



**COMSATS University Islamabad, Lahore Campus**  
Defence Road, Off Raiwind Road, Lahore

## **COURSE HANDBOOK**

1	Course Title	Operating Systems
2	Course Code	CSC322
3	Credit Hours	3(2,1)
4	Semester	Semester 5
5	Resource Person	Dr. Muhammad Hasan Jamal
6	Resource Person Contact	mhjamal@cuilahore.edu.pk
7	Contact Hours (Theory)	3 hours per week
8	Contact Hours (Lab)	N/A
9	Office Hours	TBD
10	Course Introduction	
<p>This course provides the overview of computer system and the operating system, the concepts of process management, thread management, scheduling, concurrency, synchronization, and memory management. This course builds on skills gained in preliminary programming language courses (i.e. Java and C) and gives you an in-depth understanding of designing and implementing operating systems. The course covers both theoretical and practical challenges encountered when designing, implementing, and using operating systems. This course also evaluates trade-offs between conflicting objectives in large scale system design.</p> <p>Core topics include operating system structure, hardware interfaces and abstraction, process scheduling and dispatch, threading, synchronization, inter-process communications, and memory management.</p>		
11	Learning Objectives	
<p>Through the study of this course, students will gain a comprehensive understanding on the concepts and functions of a modern operating system. Particularly, they will understand:</p> <ul style="list-style-type: none"><li>• The role of the operating system as a high-level interface to the hardware.</li><li>• OS as a resource manager that supports multiprogramming</li><li>• The low-level implementation of CPU dispatch.</li><li>• The low-level implementation of memory management.</li><li>• The performance trade-offs inherent in OS implementation</li></ul>		
12	Course Contents	
<p>The primary aim of the subject is to teach the core level concepts applied in the design and application of an operating system. Emphasis is given to the problems regarding multi-user multitasking systems, memory management, deadlocks, process management and scheduling. Concepts of concurrency, deadlock handling, resource sharing, and disk management are discussed. At the end of the course the students should be aware of the organization of different operating systems and should have a practical understanding of the related problems and solutions.</p>		

13	Lecture Schedule	
<u>Weeks</u>	<u>Topic of Lecture</u>	<u>Reading Assignment</u>
Week 1	<b>Introduction to Operating System,</b> Operating system needs/importance and history, Components of Computer System, Boot Sequence, booting operation, Components of operating system (H/W, S/W, Firmware), Functions & objectives of Operating system, Introduction to difference OSs and their design specification. Introduction to different processing system, Types of Operating system i.e. general purpose vs. special purpose operating systems and their operations.	
Week 2 & 3	<b>Process management</b> Introduction to process, Process state model, two and five state process models, PCB (Process Control Block), Operations on a process, Context switching, Inter-process communication (IPC) <b>Quiz 01, Assignment 01</b>	
Week 4 & 5	<b>CPU Scheduling</b> Scheduling evaluation parameters; Scheduling levels; Scheduling algorithms; Comparison of scheduling algorithms <b>Quiz 02, Assignment 02</b>	
Week 6	<b>Introduction to Threads</b> Process vs. threads; Multithreading, threads functionality; Thread states; User level threads and kernel level threads; (Advantages and disadvantages of both the types)	
Week 7	<b>Sessional – I, Paper Checking &amp; solution discussion</b>	
Week 8	<b>Student Week</b>	
Week 9 & 10	<b>Process Synchronization</b> Concurrency control in operating system; Problems regarding concurrent process; Solutions for concurrency control; The Critical Section Problem; Mutual exclusion and critical section; Busy waiting vs. blocking; Peterson's algorithm; Bakery algorithm; Semaphore and its application in various synchronization problems; Classic problems of synchronization <b>Quiz 03, Assignment 03</b>	
Week 11	<b>Deadlocks</b> Introduction to deadlocks, examples; Resource sharing concepts Conditions for deadlock occurrence; Deadlock handling techniques (prevention, avoidance, detection, recovery)	
Week 12	<b>Sessional – II, Paper Checking and &amp; solution discussion</b>	
Week 13 & 14	<b>Memory management:</b> Introduction to real storage management, Memory hierarchy, Storage management strategies, Contiguous vs. non-contiguous memory, allocations, Single user contiguous system, Protection mechanism, Memory Partitioning (Fixed Partitioning mechanism, Variable partition), Internal and External Fragmentation, Segmentation, Paging <b>Quiz 04, Assignment 04</b>	
Week 15 & 16	<b>Virtual Memory</b> Introduction to virtual memory management, Address translation & page fault handling, Memory management hardware: page table and Translation Lookaside Buffer, Memory management algorithms: fetch policy, replacement policy, resident set. <b>Course Revision</b>	

15	Course Assessment			
The assessment of this module shall have following breakdown structure				
	First Sessional Test		10%	
	Second Sessional Test		15%	
	Quizzes/Assignments		25%	
	Terminal Examination		50%	
The minimum pass marks for each course shall be 50%. Students obtaining less than 50% marks in any course shall be deemed to have failed in that course. The correspondence between letter grades, credit points, and percentage marks at CIIT shall be as follows:				
	Grades	Letter Grade	Credit Points	Percentage Marks
	A	(Excellent)	4.0	90and above
	A-		3.7	85-89
	B+		3.3	80-84
	B	(Good)	3.0	75-79
	B-		2.7	70-74
	C+		2.3	65-69
	C	(Average)	2.0	60-64
	C-		1.7	55-59
	D	(Minimum passing)	1.3	50-54
	F	(Failing)	0.0	Less than 50
16	Assessment Schedule			
Week	Assignment and Quiz			
Week 2	1 <sup>st</sup> Assignment and Quiz			
Week 5	2 <sup>nd</sup> Assignment and Quiz			
Week 10	3 <sup>rd</sup> Assignment and Quiz			
Week 14	4 <sup>th</sup> Assignment and Quiz			
17	Format of Assignment			
This course indoctrinates the following format for all assignments except code:				
1. Paper Size: A4				
2. Left Margin: 2 Inches				
3. Right Margin: 1 Inch				
4. Top Margin: 0.5 Inch				
5. Bottom Margin: 0.5 Inch				
6. Font: Times New Roman				
7. Font Size:				
a. Main Heading 14				
b. Sub Heading 12				
c. Text 12				
d. Titles 16				
8. Font Color: Black				
9. Line Spacing: 1.5				
10. Diagrams & Charts: Need not be colored				
11. Title page must be designed as guided by resource person in class				
12. Number of Pages: No Limit				
13. Reference Style: APA (If applicable)				
If applicable, code will be submitted in text files that can be compiled with specified programming language compiler.				

18	<b>Textbook</b>	Operating System Concepts (9 <sup>th</sup> Edition) by Abraham Silberschatz, Peter B. Galvin and Greg Gagne
19	<b>Reference Books</b>	<ul style="list-style-type: none"> <li>• Modern Operating System (3<sup>rd</sup> Edition) by Andrew S. Tanenbaum</li> <li>• Operating Systems Internals and Design Principles by William Stallings</li> </ul>
20	<b>Plagiarism</b>	<p>Plagiarism involves the unacknowledged use of someone else's work, usually in coursework, and passing it off as if it were one's own. Many students who submit apparently plagiarised work probably do so inadvertently without realising it because of poorly developed study skills, including note taking, referencing and citations; this is poor academic practice rather than malpractice. Some students plagiarise deliberately, with the intent to deceive. This intentional malpractice is a conscious, pre-mediated form of cheating and is regarded as a particularly serious breach of the core values of academic integrity. <b>CUI has zero tolerance for intentional plagiarism.</b></p> <p><b>Plagiarism</b> can include the following:</p> <ol style="list-style-type: none"> <li>1. Collusion, where a piece of work prepared by a group is represented as if it were the student's own.</li> <li>2. Commission or use of work by the student which is not his/her own and representing it as if it were, e.g.:             <ol style="list-style-type: none"> <li>a. purchase of a paper from a commercial service, including internet sites, whether pre-written or specially prepared for the student concerned</li> <li>b. submission of a paper written by another person, either by a fellow student or a person who is not a member of the university.</li> </ol> </li> <li>3. Duplication (of one's own work) of the same or almost identical work for more than one module</li> <li>4. The act of copying or paraphrasing a paper from a source text, whether in manuscript, printed or electronic form, without appropriate acknowledgement (this includes quoting directly from another source with a reference but without quotation marks);</li> <li>5. Submission of another student's work, whether with or without that student's knowledge or consent.</li> <li>6. Directly quoting from model solutions/answers made available in previous years.</li> <li>7. Cheating in class tests, e.g.             <ol style="list-style-type: none"> <li>a. when a candidate communicates, or attempts to communicate, with a fellow candidate or individual who is neither an invigilator nor member of staff</li> <li>b. copies, or attempts to copy from a fellow candidate</li> <li>c. attempts to introduce or consult during the examination any unauthorised printed or written material, or electronic calculating, information storage device, mobile phones or other communication device</li> <li>d. personates or allows himself or herself to be impersonated.</li> </ol> </li> <li>8. Fabrication of results occurs when a student claims to have carried out tests, experiments or observations that have not taken place or presents results not supported by the evidence with the object of obtaining an unfair advantage.</li> </ol> <p>These definitions apply to work in whatever format it is presented, including written work, online submissions, group work and oral presentations.</p>
21	<b>Attendance Policy</b>	<p>Every student <b>must attend 80%</b> of the lectures delivered in this course and 80% of the practical/laboratory work prescribed for the respective courses. Students falling short of required percentage of attendance of lectures/practical/laboratory work, etc., shall not be allowed to appear in the terminal examination of this course and shall be treated as having failed this course.</p>