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|  | **Operating Systems** |  |
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| **Offering Branches:** | CSE, IT | **Course code:** | **20CS3401** |
| **Course Category:** | Program Core | **Credits:** | 3 |
| **Course Type** | Theory | **Lecture-Tutorial- Practical:** | 3-0-0 |
| **Prerequisites:** | Data structures, Computer Organization and Architecture | **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, deadlocks. | **L3** |
| **CO4** | Analyze and interpret the functionalities of operating system | **L4** |
| **Course Contents** |
| **UNIT-1** | **Overview:Introduction**: What Operating Systems Do - User View, System View, Defining Operating SystemsComputer-System Organization - Computer-System Operation,Storage Structure,I/O Structure, Computer-System Architecture - Single-Processor Systems,Multiprocessor Systems,Clustered Systems ,Operating-System Structure , Operating-System Operations - Dual-Mode and Multimode Operation,Timer. **Operating System Structures:**Operating-System Services, User and Operating System Interface - Command Interpreters, Graphical User Interfaces, Choice of InterfaceSystem Calls, Types of System Calls - Process Control, File Management, Device Management, Information Maintenance, Communication,Protection. | **CO1,CO2,CO3** |
| **UNIT-2** | **Process Management:** Process Concept - The Process, Process State, Process Control Block, ThreadsProcessScheduling - Scheduling Queues,Schedulers,Context Switch, Operations on Processes - Process Creation, Process Termination, Interprocess Communication - Shared-Memory Systems, Message-Passing Systems - Naming, Synchronization, Buffering. **Threads:**Overview- Motivation, Benefits, Multicore Programming - Programming Challenges, Types of Parallelism, Multithreading Models - Many-to-One Model, One-to-One Model, Many-to-Many Model.**Process 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. | **CO1,CO2,CO4** |
| **UNIT-3** | **ProcessSynchronization:**Background, The Critical-Section Problem, Peterson’s Solution, Synchronization Hardware,Mutex Locks, Semaphores - Semaphore Usage, Semaphore Implementation, Deadlocks and Starvation, Priority Inversion, Classic Problems of Synchronization - The Bounded-Buffer Problem, The Readers–Writers Problem, The Dining-Philosophers Problem, Monitors - Monitor Usage, Dining-Philosophers Solution Using Monitors, Implementing a Monitor Using Semaphores, Resuming Processes within a Monitor.**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, An Illustrative Example, 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:****Main Memory:**Background - 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 –MemoryProtection,Memory Allocation,Fragmentation,Segmentation - Basic Method,Segmentation Hardware, Paging - Basic Method, Hardware Support,Protection, Shared Pages,Structure of the Page Table - Hierarchical Paging, Hashed Page Tables, Inverted Page Tables.**VirtualMemory:**Background, 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 - Minimum Number of Frames, Allocation Algorithms, Global versus Local Allocation, Non-Uniform Memory Access, Thrashing - Cause of Thrashing, Working-Set Model, Page-Fault Frequency. | **CO1,CO2,CO4** |
| **UNIT-5** | **Storage Management:** **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 and Disk Structure - Storage Structure, Directory Overview, Single-Level Directory, Two-Level Directory, Tree-Structured Directories, Acyclic-Graph Directories, General Graph Directory.**File–System Implementation:** File-System Structure, File-System Implementation- Overview, Partitions and Mounting, Virtual File Systems, Directory Implementation - Linear List, Hash Table, Allocation Methods - Contiguous Allocation, Linked Allocation, Indexed Allocation, Performance.**Mass-Storage Structure:** Overview of Mass-Storage Structure - Magnetic Disks, Solid-State Disks, Magnetic Tapes, Disk Structure, Disk Attachment - Host-Attached Storage, Network-Attached Storage, Storage-Area Network, Disk Scheduling - FCFS Scheduling, SSTF Scheduling, SCAN Scheduling, C-SCAN Scheduling, LOOK Scheduling, Selection of a Disk-Scheduling Algorithm. | **CO1,CO2,CO4** |
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| **Learning Resources** |
| **Text books:** |
| 1 | Operating System Concepts, Abraham Silberchatz, Peter Baer Galvin, Greg Gagne, Ninth Edition, 2016, Wiley India. |
| **References:** |
| 1 | Operating Systems - Internal and Design Principles, William Stallings, Ninth Edition, 2018, Pearson. |
| 2 | Operating Systems - Harvey M.Deitel, Paul J Deitel and David R.Choffnes , Third Edition, 2019, Pearson. |
| 3 | Operating Systems - A Concept based Approach- D.M. Dhamdhere, Second Edition, 2010, McGraw Hill. |
| **e-Resources and other Digital Material:** |
| 1 | https://onlinecourses.nptel.ac.in/noc19\_cs50/ |
| 2 | <http://www.youtube.com/watch?v=MaA0vFKtew&list=PL88oxI15Wi4Kw1aEY2bC5l_4pouojjtd4> |
| 3 | [http://www.jntuk-coeerd.in](http://www.jntuk-coeerd.in/) |
| 4 | [http://iit.qau.edu.pk/books/OS\_Eighth Edition.pdf](http://iit.qau.edu.pk/books/OS_Eighth%20Edition.pdf) |