National Computing Education Accreditation Council

NCEAC

COURSE DESCRIPTION FORM FAST-NUCES

INSTITUTION _____

PROGRAM (S) TO BE EVALUATED BSCS

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS2006
Course Title	Operating Systems
Credit Hours	3+1
Prerequisites by Course(s) and Topics	PF & Data Structures
Assessment Instruments with Weights	• Semester Assessments – 20% (2 Prog. Assignments 4 + 3 Quizzes 6 + Project 10) • Midterms – 30% • Final Exam – 50% - **Late policy**: 50% detection after 48 hours. No awards whatsoever after ONE WEEK after the deadline. - **Plagiarism** punishment up to 20 weightage. ❖ Project scope limited to Multithreaded Multiprocesses Interprocess communication programming ONLY. Proposals based on theoretical aspects and Socket programming shall not entertained. Marks distribution: 5% proposal , 70 Coding (complexity + proposed outcome), 25% viva & presentation
Course Coordinator	Dr. Nadeem Kafi Khan
Grading Policy	Absolute grading. Student will receive grades based on predetermined cutoff levels.
Current Catalog Description	This course aims to equip students with a solid understanding of operating systems, covering key areas such as system basics, process management, threads and concurrency, scheduling, concurrency and inter-process communication, memory allocation, and security measures. It also emphasizes practical skills like system programming and debugging and virtualization and containers in the context of operating systems. Students will gain hands- on experience through class assessments focusing on system design principles. The goal of this course is to provide students with a comprehensive understanding of operating systems, enabling them to develop efficient applications and address challenges in multi- user, multitasking, and distributed computing environments, while emphasizing practical skills.
Textbook (or **Laboratory Manual** for Laboratory Courses)	**Operating system Concepts by Silberchatz, 10th Edition** (Please do not use Global Edition)
Reference Material	• OPERATING SYSTEMS INTERNALS, 9th Ed. by Dr. William Stallings • Modern Operating System by Abdrew S. Tannenbaum 5th Edition.

Course Goals

A. Course Learning Outcomes (CLOs)

CLO	Name	Domain	Taxonomy Level	Tools
01	**Understand / Describe / discuss / Comprehend** - Services provided by the operating systems - Virtualization - Concurrency - Persistence - Security	Cognitive	2	A,M,F
02	**Analyze, Compare, Contrast, and evaluate** - Mechanism of scheduling task - Implementation of concurrency and synchronization mechanism - Performance issues	Cognitive	3	A,M,F
03	**Design and Implement programs using processes and threads. For example,** Simple Operating System Shell, File System Implementation, Process Scheduling Simulator, Interprocess Communication Mechanisms, System Calls Extension, Security Features Implementation, Performance Monitoring Tool.	Cognitive	3,4	A,M,F,P

Tool: A = Assignment, M = Midterm, F=Final, P = Project

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

PLO 1	Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
PLO 2	Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
PLO 3	Design/Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
PLO 4	Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research-based methods	

PLO 5	Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
PLO 6	Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
PLO 7	Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems	
PLO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	✔
PLO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
PLO 10	Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	✔
PLO 11	Project Mgmnt and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
PLO 12	Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CLOs	1	✔											
	2		✔										
	3			✔									
	4					✔							

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one- hour lectures)

1. Topics to be covered Theory classes:

Weeks	List of Topics	Chap. #	Contact Hours	CLO	
1	Introduction and OS basics	1	0.5	1	
2	Introduction to Operating system	1	5.5	1	
3	Operating system structure	2	3	1	
4	Processes	3	3	1,2,3	Quiz 1
5	Process Scheduling Algorithm	5	3	1,2,3	Asign 1
6	**Mid Term 1**				
7	Threads and Concurrency	4	3	1,2,3	Project
8	Process Synchronization Tools and Examples	6,7	3	2,3	
9	Deadlocks	8	3	2,3	
10	Main Memory	9	3	1,2	Quiz 2
11	Virtual Memory	10	3	1,2	Asign 2
12	**Mid Term 2**				
13	I/O Systems, File-System Interface	12	3	1,2	
14	Virtual Machines	18	3	1,2	
15	Revision/completion of topics - 1	1	3	1,2	Quiz 3
16	Revision/completion of topics - 2				
17	Project Presentations and Viva				

Laboratory Projects / Experiments Done in the Course

2. Topics to be covered in Labs:

Lab 1: Introduction & Basic Linux Commands and Virtual Box installation

Lab 2: Creating, Compiling and executing C/C++ programs using gcc/g++ compilers using makefile

Lab 3: Linux Shell Scripting (installations and configurations, system admin, task orchestration)

Lab 4: System Call related to Process Management, argument arrays

Lab 5: POSIX thread programming without synchronization

Lab 6: Inter- Process Communication (IPC, Named Pipes and demo basic sockets programming)

Lab 7: Shared Memory and Memory Mapped Files

Lab 8: Mid Exam

Lab 9: Multithread Programming with synchronization primitives – 1

Lab 10: Multithread Programming with synchronization primitives – 2 (using File-System calls)

Lab 11: The Readers and Writers Problem Lab

Lab 12: OS security lab (desktop and server threats, hardening Linux OS, network security basics)

Lab 13: System Configuration. Boot loader, Managing Services, System Startup Files (rc.d, rc.sysinit rc.local init.d), make, configure install, Integrity Checks

Lab 14: Creating a module in Kernel – 1

Lab 15: Creating a module in Kernel – 2

Lab 16: Final Lab Exam (Lab Midterm syllabus will be 20% and rest 80%)

Lab 17: Lab Project Evaluation and Lab Final Exam Review.

Programming Assignments Done in the Course	**2 in Theory and 13+ in different OS labs**			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	20	15	6	1
Oral and Written Communications	Every student is required to submit at least __1__written report of typically _2__pages and to make _1___ oral presentations of typically ___10___ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name: Dr. Nadeem Kafi Khan

Instructor Signature: _____
Date: 20th January, 2025