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| 23CS3401/ 23IT3401 |  **PVP23** |
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| **OPERATING SYSTEMS****(Micro Syllabus)** |
| **Offering Branches:** | CSE/IT |  |  |
| **Course Category:** | Program Core | **Credits:** | 3 |
| **Course Type** | Theory | **Lecture-Tutorial- Practical:** | 3-0-0 |
| **Prerequisites:** | Data structures | **Continuous Evaluation:** | 30 |
| **Semester End Evaluation:** | 70 |
| **Total Marks:** | 100 |
| **Course Outcomes** |
| Upon successful completion of the course, the student will be able to: |
| **CO1** | Understand the structure and functionalities of operating systems | **L2** |
| **CO2** | Apply different algorithms of CPU scheduling, Page replacement and disk scheduling. | **L3** |
| **CO3** | Apply various concepts to solve problems related to process synchronization and deadlocks. | **L3** |
| **CO4** | Analyze and interpret the functionalities of operating system. | **L4** |
| **Course Content** |
| **UNIT-1** | **Operating Systems Overview:** Introduction: What Operating Systems Do - User View, System View, Defining Operating Systems. Operating system functions – Process Management, Memory Management, Storage Management, Protection and Security. Operating systems operations – Dual Mode and Multi Mode Operations, Timer.Computing environments, Free and Open-Source Operating Systems.**System Structures:** Operating System Services, User and Operating System Interface - Command Interpreters, Graphical User Interfaces, Choice of Interface. System calls, Types of System Calls - Process Control, File Management, Device Management, Information Maintenance, Communication, Protection. System programs, Operating system Design and Implementation. | **CO1** |
| **UNIT-2** | **Process:** Process Concept - The Process, Process State, Process Control Block, Threads. Process Scheduling - Scheduling Queues, Schedulers, Context Switch.Operations on Processes - Process Creation, Process Termination.Inter-process Communication - Shared Memory Systems, Message Passing Systems.**Threads and Concurrency:** Overview - Motivation, Benefits.Multithreading Models - Many-to-One Model, One-to-One Model, Many-to-Many Model.Thread libraries – Pthreads, Window Threads, Java Threads.Threading issues - fork() and exec() system calls, Signal Handling, Thread cancellation.**CPU Scheduling:** Basic Concepts - CPU –I/O Burst Cycle, CPU Scheduler, Preemptive Scheduling, Dispatcher. Scheduling Criteria, Scheduling Algorithms - First-Come, First-Served Scheduling, Shortest-Job-First Scheduling, Priority Scheduling, Round-Robin Scheduling. Multiple processor scheduling |  **CO1, CO2, CO4** |
| **UNIT-3** | **Synchronization Tools:** The Critical-Section Problem, Peterson’s Solution, Mutex Locks, Semaphores - Semaphore Usage, Semaphore Implementation, Deadlocks and Starvation.Classic Problems of Synchronization - The Bounded-Buffer Problem, The Readers–Writers Problem, The Dining-Philosophers Problem.Monitors **–** Monitor Usage, Dining-Philosophers Solution using Monitors.**Deadlocks:** System Model, Deadlock Characterization - Necessary Conditions, Resource-Allocation Graph. Methods for Handling Deadlocks, Deadlock Prevention - Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait.Deadlock Avoidance - Safe State, Resource-Allocation-Graph Algorithm, Banker’s Algorithm, Safety Algorithm, Resource-Request Algorithm.Deadlock Detection - Single Instance of Each Resource Type, Several Instances of a Resource Type, Detection-Algorithm Usage.Recovery from Deadlock - Process Termination, Resource Preemption. | **CO1, CO3, CO4** |
| **UNIT-4** | **Memory-Management Strategies:** Introduction - Basic Hardware, Address Binding, Logical Versus Physical Address Space, Dynamic Loading, Dynamic Linking and Shared Libraries.Swapping - Standard Swapping, Swapping on Mobile Systems.Contiguous memory allocation - Memory Protection, Memory Allocation, Fragmentation.Paging - Basic Method, Hardware Support, Protection, Shared Pages.Structure of the Page Table - Hierarchical Paging, Hashed Page Tables, Inverted Page Tables.**Virtual Memory Management:** Introduction, Demand paging - Basic Concepts, Performance of Demand Paging, Copy-on-write.Page replacement - Basic Page Replacement, FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement.Allocation of frames – Allocation Algorithms, Global versus Local Allocation, Thrashing – Causes of Thrashing, Working-Set Model, Page Fault Frequency.**Storage Management:** Overview of Mass Storage Structure - Magnetic Disks, Solid-State Disks, Magnetic Tapes.HDD Scheduling - Disk Scheduling - FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN Scheduling, LOOK Scheduling, Selection of a Disk-Scheduling Algorithm. | **CO1, CO2, CO4** |
| **UNIT-5** | **File System:** File System Interface: File concept - File Attributes, File Operations, File Types, File Structure, Internal File Structure.Access methods - Sequential Access, Direct Access, Other Access Methods.Directory Structure - Storage Structure, Directory Overview, Single-Level Directory, Two-Level Directory, Tree-Structured Directories, Acyclic-Graph Directories, General Graph Directory.**File system Implementation:** Overview, Partitions and Mounting. File-system structure, File-system Operations.Directory implementation - Linear List, Hash Table.Allocation method - Contiguous Allocation, Linked Allocation, Indexed Allocation, Performance.Free space management – Bit Vector, Linked List. **File System Internals:** File-System Mounting, Partitions and Mounting, File Sharing. **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix. | **CO1, CO4** |
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| **Learning Resources** |
| **Text book:** |
| 1 | Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018. |
| 2 | Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016. |
| **References:** |
| 1 | Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018. |
| 2 | Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013. |
| **e-Resources and other Digital Material:** |
| 1 | <https://archive.nptel.ac.in/courses/106/102/106102132/> |
| 2 | <http://peterindia.net/OperatingSystems.html> |

**Course Coordinator HOD**