

FACULTY OF COMPUTER APPLICATIONS
Master of Computer Applications

Sem. : 1
Subject Code : 05MC1104
Subject : Operating Systems

Course Objectives:

1. To Understand the overall structure, components, and functions of an OS.
2. To Analyse process management, CPU scheduling, and inter-process communication.
3. To Examine process synchronization mechanisms and deadlock handling strategies.
4. To Understand main memory management techniques and virtual memory
5. To Learn file systems, disk scheduling, I/O management, and OS security.

Prerequisites: Basic knowledge of computers.

Unit No	Topics Covered	No. of Lectures Required
1	Introduction to Operating Systems: Definition and Objectives of Operating System, Evolution and Types of OS, Operating System Structures, System Calls and System Programs, OS Services and Components, User Mode and Kernel Mode, Virtual Machines	5
2	Process Management: Process Concept and Process States, Process Control Block (PCB), Process Scheduling, Scheduling Criteria and Algorithms (FCFS, SJF, Round Robin, SRT, HRRN), Inter-Process Communication (IPC), Threads and Multithreading, Process Vs. Threads	10
3	Process Synchronization & Deadlocks: Key terms related to concurrency, Critical Section Problem, Synchronization Tools (Mutex Locks, Semaphores, Monitors), Classical Synchronization Problems (Producer-Consumer, Dining Philosophers, Readers-Writers) Deadlocks: Deadlock Characterization, Deadlock Prevention, Deadlock Avoidance (Banker's Algorithm), Deadlock Detection and Recovery	12

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4	Memory Management & Virtual Memory: Memory Management Concepts, Contiguous and Non-Contiguous Allocation, Paging and Segmentation Virtual Memory: Demand Paging, Hardware and control structures, Address translation in Paging, Address translation in segmentation, Page Replacement Algorithms (FIFO, LRU, Optimal), Thrashing	8
5	File Management, Input/Output & Security File Concept and File Attributes, File System Structure, Directory Structure, File Allocation Methods, Secondary Storage Management Input/Output I/O Hardware and I/O Techniques, Disk Scheduling (RAID, FCFS, SSTF, SCAN, C-SCAN) Security Protection and Security in OS, Authentication Mechanisms, Access Control Models, Security Attacks, Trusted OS & Security Kernels	10

Course Outcomes: (Student will be able to..)

- CO1: Demonstrate understanding of OS structure, components, and design
CO2: Analyze and compare CPU scheduling algorithms and their performance impact.
CO3: Apply synchronization mechanisms and solve concurrency/deadlock problems.
CO4: Apply memory partitioning solutions and virtual memory techniques.
CO5: Evaluate file systems, disk scheduling, I/O management, and security mechanisms

Text Book :

1. "Operating Systems: Internals and Design Principles", William Stallings, Prentice Hall India, 7th Edition
2. "Operating System Concepts", Silberschatz A., Peter B. Galvin and Greg Gagne, Wiley-India, 8th Edition

Reference Books :

1. "Modern Operating Systems", Tanenbaum A.S., PHI, 4th Edition
2. "Operating Systems – A Concept Based Approach", Dhamdhare, McGraw-Hill
3. "Understanding Operating Systems", Flynn I.M., Cengage India Publication
4. "The Design of UNIX Operating System", Bach M.J., Prentice Hall India, 1993
5. "Unix Shell Programming", Yashvant Kanetkar, BPB Publications, 1st Edition
6. "Unix Concepts and Applications", Sumitabha Das, McGraw-Hill Publications, 4th Edition

Web References :

1. <https://www.javatpoint.com/os-tutorial>
2. <https://www.geeksforgeeks.org/operating-systems/>

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App References :

1. Operating System Tutorials
2. AnLinux : Run Linux on Android
3. Linux Tutorial

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Syllabus Coverage from Text / Reference Book & Web/App Reference:

Unit #	Topics	Text Book 1: Stallings Operating Systems (7th Ed.)
1	Introduction to OS Definition, Objectives, Types, OS Structure, System Calls, OS Services, User/Kernel Mode, Virtual Machines	Ch.1: 1.1, 1.2 Ch.2: 2.1, 2.2, 2.3, 2.4 Ch.3: 3.1, 3.2
2	Process Management Process Concept, States, PCB, Scheduling Algorithms (FCFS, SJF, Priority, RR), IPC, Threads, Multithreading	Ch.3: 3.1, 3.2, 3.3, 3.4 Ch.4: 4.1, 4.2 Ch.9: 9.1, 9.2
3	Process Synchronization & Deadlocks Critical Section, Mutex, Semaphores, Monitors, Producer-Consumer, Dining Philosophers, Readers-Writers, Deadlock Prevention / Avoidance (Banker's) / Detection / Recovery	Ch.5: 5.1, 5.3, 5.6 Ch.6: 6.1, 6.2, 6.3, 6.4, 6.6
4	Memory Management & Virtual Memory Contiguous/Non-Contiguous Allocation, Paging, Segmentation, Virtual Memory, Demand Paging, Page Replacement (FIFO, LRU, Optimal), Thrashing	Ch.7: 7.1, 7.2, 7.3, 7.4 Ch.8: 8.1, 8.2, 8.3
5	File Management, Disk Scheduling, I/O & Security File Concept, File System Structure, Directories, Allocation Methods, Free Space; Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN); I/O Hardware & Techniques; OS Protection & Security	Ch.11: 11.1, 11.2, 11.4, 11.5, 11.6 Ch.12: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6 Ch.14: 14.1, 14.2, 14.3

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PRACTICALS

Sr. No.	List of Practical
UNIT - 1	
1	Introduction to Linux environment: Check the output of basic commands: date, ls, who, cal, ps, wc, cat, uname, pwd, mkdir, rmdir, cd, cp, rm, mv, chmod
2	Check the output of following filter commands: diff, grep, sed, head, tail, cut, paste, sort, find
3	Write shell script to accept numbers and perform addition, subtraction, multiplication and division
4	Write shell script to accept the string and check whether the string is palindrome or not
5	Write shell script to accept the number, check whether it is odd or even, find length of the number and sum of its digits
6	Write shell script to accept the string and replace it by another string
7	Accept the filename and display the last modification time if file exists, otherwise display appropriate message
8	Fetch the data from file and display data into another file in reverse order
9	Write a script to delete zero sized files from a given directory (and all its sub-directories)
10	Write a shell script to print all the prime numbers from 1 to 300 (Use nested loops, break and continue)
UNIT - 2	
11	Write a script that lists files by modification time when called with 1m and by access time when called with 1a. By default the script should show the listing of all files in current directory
12	Write a script that behaves both in interactive and noninteractive mode. When no arguments are supplied, it picks up each C program and lists first 10 lines, then prompts for deletion
13	Display the processes in the system every 30 seconds five times using (i) while loop, (ii) for loop
14	Write a script which looks up every .c file in current directory for the strings printf or fprintf. If found, the script adds #include <stdio.h> at the beginning of the file
15	Write a script that uses find to look for a file and echo a suitable message if the file is not found

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16	Write a script for generating a mark sheet after reading data from a file (student roll no, name, marks of three subjects)
17	Write a shell script to accept distance between two cities (in km) and convert it to meters, feet, inches and centimeters
18	Write a script to display all words of a file in ascending order and to display the last modified file
19	Ramesh's basic salary is input through keyboard. DA is 40% and HRA is 20% of basic salary. Write a script to calculate gross salary
20	The length, breadth of a rectangle and radius of a circle are input through keyboard. Write a shell script to calculate area of rectangle and circumference of the circle
UNIT - 3	
21	Write a script to make following file and directory management operations menu-based: Display current directory, List directory, Make directory, Change directory, Copy/Rename/Delete/Edit a file
22	Write a script which reads a text file and outputs: Count of characters, words and lines; File in reverse; Frequency of a particular word; Lowercase in place of uppercase
23	Write a shell script to check whether the named user is currently logged in or not
24	Implementation of Producer-Consumer Problem using Semaphores
25	Write shell script for simple library management system. Database fields: Accno, Title, Author, Edition, Publisher. Operations: View/Add/Delete/Count records
26	Accept filename and display the permission of that file if it exists, otherwise print appropriate message
27	Write a script to display the date, time and a welcome message (Good Morning/Afternoon/Evening) using 24-hour notation
28	Write a script to display the name of those files in a given directory which are having multiple links
29	Write a script to display the name of all executable files in the given directory
30	Write a script to display the last modified file
UNIT - 4	
31	Write a Shell Script to take user data as command line argument and display a greetings message

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32	Write a script that deletes all leading and trailing spaces in all lines in a file. Also remove blank lines from the file
33	Write Menu driven program for: Display all words of file in ascending order, Remove all spaces from file, Display zero size files, Perform Find and Replace operation
34	Write a Script for Simple Database Management System (EMP_NO, EMP_NAME, EMP_ADDRESS, EMP_AGE, EMP_GENDER, EMP_DESIGNATION, EMP_BASIC_SALARY). Menu: View/Add/Delete/Modify Record, Count Records, Exit
35	Write a shell script to receive filename or full path and display its ls -l information in proper format
36	Write a shell script to determine whether a year (input from keyboard) is a leap year or not. If no argument is supplied, use current year
37	Banker's Algorithm simulation for Deadlock Avoidance
38	Write a script to determine profit or loss given cost price and selling price. Display amount of profit/loss
39	Write a shell script which deletes all lines containing the word unix in the files supplied as arguments
40	Write a shell script to display a list of all files in the current directory for which you have read, write and execute permissions