Code: 9EC06
Prerequisite: Computer Organization

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Course Objective:
Learn working principles of Operating Systems.

Course Outcomes:
After completion of this course student will be able to:
1. Describe the functional architecture of an Operating System with usage of system calls.[L2]-U1
2. Analyze various process scheduling algorithms & pragmatics of scheduling algorithms used by various Operating Systems.[L4]-U2
3. Solve issues related to process synchronization and Interprocess Communication (IPC) in the Operating System.[L3]-U3
4. Illustrate the concepts of Memory Management and deadlock.[L3]-U4
5. Discuss the concepts of File System with regard to Directory and Disk Management Algorithms, summarize the aspects of I/O Systems, Protection and Security.[L2]-U5,U6

UNIT I

Introduction to Operating System: Definition, Functions of Operating Systems, **Types of Operating Systems:** Batch Operating System, Multiprogramming Operating System, Multiprocessing Operating System, Multitasking Operating System, Network Operating System, Real Time Operating System, Time-Sharing Operating System and Distributed Operating System.

Computer System Architecture: Four Components of a Computer System, **Operating System Services**, **System Calls**: Definition, Types of System Calls, **Operating System Structure:** Simple Structure, Layered Approach, **Threads:** Definition**,** Need of threads, types of threads.

UNIT II

Process Management: Process concept: Definition of Process, Process State Diagram, PCB (Process Control Block), CPU Switch from process to process, Context Switching, Process Vs Thread.

Process Scheduling: Process Queues: Job Queue, Ready Queue, I/O/Device/Waiting Queue, Representation of Process Scheduling, **Types of Process Schedulers:** Long-term, Short-term and Medium-Term Scheduler.

CPU Scheduling: Preemptive Scheduling, Non-Preemptive Scheduling, Scheduling Criteria, **Scheduling Algorithms (Preemptive and Non-Preemptive with Arrival Time):** First Come First Serve (FCFS), Shortest-Job-First (SJF), Shortest Remaining Time First (SRTF), Priority Scheduling, Round Robin (RR), Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling.

UNIT III

Process Synchronization - The Critical Section Problem: Solution to Critical Section Problem (Software and Hardware), Synchronization Hardware, Classical Problems of Synchronization, Semaphores, Monitors.

Interprocess Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT IV

Deadlocks: Definition, Necessary Conditions for Deadlock, **Methods For Handling Deadlocks**: Deadlock Prevention, Avoidance (Bankers Algorithm), Detection and Deadlock recovery.

Memory Management: Logical versus Physical Address Space, Swapping, Contiguous memory allocation, Paging and Segmentation techniques, Segmentation with paging, **Virtual Memory:** Demand Paging, **Page-Replacement Algorithms**: FIFO, LRU and Optimal, Thrashing.

UNIT V

File System: Different types of files and their access methods, **Directory Structures:** Various file allocation methods - Contiguous, Linked with FAT and Indexed, **Disk Scheduling Algorithms**: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.

UNIT VI

I/O Systems: I/O Hardware: Polling, Interrupts and DMA, **Protection:** Goals of Protection, Principles of Protection, Access Matrix, Implementation of Access Matrix, Access Control List, Capability List, Program threats.

TEXT BOOKS:

1. Operating System Concepts by Silberchatz Galvin, 8th edition.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings,4th edition, 2001, Prentice-Hall

REFERENCES:

1. Operating System by Peterson, 1985, AW.
2. Operating System by Milankovic, 1990, TMH.
3. Operating System Incorporating With Unix & Windows By Colin Ritche, 1974, TMH.
4. Operating Systems by Mandrik & Donovan, TMH
5. Operating Systems by Deitel, 1990, AWL.
6. Operating Systems – Advanced Concepts By Mukesh Singhal , N.G. Shivaratri, 2003, T.M.H