

### CSA4102 Operating Systems

Credits: 4C

Learning Outcomes	Suggested Pedagogical Processes
Understand basic functions and concepts of Operating system.	Discuss various concepts and operations of Operating System using PowerPoint presentation.
Able to learn Architecture of Operating System, process management and memory management.	Explain the architecture of Operating system by drawing a figure on the Blackboard. Explain about concepts, algorithms related to process management and memory management with examples on the Blackboard.
Gain knowledge of process synchronization, CPU scheduling and deadlock.	Explain various concepts and algorithms related to process synchronization, CPU scheduling and deadlock with examples on the Blackboard.
Get familiarity with the concept of I/O and File management.	Explain various concepts and operations of I/O and File management with examples on the Blackboard.
Able to get familiarity with various Memory management techniques and related algorithms.	Explain various concepts and algorithms related to Memory management techniques.

Unit No.	Title of Unit and Contents
I	<b>Introduction to Operating System</b> 1.1 Definition of operating system 1.2 Services provided by OS 1.3 System Calls: definition, implementation
II	<b>Process Management</b> 2.1 Introduction and definition of process 2.2 Process state transition 2.3 Process Control Block 2.4 Process scheduling 2.5 Scheduling queues 2.6 Types of schedulers: Long Term Schedulers, Middle Term Schedulers, Short Term Schedulers, IO Scheduler 2.7 Context Switch
III	<b>CPU Scheduling</b> 3.1 Introduction 3.2 Scheduling Concepts: CPU- I/O Burst Cycle, CPU Scheduler, Pre-emptive and Non-Pre-emptive scheduling, Dispatcher 3.3 Scheduling criteria(terminologies used in scheduling): CPU Utilization, Throughput, Turnaround time, Waiting time, Response time 3.4 Scheduling Algorithms: FCFS,SJF (Preemptive & Nonpreemptive), Priority Scheduling (Preemptive & Nonpreemptive), Round Robin Scheduling 3.5 Multilevel Queues, Multilevel Feedback queues
IV	<b>Process Synchronization</b> 4.1 Introduction 4.2 Critical section problem

	4.3 Semaphores: Concept, Implementation, Deadlock & Starvation 4.4 Classic Problems of synchronization: Bounded buffer problem, Readers & writers problem, Dining Philosophers problem 4.5 Monitors
V	<b>Deadlocks</b> 5.1 Introduction 5.2 Deadlock characterization: Necessary Conditions, Resource-Allocation Graph 5.3 Methods for handling deadlocks: Deadlock Avoidance 5.4 Deadlock Prevention: Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait 5.5 Deadlock Avoidance: Safe state, Resource Allocation Graph Algorithm, Banker's Algorithm 5.6 Deadlock Detection 5.7 Recovery from Deadlock
VI	<b>Memory Management</b> 6.1 Introduction to memory management 6.2 Problems with memory management 6.3 Logical vs. physical addresses 6.4 Dynamic vs. Static linking 6.5 Swapping 6.6 Paging 6.7 Structure of Page Table 6.8 Segmentation 6.9 Virtual memory 6.10 Demand paging 6.11 Page Replacement: Page replacement Algorithms: FIFO, MRU, LRU, MFU, LFU, Second Chance algorithm, Optimal replacement
VII	<b>File System</b> 7.1 Introduction 7.2 File concepts : File attributes, File operations, File types, File structure 7.3 Access Methods: Sequential Access, Direct Access, Other Access Methods 7.4 Directory and Disk Structure 7.5 File Protection 7.6 Allocation methods: Contiguous allocation, Linked Allocation, Indexed Allocation 7.7 Free space management: Bit map or Bit vector, Linked list, Grouping, Counting
VIII	<b>Device Management &amp; I/O System</b> 8.1 Introduction 8.2 I/O Hardware: Polling, Interrupt (Maskable and Non-maskable) 8.3 Kernel I/O Subsystem: I/O Scheduling, Buffering, Caching, Spooling and device Reservation, Error Handling, Kernel Data Structures 8.4 Disk Scheduling: First Come First Served (FCFS), Shortest Seek Time First (SSTF), Scan, C-Scan, LOOK, C-LOOK

### **Learning Resources**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating Systems, – Willey Publication (8th Edition), 2009
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating Systems, – Willey Publication (9th Edition), 2015
3. Pabitra Pal Choudhary, Operating Systems : Principles and Design – (PHI Learning Pvt. Ltd), Paperback, 2009
4. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall (7<sup>th</sup> Edition), 2017