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 (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Project + Presentation 10% Assignments 10% Midterms 30% Final 50%
Course Coordinator	Abdul Rahman
URL (if any)	http://slate.nu.edu.pk/portal/site/0f61819d-6f32-497a-a353-a0e126597e8f
Current Catalog Description	The objective of this course is to give students knowledge of construction and working of Operating systems, to enable them to understand management and sharing of computer resources, Operating systems basics, system calls, process concept and scheduling, inter-process communication, communication and concurrency and develop effective and efficient applications and to appreciate the problems and issues regarding multi-user, multitasking, and distributed systems, multithreaded programming, multithreading models, threading issues, process scheduling algorithms, thread scheduling, multiple-processor scheduling, synchronization, critical section, synchronization hardware, synchronization problems, deadlocks, detecting and recovering from deadlocks, memory management, swapping, contiguous memory allocation, segmentation & paging, virtual memory management, paging, file concept, directory and disk structure, directory implementation, free space management, disk structure, system protection, virtual machines, operating system security.
Textbook (or **Laboratory Manual** for Laboratory Courses)	• Operating system Concepts by Silberchatz, 10th Edition • OPERATING SYSTEMS INTERNALS, 9th Ed. by Dr. William Stallings • Modern Operating System by Abdrew S. Tannenbaum 5th Edition. • The Definitive Guide To Suse Linux Enterprise Server 12
Reference Material	• Linux: The Complete Reference, Sixth Edition • Linux Shell Scripting Cookbook, Second Edition • LINUX, System Programming by Robert Love • LINUX KERNEL IN A NUTSHELL by Greg Kroah-Hartman • Linux Bible Ninth Edition by Christopher Negus

Course Goals

A. Course Learning Outcomes (CLOs)

CLO	Name	Domain	Taxonomy Level	Tools
01	**Understand** / Comprehend the core functions (i.e. process management, scheduling, memory management, file management, disk management) and structure of operating system. **Compare** the functionality of different computing hardware structures and Operating Systems Structures.	Cognitive	2	A,M,F
02	**Analyze** and evaluate the algorithms of the core functions of the Operating Systems and explain the major performance issues about the core functions. **Analyze** concurrency problems in multi-processing/multi-thread operating systems and Evaluate different process co-coordinating solutions.	Cognitive	3	A,M,F
03	**Design** and Implement solutions for POSIX compliant Enterprise Operating systems (SUSE Enterprise Linux / iOS) OR refine existing solutions to reflect implementation details	Cognitive	3,4	A,M,F,P
04	**Apply** and use Opensource toolchain to develop & design of operating system software.	Cognitive	3,4,5	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:

Weeks	List of Topics	No. of Weeks	Contact Hours	CLO	
1	History of Operating systems & Open-source movement, POSIX, GNU / GLP, The Cathedral and the Bazaar, Windows Refund Day, Homebrew Computer Club	0.5	1.5	1	
2	Introduction to Operating system,	1.5	4.5	1	
3	Operating system structure	1	3	1,3	Assignment 1
4	Process Concept (Process	1	3	1,2,3	

		scheduling, interposes communication)				
	5	Process scheduling Algorithm (Algorithms for process scheduling, real time scheduling)	1	3	1,2,3	
	6	Mid Term 1				
	7	Multi-threaded Programming(threads models , threads issues)	1	3	2,3	Assignment 2
	8	Process Synchronization	1	3	2,3	
	9	Process Synchronization continued	1	3	2,3	
	10	Memory management strategies	1	3	1,2	Assignment 3
	11	Memory management strategies continued	1	3	2,3	
	12	Mid Term 2				
	13	Virtual Memory	1	3	1,2	Assignment 4
	14	Virtual Memory continued	1	3	2,3	
	15	Dead Lock	1	3	1,2	
	16	Embedded Linux	1	3	2,3,4	
	17	Protection and Security	1	3	2,3,4	
		Total	**15**	**45**		

Laboratory Projects/Experiments Done in the Course	Lab 1: Introduction & Basic Linux Commands
	Lab 2: Shell Scripting & vi, Aliases, Environment Variables and Subshells
	Lab 3: Working with SAMBA & network services
	Lab 4: Linux multifunction Server Management (LAMP stack) Postfix Thunderbird.
	Lab 5: System Call related to Process Management, argument arrays
	Lab 6: Inter- Process Communication
	Lab 7: System Configuration. Boot loader, Managing Services, System Startup Files (rc.d, rc.sysinit rc.local init.d), make, configure install, Integrity Checks
	Lab 8: Mid Exam
	Lab 9: Multithread Programming in Pthreads
	Lab 10: Multithread Programming in OpenMP (shared memory)
	Lab 11: Semaphores in Linux
	Lab 12: Working with Embedded Linux
	Lab 13: Linux hardening & security
	Lab 14: Final Lab Exam

Programming Assignments Done in the Course	4			
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 ___**Engr. Abdul Rahman Mahmood**_ __

Instructor Signature _____

Date _**12-01-2023**_____