Priority Round Robin, Multilevel Queue, Multiple Feedback Queue, Real Time scheduling : Rate Monotonic, Earliest Deadline First; Operations on processes: Creation and Termination

Threads: Threads and its benefits, Multi-threading models, Kernel Level thread, user level thread and hybrid threads, Thread Scheduling: Content Scope, Pthread Scheduling, Threading Issues

Case study: Process Management in Linux

Unit III: Inter Process Communication and Synchronization **9 Lecture Hours**

Inter Process Communication (IPC), IPC mechanisms: Shared Memory and Message Passing (Shared Memory, Pipes and Named pipes in Linux), Critical Section Problem, Race Condition, Producer Consumer Problem, Solution to Critical section Problem:

Hardware and Software Solutions, Software Solutions: Semaphores: Counting semaphore, Binary semaphore, Monitors, Algorithm 1, Algorithm 2, Algorithm 3/Peterson Solution, Bakery Algorithm, Classic process synchronization problems (case studies).

Unit IV: Deadlock Handling **6 Lecture Hours**

Deadlock, Deadlock characterization: Necessary Conditions for Deadlock, Resource Allocation Graph; Methods for Handling Deadlocks: Deadlock Prevention, Deadlock Avoidance: Safe State, Resource Allocation Graph Algorithm, Bankers Algorithm; Deadlock Detection; Recovery from deadlock: process Termination and Resource Preemption

Unit V: Memory Management **9 Lecture Hours**

Memory protection, Address binding, Logical versus Physical Address Space, Dynamic Loading, Dynamic Linking, Swapping, Memory Management Strategies: Contiguous and Non-Contiguous; Contiguous memory management: static and dynamic: First Fit, Best Fit, Worst Fit, Buddy System, Internal Fragmentation, External Fragmentation, Compaction, Non Contiguous memory management: Paging, Paging Hardware Support, Structure of Page Table: Hierarchical paging, Hashed page tables and Inverted page tables, Virtual memory, Demand Paging, Page Fault, handling of Page Fault, Page Replacement, Page Replacement Algorithms, Belady's anamoly, Allocation of frames, Thrashing, Segmentation: concept, Segmentation hardware, Segmentation with Paging

Case Study: Memory Management in Linux

Unit VI: Storage Management **7 Lecture Hours**

File concepts, File system structure, File attributes, File operations, File types, File access method, File system mounting, Directory, Different logical structure of directories, Disk structure, Disk allocation methods: contiguous, linked and indexed, Free space management, Disk scheduling algorithms.

Case Studies: File System in Linux and Windows

Total lecture Hours 45

Textbooks

1. Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley & Sons, 2018.

2. Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson, 2021.

3. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Pearson, 2021.

Reference Books

1. Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", 1st Edition, CreateSpace Independent Publishing Platform, 2018.

2. J. Archer Harris, "Schaum's Outline of Operating Systems", 1st Edition, McGraw-Hill Education, 2002.

3. Garry J Nutt, "Operating System – A modern perspective", 2nd Edition, Addison Wesley, 2002.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme

Components	IA	MID SEM	End Sem	Total
Weightage (%)	50	20	30	100

Detailed breakup of Internal Assessment

Internal Assessment Component	Weightage in calculation of Internal Assessment (100 marks)
Quiz 1	15%
Quiz 2	15%
Class Test 1	15%
Class Test 2	15%
Assignment 1/Project	20%
Assignment 2/Project	20%