19CSE213 Operating Systems 3-0-3-4

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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AMRITA SCHOOL OF ENGINEERING

COURSE STRUCTURE

Academic Year: 2020-2021 **Semester : 4**

Programme: II Year B.Tech CSE **Course code: 19CSE213**

1. COURSE OVERVIEW

The course aims at teaching students understand the structure and implementation of modern operating systems,virtual machines and their applications.It summarizes techniques for achieving process synchronization and managing resources like memory, CPU, and files and directories in an operation system.It compares and contrasts the common algorithms used for both pre-emptive and non-pre-emptive scheduling of tasks in operating systems (such a priority, performance comparison, and fair-share schemes).It gives a broad overview of memory hierarchy and the schemes used by the operating systems to manage storage requirements efficiently.

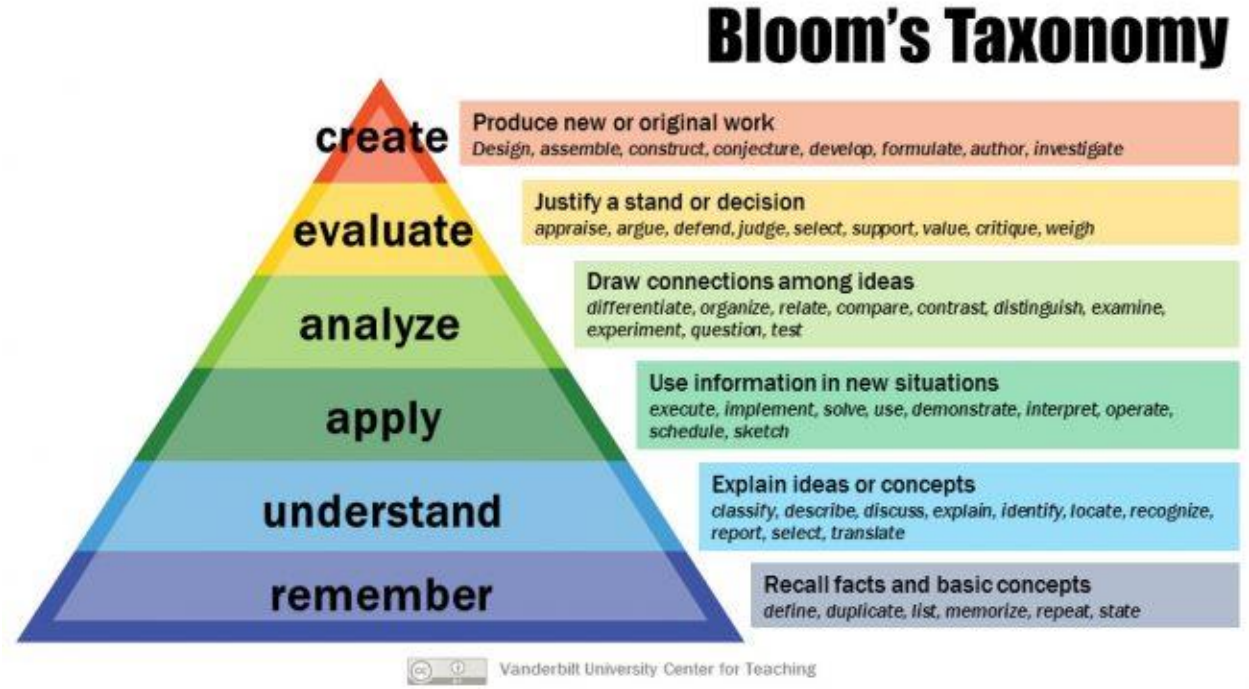
2. COURSE OBJECTIVES

- This course aims at introducing the structure and implementation of modern operating systems, virtual machines and their applications.
- It summarizes techniques for achieving process synchronization and managing resources like memory, CPU, and files and directories in an operation system.
- A study of common algorithms used for both pre-emptive and non-pre-emptive scheduling of tasks in operating systems (such a priority, performance comparison, and fair-share schemes) will be done.
- It gives a broad overview of memory hierarchy and the schemes used by the operating systems to manage storage requirements efficiently.

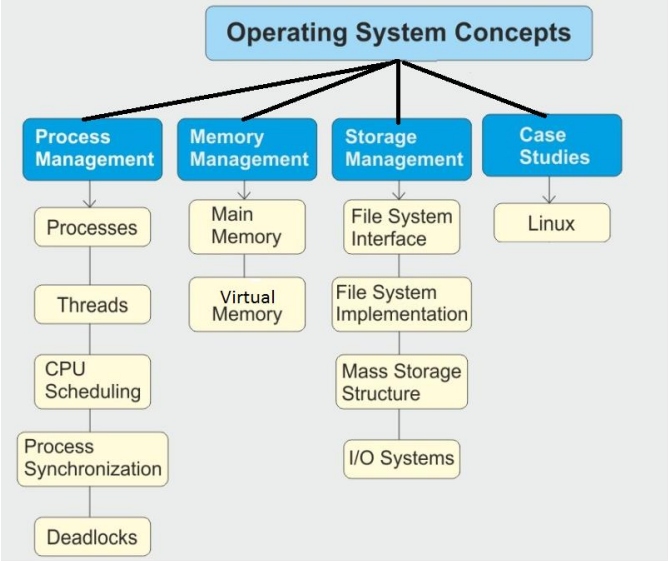
3. COURSE OUTCOMES

	Course Outcome	**Bloom's Taxonomy Level**
CO 1	Understand the architecture and functionalities of modern	L2 Understand

	OS and virtual machines	
CO 2	Understand and apply the algorithms for resource management and scheduling	L3 Apply
CO 3	Analyze and Apply semaphores and monitors for classical and real world synchronization scenarios	L4 Analyze
CO 4	Engage in independent learning as a team to study characteristic features of modern operating systems	L4 Analyze



4. CONCEPT MAP



SYLLABUS

Unit 1

Operating systems Services: Overview – hardware protection – operating systems services – system calls – system structure – virtual machines. Process and Processor management: Process concepts – process scheduling – operations on process – cooperating process – inter-process communication – multi threading models – threading issues – thread types – CPU scheduling – scheduling algorithms.

Unit 2

Process synchronization: critical section problem – synchronization hardware – semaphores – classical problems of synchronization – critical regions – monitors – deadlocks – deadlock characterization – methods of handling deadlocks – deadlock prevention – avoidance – detection and recovery. Memory management – swapping – contiguous memory allocation. Paging and segmentation – segmentation with paging – virtual memory – demand paging – process creation – page replacement – thrashing.

Unit 3

File management: File systems: directory structure – directory implementation – disk scheduling. Case study: threading concepts in operating systems, kernel structures.

Text Book(s)

Silberschatz A, Gagne G, Galvin PB. Operating system concepts. Tenth Edition, John Wiley and Sons; 2018.

Reference Book(s)

Deitel HM, Deitel PJ, Choffnes DR. Operating systems. Third Edition, Prentice Hall; 2004.

Tannenbaum AS. Modern Operating Systems. Fourth Edition, Prentice Hall; 2016.

Stevens WR, Rago SA. Advanced programming in the UNIX environment. Second Edition, Addison-Wesley; 2008.

Nutt G. Operating systems. Third Edition, Addison Wesley; 2009.

COURSE PLAN WITH MODULE WISE OBJECTIVES

Lecture Hours	Topics	Keywords	Objectives	Remarks
UNIT I: Introduction to OS, Process Management – Multithreading, CPU Scheduling				
01-03	Introduction to operating system. Types of systems	Introduction, Goal, Mainframe system, Multiprocessing, Real time system, Desktop system, distributed system, Cluster system, Handheld system	Introduction to Operating Systems Understand the different types of operating systems	
Lab	Basic Linux Commands	File System and Management, Directories,File Permission Setup, Pipes and Filters, Process Management	Give the student an overview of Linux Commands to manage a typical Linux System	
04-06	Computer system structures, hardware protection	Computer system operation, dual mode operation, IO protection, memory protection, CPU protection	Understand the operations of Operating systems Overview of the protection and security of OS	
Lab	Shell Scripts	Variables and Special Variables, Arrays, Operators, Decision Making, loops and loop control, I/O Redirections, Functions	Students are exposed with shell environment and to implement programs in shell	

07-12	Operating system structures	OS services, system calls, system structures, virtual machines	Understand and study the operating system structures. Study of system calls and implementation of system calls Introduction to Virtual Machines	
Lab	File and Directory Related System Calls Process and Thread Creation	Creat, Open, Close, Read, Write, Dup, Readdir, Opendir, Closedir Fork, Fork and Wait, Fork and Exec/Execv/Execl, pthreadcreate, join	Simulating Linux commands using system calls Creation and execution of parent and child process in different order. Understanding working with threads	
13-17	Process management	Process concepts, Process scheduling, Operation on processors, Inter process communication, cooperating process	Introduction to the concept of processes, operations on processes. Overview of Interprocess Communication and how to implement it.	
Lab	Inter-Process Communications	Pipes, Shared Memory, Buffer, Message Queues	Implement IPC using system call for a given application	
18-22	Threads	Overview, Multithreaded models, threading issues, types	Overview of Threads, types and different threading issues.	
PERIODICAL TEST-1				
23-28	CPU scheduling	Concepts, scheduling algorithms-FCFS, SJF, priority, RR, Multilevel queue, Multilevel feedback	Introduction to CPU scheduling concepts Understand various CPU scheduling algorithms and	

		queue	solve problems and compare the performance of various scheduling algorithms	
Lab	Scheduling algorithms	FCFS, SJF : both preemptive and non-preemptive, Priority : both preemptive and non-preemptive, Round –Robin : both preemptive and non-preemptive	Implementation of CPU Scheduling Algorithms	
29- 36	Process synchronization	Critical section problem, Synchronization hardware, Semaphore, classical problems, critical regions, monitors	Understand the concurrency concepts, critical-section problem and various solutions for CS problem. Solve classical and real-world synchronization scenarios using semaphores and monitor concepts	
Lab	Process Synchronization	Readers-Writers, Dining Philosopher and Bounded BufferProblems	Design algorithms for real world synchronization scenarios	
PERIODICAL TEST-2				
37-44	Deadlocks	Characterization, handling deadlocks, prevention, avoidance, detection, Recovery	Overview of deadlock concepts and ways for handling deadlocks Understand and apply Banker's algorithm for handling deadlocks	
Lab	Deadlock Handling	Deadlock Detection, Deadlock Avoidance Algorithm	Implement Deadlock Detection and Avoidance Algorithm	
UNIT III: Memory Management, Virtual Memory Management and File Systems				

45-50	Storage management-Memory management	Swapping ,continuous memory allocation, paging, segmentation, segmentation with paging	Introduction to memory management concepts Working of paging and segmentation concepts	
Lab	Memory Management	Firstfit,Bestfit and Worst fit	Implement Static and Dynamic allocation schemes	
51-56	Virtual memory	Demand paging, process creation, page replacement, thrashing	Study of Demand paging and various page replacement algorithms for virtual memory management	
Lab	Page replacement policies	FIFO, Optimal, LRU	Implement Page Replacement Algorithms	
57-60	File systems	Directory structure, implementation, disk scheduling	Study of various I/O structure and how to implement it.	
	CASE STUDY (Group Activity)	Mobile OS(Android &IoS), Minix, Linux, Nach OS	Technical Document (Not less than 10 pages) PPT (Max 15 Slides) Oral Presentation + Viva voce Students could show demonstrations on the chosen OS (Command Execution, IPC, Process Sync mechanisms etc..)	
END SEMESTER EXAMINATIONS				

Evaluation Pattern:

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	

*Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports.

Evaluation Rubrics

1. Question,
2. Design(Pseudocode/Algorithm)
3. System call Syntax
4. Output

Rubric s

1.Design or Logic - 5
2.Implementation - 10
3.Results and Interpretation -5
4.Quiz/Viva – 5 Marks

Rubric – 1

1. Completion (30%) – 2 Marks
2. Completion (50%) - 3 Marks
3. Completion (75%) – 4 Marks
4. Completion (100%)– 5 Marks

Rubric – 2

1. Completion (30%) – Code (With Errors, Correct Logic) –3 Marks
2.Completion (50%) – Code (With Errors, Correct Logic) - 5 Marks
3.Completion (75%) – Code (Without Errors, Correct Logic, But missing scenarios) - 7 Marks
4. Completion (100%) – Code (Without Errors, Correct Logic covering all the test scenarios) - 10 Marks

Rubric – 3

1.Completion (30%) – No Result because of syntax errors - 1 Mark
2.Completion (50%) - Main code compilation done without errors- 2 Marks

3. Completion (75%) – Compilation done, Missing test scenarios – 3 to 4 Marks depending on testcases handled
4. Completion (100%) – All perfect and covered all test scenarios - 5 Marks

Rubric – 4

Minimum 2 viva questions 2.5 marks each

Case Study Assessment:

1. Max size of the group : 4 Members
2. All reports are to be handwritten in A4 sheets. A final bound copy of the consolidated report need to be submitted at the end of term III.
3. Each team is to select an OS other than LINUX and its flavors.
4. Rubrics for Evaluation

Term	Portions	Rubrics	Marks
I	Installation of OS Interface Features File and Directory management Features	Installation – 3 Marks Report – 2 Marks Implementation of System calls related to File and Directory management – 5 Marks	10
II	Support for Process/ Threads Scheduling and Synchronization of Process/Threads	Implementation of System Calls related to scheduling – 3 Marks Implementation of System Calls related to synchronization – 4 Marks Report – 3 Marks	10
III	Memory Management Other Advanced Features Comparison with LINUX	Implementation of related to memory allocation policies – 4 Marks Advanced Features – 2 Marks Comparison chart (Similarities and Differences)– 4 Marks	10

WEEK WISE PLAN – Quiz and Tutorial

Week	CA	Topics
Week 1	~	~
Week 2	Quiz 1	Basic concepts in OS

Week 3	Quiz 2	Process Concept and IPC
Week 4	Tutorial 1	Multithreading
Week 5	~	~
Periodical – I		
Week 6	~	~
Week 7	Quiz 3	Processor Scheduling
Week 8	Quiz 4	Process Synchronization
Week 9	Tutorial 2	Process Synchronization and Deadlock
Week 10	~	~
Periodical – II		
Week 11	~	~
Week 12	~	~
Week 13	Quiz 5	Memory Management
Week 14	~	~
Week 15	Tutorial 3	Disk and File Management
End Semester		

Note:

Lab portions marked in blue would be strict evaluation lab. (To be conducted one per term during lab hour with strict time constraints)

For case study reports are to be submitted and Viva voce would be conducted.