CSE 3231: Operating System and System Programming

COURSE INFORMATION

Course Code: CSE 3231
Course Title: Operating System and System Programming
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Lecture Contact Hours: 3.00
Credit Hours: 3.00

PRE-REQUISITE

Course Code: N/A

Course Title: N/A

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course focuses on the fundamental concepts of Operating System and System Programming and System Programming structure, computer hardware, system structure, process, thread, memory management, deadlock, disk structure, file system, protection, security, virtualization and cloud system.

OBJECTIVE

1. To learn the fundamental and system structure of operating system.
2. To develop idea about embedded Operating System and System Programming and System Programming from this basic knowledge.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Classify, identify and analyse modern operating systems; concept for virtualization, cloud and multiple processor systems.	C1-C4	1		3	T,MT, F
CO2	Understand and analyse process, thread, memory and file management systems.	C2,C4	1,		3	T, MT
CO3	Understand and implement algorithms for process, thread, deadlock and memory management.	C2, C3	2		5	T, F
CO4	Develop the communication skill by presenting topics on operating systems.	A2		1	5,6	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction: Introduction to OS. Operating system function, evaluation of OS, Different types of OS: batch, multi-programmed,time-sharing, real-time, distributed, parallel.

System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protection, operating system structure (simple, layered, virtual machine), OS service, system call.

Process Management: Processes: Concept of processes, process scheduling, operations on processes, co-operating processes, interprocess communication.
Threads: Overview, benefits of threads, user and kernel threads.
CPU Scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.
Process Synchronization: Background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
Deadlocks: System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.
Memory Management: Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.
Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.
File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.
I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.
Disk Management: Disk reliability, disk formatting, boot block, bad blocks.
Protection & Security: Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

SKILL MAPPING

No.	Course Learning Outcomes	Program Outcomes (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Classify, identify and analyse modern operating systems; concept for virtualization, cloud and multiple processor systems.	H											
CO2	Understand and analyse process, thread, memory and file management systems.		H										
CO3	Understand and implement algorithms for process, thread, deadlock and memory management.			H									
CO4	Develop the communication skill by presenting topics on operating systems.										L		

(H-High, M-Medium, L-Low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Increase breadth & depth of knowledge through Classifying, identifying and analysing various aspect of modern operating systems.
CO2-PO2	High	Understand and solve various complex problems by analysing process, thread, memory and file management system.
CO3-PO3	High	Understand and implement algorithms for process, thread, deadlock and memory management which solutions have previously been identified and coded.
CO4-PO10	Low	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and learning activities	Engagement (hours)
Face-to-face learning	
Lecture	42
Practical/Tutorial/Studio	-
Student-centered learning	-
Self-directed learning	
Non-face-to-face learning	42
Revision	21
Assessment preparations	21
Formal assessment	
Continuous assessment	2
Final examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lectures	Topics	Assessment Methods
1	Lec 1	Introduction evolution, goals and Components of OS, types of OS.	Class Test 1
	Lec 2		
	Lec 3		
2	Lec 4	Process managements, process states and state transition, process control blocks.	
	Lec 5		
	Lec 6		

3	Lec 7 Lec 8 Lec 9	Job and process scheduling, scheduling levels, objective and criteria CPU scheduling algorithms.	
4	Lec 10 Lec 11 Lec 12	Process coordination, critical section problems, semaphores,	Class Test 2
5	Lec 13 Lec 14 Lec 15	Language constructs, classical problems of process coordination, Inter-process communication, message and mailbox etc.	
6	Lec 16 Lec 17 Lec 18	Memory management memory allocation schemes, Paging and segmentation, virtual memory.	
7	Lec 19 Lec 20 Lec 21	Page replacement strategies, working sets, demand paging.	
8	Lec 22 Lec 23 Lec 24	File system functions file organization logical and physical file maps, tree structure file systems.	Class Test 3
9	Lec 25 Lec 26 Lec 27	I/O programming Device management techniques. Interrupts processing parallel processing.	
10	Lec 28 Lec 29 Lec 30	Secondary storage management, disk scheduling algorithms, RAID structure.	
11	Lec 31 Lec 32 Lec 33	Deadlock, deadlock prevention. avoidance direction and recovery.	Class Test 4
12	Lec 34 Lec 35 Lec 36	Operating System and System Programming and System Programming protection, System security, timesharing, Types and techniques for efficient virtualization, memory and i/o virtualizations, virtual appliances.	
13	Lec 37 Lec 38 Lec 39	Clouds as a service, virtual machine, Multiple Processor Systems: Multiprocessor, Multicomputer, Distributed Systems, Case Studies.	
14	Lec 40 Lec 41 Lec 42	Review Class	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom Taxonomy
Continuous Assessment (40%)	Class Test 1-3	20%	CO1 CO3 CO4	C1-C2, P1 C1-C3, P3 C3, C5
	Class Participation	5%	CO5	A2
	Mid Term	15%	CO2	A5, C1-C4
Final Exam		60%	CO1 CO2 CO3 CO4	C1-C2, P1 C1-C4, A5 C1-C3, P3 C3, C5
Total Marks		100%		

(CO=Course Outcome, C=Cognitive Domain, P=Psychomotor Domain, A=Affective Domain)

REFERENCE BOOKS

1. Operating System and System Programming and System Programming concepts - A. Silberschatz, P.B. Galvin, Greg Gagne
2. Modern Operating Systems (4th) - Andrew S. Tanenbaum; Prentice Hall

REFERENCE SITE

1. **https://www.geeksforgeeks.org/operating-systems/**