



COMSATS University Islamabad

Department of Computer Science

Course Syllabus

Course Information

Course Code: **CSC323**

Credit Hours: **3(2,1)**

Lab Hours/Week: **3**

Course Title: **Operating Systems**

Lecture Hours/Week: **3**

Pre-Requisites: **CSC211- Data Structures and Algorithms**

Catalogue Description:

This course introduces the services and functions performed by operating system for smooth and accurate system operations. Topics include: Operating Systems Overview; Device Organization & System Operations; Operating Systems Principles; Process Management; Process Synchronization; Deadlocks; Multiprocessor Issues; Memory Management; Storage Management; and Security & Protection.

Text and Reference Books

Textbooks:

1. Operating System Concepts, Silberschatz & Galvin, Addison-Wesley, 2021.
2. Modern Operating Systems, Tanenbaum, A. S., Prentice Hall, 2014.

Reference Book:

1. Operating Systems: Internals and Design Principles, Stallings, W., Pearson, 2017.

Week wise Plan:

Lecture #	CDF Unit #	Topics Covered	Reading Material
1.	1	Operating Systems: Overview, Purpose & Functionality, Evolution, Needs, Principles, and Computing Environments.	Silberschatz: Ch1
2.	1	Device Organization & System Operations: Interrupts, Dual Mode Execution, Single & Multi User; and Computer System Architecture.	Silberschatz: Ch1
3.	1	Operating System Structure; and Resource Management Services.	Silberschatz: Ch1
4.	1	Operating Systems Services; User-Interfaces; and System-Calls.	Silberschatz: Ch2
5.	1	OS Design Issues; OS Structuring Approaches: Monolithic, Layered, Modular, Micro-kernel, and Hybrid Models.	Silberschatz: Ch2
6.	2	Process Management: Overview, Process Concept, Process States, PCB & Context-Switch, and Process Scheduling & Scheduling Queues.	Silberschatz: Ch3
7.	2	Operations on Processes: Process Creation (Fork, Exec & Wait System-Calls), Process Termination (Exit & Abort System Calls), Cascading Termination, and Zombie & Orphan Processes.	Silberschatz: Ch3
8.	2	Inter-Process Communication: Shared Memory and Message Passing.	Silberschatz: Ch3
9.	2	Threads: Overview, Processes vs. Threads, Multiple Simultaneous Computations, and Alhamad's Law.	Silberschatz: Ch4
10.	2	Multithreading Models; and Multithreading Libraries.	Silberschatz: Ch4
11.	2	CPU Scheduling: CPU- I/O Burst Life Cycle, Scheduling Points, Scheduling Criteria; Scheduling Types, Scheduling Algorithms: FCFS Scheduling.	Silberschatz: Ch5
12.	2	Scheduling Algorithms: SJF Scheduling, Predicting Next CPU Burst, SRTF	Silberschatz:

		Scheduling, and Priority Scheduling.	Ch5
13.	2	Scheduling Algorithms: Round-Robin Scheduling, Multi-Level Queue, and Multi-Level Feedback Queue Scheduling.	Silberschatz: Ch5
14.	3	Process Synchronization: Overview, Need; Critical-Section Problem: Definition, Solution Overview, Conditions for Correct Solution, and Two-Process Solution to CS Problem.	Silberschatz: Ch6
15.	3	Hardware based Solutions to CS Problem: Enabling & Disabling Interrupts, Test & Set, Compare & Swap; and Software based Solutions: Mutex-Locks.	Silberschatz: Ch6
16.	3	Software based Solutions: Semaphore; and Classical Synchronization Problems.	Silberschatz: Ch7
17.	Mid Term Exam		
18.			
19.	3	Deadlocks Overview; Characterization: Conditions & Resource Allocation Graph; and Deadlock Handling Techniques: Deadlock Prevention.	Silberschatz: Ch8
20.	3	Deadlock Avoidance: Resource-Allocation Graph, and Bankers Algorithm.	Silberschatz: Ch8
21.	3	Deadlock Detection & Recovery.	Silberschatz: Ch8
22.	4	Memory Management: Review of Physical Memory & Memory Management Hardware, Address Binding, Address Space Types, and Dynamic Loading/Linking & Shared Libraries.	Silberschatz: Ch9
23.	4	Contiguous Memory Allocation: Fixed Partitioning & Dynamic Partitioning; and Non-Contiguous Memory Allocation: Segmentation.	Silberschatz: Ch9
24.	4	Paging: Basic Method, HW Support, and Protection.	Silberschatz: Ch9
25.	4	Virtual Memory: Background, Benefits; Demand Paging: Basic Concept, Performance and Copy-on-Write.	Silberschatz: Ch10
26.	4	Page Replacement Algorithms: Overview, FIFO, Optimal, LRU, Second-Chance Algorithm, MFU & LFU, and Thrashing.	Silberschatz: Ch10
27.	5	Mass Storage Management: Hard-disks, Volatile & Non-Volatile Memory; Disk Scheduling; and NVM Scheduling.	Silberschatz: Ch11
28.	5	Storage Device Management: Formatting, Boot Block, Bad Blocks; and Swap-Space Management.	Silberschatz: Ch11
29.	5	File System: File concept, Access Methods, and Directory Structure.	Silberschatz: Ch13
30.	5	File Protection; and Memory-Mapped Files.	Silberschatz: Ch13
31.	6	OS Security: Overview, Program Threats, Network Threats, Cryptography, and Security Implementation.	Silberschatz: Ch16
32.	6	Protection: Overview, Goals, Principles, and Access Control.	Silberschatz: Ch16
Final Term Exam			
Student Outcomes (SOs)			
S.#	Description		
1	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements		

2	Identify, formulate, research literature, and solve <i>complex</i> computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines
4	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to <i>complex</i> computing activities, with an understanding of the limitations

Course Learning Outcomes (CLO)

Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	SO
CLO's for Theory				
CLO-1	1	Elaborate concepts and principles of operating systems.	<i>Understanding</i>	1
CLO-2	2-3	Analyze various operations performed by operating system for process management.	<i>Analyzing</i>	1-2
CLO-3	4	Analyze the memory management issues and techniques in the context of operating system.	<i>Analyzing</i>	2
CLO-4	5	State the concepts of file system, storage and security issues.	<i>Understanding</i>	1
CLO's for Lab				
CLO-5	1	Operate basic services and functionality of operating systems.	<i>Applying</i>	1
CLO-6	1	Compose Linux commands using Shell scripting.	<i>Applying</i>	1,4
CLO-7	2-3	Implement the concepts of process management.	<i>Applying</i>	2,4

CLO Assessment Mechanism

Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5	CLO-6	CLO-7
Quizzes	Quiz 1	Quiz 2	Quiz 3	Quiz 4	-	-	-
Assignments	Assignment 1	Assignment 2	Assignment 3	Assignment 4	LAB Assignment	LAB Assignment	LAB Assignments
Mid Term Exam	Mid Term Exam	Mid Term Exam	-	-	-	-	-
Final Term Exam	Final Exam				-		

Policy & Procedures

- **Attendance Policy:** Every student must attend 80% of the lectures as well as laboratory in this course. The students falling short of required percentage of attendance of lectures/laboratory work, is not allowed to appear in the terminal examination.
- **Course Assessment:**

	Quizzes	Assignments	Mid Term Exam	Terminal Exam	Total
Theory (T)	15	10	25	50	100
Lab (L)	-	25	25	50	100
Final Marks (T+L)	(T/100) *75 + (L/100) *25				

- **Grading Policy:** The minimum passing marks for each course is 50% (In case of LAB; in addition to theory, student is also required to obtain 50% marks in the lab to pass the course). The correspondence between letter grades, credit points, and percentage marks at CUI is as follows:

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Marks	>= 85	80 - 84	75 - 79	71 - 74	68 - 70	64 - 67	61 - 63	58 - 60	54 - 57	50-53	< 50
Cr. Point	3.67-4.00	3.34-3.66	3.01-3.33	2.67-3.00	2.34-2.66	2.01-2.33	1.67-2.00	1.31-1.66	1.01-1.30	0.10-1.00	0.00

- **Missing Exam:** No makeup exam will be given for final exam under any circumstance. When a student misses the mid-term exam for a legitimate reason (such as medical emergencies), his grade for this exam will be determined based on the Department policy. Further, the student must provide an official excuse within one week of the missed exam.
- **Academic Integrity:** All CUI policies regarding ethics apply to this course. The students are advised to discuss their grievances/problems with their counsellors or course instructor in a respectful manner.
- **Plagiarism Policy:** Plagiarism, copying and any other dishonest behaviour is prohibited by the rules and regulations of CUI. Violators will face serious consequences.