Riphah International Colleges

A Project of Riphah International University

Course Outline

Course Information	Course Title	**Operating System**		
	Course ID	CMS-115	Course Type	Computing Core
	Credit hours	3 (2-1)	Hours per week (C-L)	2-3
	Program(s)	ADP-ITM, Comp-System	Preferred Semester	2nd
	Session	Spring 2025	Version	1.0
Course Description	Operating System course is designed to give basic concepts in operating systems and how different choices in operating system design and implementation have effects on applications, and user environment supported by different types of operating systems			

Course Objectives (CO)

The objective of this course is to enable students to understand;

No.	Objective	Relation with PEO
CO1.	basic concepts of operating systems including process, memory, I/O, file and concurrency management	PEO1
CO2.	purpose, structure and functions of operating systems	PEO6
CO3.	design trade-offs, design decisions and their dependence on the target environment	PEO2
CO4.	exposure to current trends in operating systems research and development	PEO3

Course Learning Outcomes (CLO)

At the end of this course students will be able to;

No.	Outcome	Relation with PLO	BT Level	PLO Level
CLO1.	**Understand** the impact of different features on OS design.		C1	
CLO2.	**Apply** knowledge to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.		C2	
CLO3.	**Analyze** operating systems structure and functionality, including memory allocation virtual memory, demand paging and process and device management.		C3	
CLO4.	**Evaluate** operating system performance.		C4	

Lecture type	Lectures, Lab sessions					
Prerequisites						
Follow up Courses						
Textbook	Title	Edition	Authors	Publisher	Year	ISBN
	Operating System Concepts	10th Edition	A. Silberschatz, J. Peterson, P. Galvin	Wiley	2018	978-1-119-32091-3
Reference Books	Operating Systems: Internals and Design Principles	7th Edition	William Stallings			
	Modern Operating Systems	3rd Edition	A.S. Tanenbaum	Prentice Hall		
	Linux Command Line and Shell Scripting Bible	3rd Edition	Richard Blum, Christine Bresnahan	Wiley	2015	978-1-118-98384-3
Reference Material						
Tools and Technologies	VMware Workstation, Ubuntu OS, Windows OS					

Design skills / techniques	Flipped learning, project-based learning					
Assessment Criteria (100%)	Assessment	Weight	Used to attain CLO	Assessment	Weight	Used to attain CLO
	Assignment	5%	CLO 1,2,4,5,6	Quiz	10%	CLO 1,3,4,5
	Lab	20%	CLO 1,3,4,5	Project / Presentation	10%	
	Attendance	2%	-	Participation	3%	-
	Mid Term	20%	CLO 1,2,3,4,5	Final	30%	CLO 1,2,3,4,5
	Other 1	0%		Other 2	0%	-
Methods of Evaluation	Quizzes, Assignments, Mid/Final exam, Lab, Project					
Notes						

COURSE CONTENTS

Week No.	Topic	Lecture No.	Lecture Contents	Relation with CLO	Lecture Material	Class Activity	Tasks
W1.	Introduction & Background	L1.	• Introduction to operating system • Computer System Overview, • Application software, • System software, • Machine language, • Microprogramming, • Physical devices • Evolution of Operating Systems	CLO1	Slides: Chapter 0 Slides: Chapter 1	Activity: Introduction of each student	Homework: Go through the module handbook thoroughly
		L2.	• Types of Operating Systems • Computing Environments • History of Operating Systems, • Introduction to Unix, MS-DOS and Windows	CLO1	Slides Lecture 1 Video: How to fix computer (3:30)		Video: How To Make An Operating System (8:30 min)
W2.	Operating System Structure	L3.	• Process Management, • Memory Management, • File Management, • I/O System Management, • Secondary Storage Management, • Networking • System Protection	CLO1	Slides: Chapter 2		Assignment 1: Modern Operating System Comparison
		L4.	• Operating system services • Operating System Structure, • OS layered approach, • OS/2 layer structure, • Microkernel System Structure	CLO1, CLO2			Project Phase 1:
W3.	Operating System Structure	L5.	• Operating System Design and Implementation • System design goals, • Mechanisms and policies, • Operating system implementation • Traditional UNIX System Structure, • Microkernel System Structure, • Solaris Modular Approach, • Mac OS X Structure, • Android Architecture	CLO2, CLO3			
		L6.	• Operating System Generation (SYSGEN) • Kernel/Kernel Mode • System Calls, System Call Processing, • Types of System Calls • Interrupts, Interrupt Processing, • Types of Interrupts	CLO 2		Quiz 1	Video: Create Your Own Operating System (40:06 min)

Week No.	Topic	Lecture No.	Lecture Contents	Relation with CLO	Lecture Material	Class Activity	Tasks
W4.	Process Concepts	L7.	• The process concept, • Program vs process • Process creation, • Process Control Block, • Process Table, • Shell, Operation on processes • Context Switch, • Process states, • Process states transitions, • Five state process model, • CPU-bound vs I/O-bound processes • Unix process state transition diagram	CLO 1,3	Slides: Chapter 3		Project Phase 2:
		L8.	• Kernel/kernel mode • System calls & its types • Interrupts, Interrupt processing, • Types of Interrupts	CLO 1,3			
W5.	Scheduling	L9.	• Scheduler, Scheduling algorithm, • Objectives of Scheduling, • Criteria for scheduling, • Types of Scheduling, • Process Scheduling Queues	CLO 1-4	Slides: Chapter 4		Assignment 2
		L10.	• Scheduling Algorithms (FCFS, SJF, Priority, Round Robin) • Multilevel feedback queues scheduling • BSD Unix scheduling, • Multiple processor scheduling • Threads, Thread support Solaris	CLO 2,4		Quiz 2	
W6.	Memory Management	L11.	• Memory, Memory management, • Memory Hierarchy, • Process loading and swapping • Memory allocation methods, • Single partition allocation	CLO 1-3	Slides: Chapter 5		
		L12.	• Storage management strategies, • Fetch strategies, • Placement strategies, • Replacement Strategies, • Variable partition with compaction	CLO 2-4			

Week No.	Topic	Lecture No.	Lecture Contents	Relation with CLO	Lecture Material	Class Activity	Tasks
W7.	Memory Management	L13.	• Non-contiguous memory allocation • Paging vs Segmentation • Simple paging & its Implementation, • Page address translation, • Implementation of Page Table, • Paging with TLB • Page Table Structure, • Hierarchical Page Tables, • Hashed Page Tables, • Inverted Page Tables	CLO 3			Project Phase-3:
		L14.	• Simple segmentation, • Segment addressing, • Paging vs. Segmentation	CLO 1,3			
W8.	Intel IA-32 Architecture	L15	• The Intel IA-32 Architecture, • Logical to Physical Address Translation in IA-32, Intel IA-32 Segmentation	CLO-4			
		L16.	• Intel IA-32 Paging Architecture. • ARM Architecture.	CLO-4			
W9.	Mid Term Exam Week	L17.	Mid Term Examination				
		L18.					
W10.	Virtual Memory	L19.	• Virtual memory & its Mechanism • Translation Look Aside Buffer, • Address Translation • Page fault, • Page replacement, • FIFO, • Belady's Anomaly, • Optimal LRU, • Random page replacement, • LFU, MFU, Non-used recently page replacement algorithm	CLO 1,2	Slides: Chapter 6		
		L20.	• Paging Mechanism • Additional techniques, • Memory protection and sharing • MS-DOS Memory management, • Windows memory management, • Unix memory Management	CLO 1,3		Assignment 3	
W11.	Threads & Multitasking	L21.	• Multitasking, Threads • Types of threads, • Kernel threads, • User level threads	CLO 1,3	Slides: Chapter 7	Quiz 3	Project Phase-4:

Week No.	Topic	Lecture No.	Lecture Contents	Relation with CLO	Lecture Material	Class Activity	Tasks
		L22.	• Multithreading model, • One to One Model, • Many to One Model, • Many to Many Model • Solaris 2 threads, • Windows 2000 threads, • Linux threads, • Java threads	CLO 1,2			
W12.	Concurrent Processes	L23.	• Concurrent processes, • Resources, • Race condition	CLO 1,3	Slides: Chapter 8		
		L24.	• Synchronization, • Critical section, • Mutual Exclusion, • Deadlock	CLO 1,3			
W13.	Inter-process communication	L25.	• Pipes • Semaphores, use of semaphore for critical section problem • Monitors	CLO 1,3			Assignment 4
		L26.	• Signals, Message passing, use of messages for synchronization • Shared memory, • Object linking & embedding • Client-Server Communication, • Sockets, • Remote Procedure Calls (RPC), • Remote Method Invocation (RMI)	CLO 1,2,3			
W14.	Input / Output Management	L27.	• Input/Output organization, • Objectives of I/O system • Buffering, • Double buffering transfer, • Multiple of circular buffering transfer • Unix I/O system, MS-DOS I/O system, • Device drivers in windows	CLO 2,3	Slides: Chapter 10	Quiz 4	
		L28.	• Disk structure, • Seek time, • Latency • Disk scheduling, • FCFS, SSTF, • Scan scheduling	CLO 1,3,4			
W15.	File Management	L29.	• File Types, • File Identification • MS-DOS, UNIX, Windows file naming • Alias Filenames	CLO 1,3	Slides: Chapter 11		

Week No.	Topic	Lecture No.	Lecture Contents	Relation with CLO	Lecture Material	Class Activity	Tasks
		L30.	• File management techniques (MS-DOS, Unix, Windows)	CLO 3,4			
W16.	Distributed Operating Systems	L31.	• Distributed System, • Distributed Operating System, • Distributed OS vs Network OS • Distributed System's Design Issues, • Distributed System Transparencies, • DOS Information Management Solution	CLO 1,3,4	Slides: Chapter 12		
		L32.	• Distributed File System, • DFS Structure • File Naming Schemes, • Remote File Access • Stateful vs. Stateless Service, • Stateful File Service, • Stateless File Server, • File Replication	CLO 1,3, 4			
W17.	Revision	L33. & L34.	• Revision • Project Demonstration & Presentations • Lab papers	CLO 1-4			
		L34.					
W18.	Final Term Exam		• Final examination	CLO 1-4			

LAB CONTENTS				
Week No.	**Topic**	**Lab Contents / Activity**	**Home Tasks**	**Relation with CLO**
W1.	Introduction	• Introduction to Software • Different Operating System comparison, usage share, Terminologies • Overview of OS Architecture, Shell and Kernel • File & Directory, File attributes		CLO 1,2,3
W2.	Linux installation and GUI	• Virtualization • Installing Linux • Overview of Linux, GUI • Organization of the file system • Absolute pathname, relative pathname • Installing Ubuntu, Overview of Ubuntu		CLO 2,3
W3.	Linux commands	• Introduction to BASH shell Commands: LS • Commands: CD, MKDIR, RMDIR • Command: RM, CP, CV • File Editors Pico, VI/VIM editor (File create, edit, save)		CLO 1,2,3
W4.	Commands Contd.	• LS (detail) • Directory and file Permissions • CHMOD • File Sorting: SORT commands • DATE (options), ECHO, CLEAR, WHO, WHO AM I • CAT Command		CLO 2,3
W5.	Advance Issues	• Streams • I/O Redirection, • Pipes • Background and foreground processing, Ps, Kill		CLO 2,3
W6.	Advance Management	• User Management: Commands • Passwd, Directory and file permissions - Chmod, id • Log files, RPM, YUM, Yellow pages update Manager • Process Prioritization, Commands: NICE, RENICE, TOP • Job Scheduling, Commands: AT, ATQ, and CRONE		CLO 2,3
W7.	C Programming and System Calls	• Introduction to C programming & GCC • GCC Compiler and commands • Sleep System call, Exist, Exit Status,		CLO 2,3
W8.	Mid Term Exam Week	• Mid Term Examination		CLO 1-4
W9.	C Programming and System Calls	• System Calls (getpid(), getppid() etc), System Function		CLO 2,3
W10.	Process and System Calls	• Process creation, fork • exec system calls • wait system calls		CLO 2,3
W11.	Threads applications using Java	• Java Thread (Lab) • Introduction to Java threads, • Multithreading		CLO 2,3

		• Thread – Start, join, sleep, setPriority, isAlive etc. • Depricated (Stop, Suspend, Resume)		
W12.	Signal Handling	• Signal Handling • Handling different signals, Ignoring signal • Trap, and handling with shell scripts • Handling in C		CLO 2,3
W13.	Windows Server – Introduction	• Overview - Windows Server (latest) • Installation and initial configuration for Environment.		CLO 2,3
W14.	Windows Server Configuration	• Overview, DNS, DHCP and Active Directory • Install and configuration for Active Directory, DNS, DHCP		CLO 2,3
W15.	Topic Presentations	• Topic Presentations		CLO 2,3
W16.	Project Demonstration	• OS Simulation Project Demonstrations		CLO 2,3
W17.	Final exam (Lab papers)			CLO 1-4