National University of Sciences & Technology (NUST)
School of Electrical Engineering and Computer Science (SEECS)
Department of Computing

CS-330 Operating Systems

Course Code:	CS-330	**Semester:**	5th
Credit Hours:	3+1	**Prerequisite Codes:**	CS-110 Fundamentals of Computer Programming
Instructor:	Fahad Javed	**Class:**	BSCS-6 (Sec A & B)
Office:	A-308, SEECS Office block	**Telephone:**	
Lecture Days:	Mon, Wed, Fri	**E-mail:**	fahad.javed@seecs.edu.pk
Class Room:	RIMMS 21 & 2	**Consulting Hours:**	Tuesday 10:00-12:00
Lab Engineer:	Iram Tariq	**Lab Engineer Email:**	iram.tariq@seecs.edu.pk
Knowledge Group:	KGH-DB	**Updates on LMS:**	Once a week

Course Description:

The purpose of this course is to teach the design and implementation of operating systems. Topics covered include concepts of operating systems and systems programming; processes, threads, inter-process communication, and synchronization; memory allocation, segmentation, paging; loading and linking, libraries; resource allocation, scheduling, performance evaluation; I/O systems, storage devices, and file systems. The course will emphasize a highly hands-on approach asking students to implement thread scheduling, user programs, systems calls and virtual memory using the Pintos instructional operating system.

Course Objectives:

The main objective of the course is to teach students how to: 1) Design and implement systems-level software, 2) Understand how real operating systems work, and 3) Appreciate the tradeoffs involved in operating systems design.

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**BT Level***	**BT Level***
1. Explain & summarize OS services and abstractions	C-2	PLO-A
2. Analyze the applicability of different OS algorithms	C-4	PLO-B
3. Design & implement various pieces of OS software	C-5	PLO-C
4. Design and construct programs to interact with OS components through its API	P-6	PLO-I

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Program Learning Outcomes

A Computing Knowledge: An ability to apply knowledge of computing and mathematics appropriate to the discipline.

B Problem Analysis: An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.

C Design/Development of Solutions: An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.

D Individual & Team Work: An ability to function effectively on teams to accomplish a common goal.

E Ethics: An understanding of professional, ethical, legal, security and social issues and responsibilities.

F Communication: An ability to communicate effectively with a range of audiences.
G Societal Impact: An ability to analyze the local and global impact of computing on individuals, organizations, and society.
H Lifelong Learning: Recognition of the need for and an ability to engage in continuing professional development.
I Modern Tool Usage: An ability to use current techniques, skills, and tools necessary for computing practice.
J Investigation: An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
K Project Management: An ability to apply design and development principles in the construction of software systems of varying complexity

Books:

Text Book:
1. Avi Silberschatz, Peter Baer Galvin, and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley & Sons, Inc. ISBN 978-1-118-06333-0, December 2012.

Reference Books:
1. Andrew S Tanenbaum, Modern Operating Systems, 3rd Edition, Publisher: Prentice Hall, December 2007.
2. Elmasri, Ramez, A. Carrick, and David Levine. *Operating systems: a spiral approach*. McGraw-Hill, Inc., 2009.

Week	Lecture Topic	Reading List
01	Introduction to OS and Linux	OS Concepts (Ch#1, #2)
02	Introduction to OS (cont)	OS Concepts (Ch#3)
03	Process, program, I/O & System	OS Concepts (Ch#2)
04	Memory Management	OS Concepts (Ch#7)
05	Processes	OS Concepts (Ch#3)
06	**OHT-1**	
07	Process & memory interdependencies	OS Concepts (Ch#3&7)
08	Process Scheduling	OS Concepts (Ch#5)
09	Memory Management: Virtual Memory	OS Concepts (Ch#8)
10	Threads	OS Concepts (Ch#4)
11	Synchronization	OS Concepts (Ch#6)
12	Protection	OS Concepts (Ch#13-14)
13	**OHT-2**	
14	File Systems – II & I/O	OS Concepts (Ch#10,12)
15	Security	OS Concepts (Ch#14)
16	Memory Management: Virtual Memory – II	OS Concepts (Ch#8)
17	Advanced Topic: LINUX, Windows and FreeBSD	OS Concepts (Ch#15,16 A)
18	**End Semester Exam**	

Lab Experiments	
01	Introduction to Linux
02	Observing OS Behavior
03	Pintos Programming Assignment 1
04	Memory Management – I
05	I/O and file system
06	Shell Programming
07	Threads
08	Synchronization
09	Pintos Programming Assignment 2
10	Inter-process Communication
11	Memory Management – 2
12	Interacting with Linux Files

Tentative Grading Policy:

Theory

30% OHT
40% Final Exam
15% Quizzes
15% Assignments

Practical

60% Weekly Labs
40% Semester Project

Tools / Software Requirement:

Linux OS (preferably Ubuntu 12.04+), GNU C Compiler (GCC), Virtualization Software (VirtualBox/VMWare Player)

Grading Policy:

Quiz Policy:	The quizzes may be unannounced and normally last for ten minutes. The question framed is to test the concepts involved in last few lectures.
Assignment Policy:	The course website will be the primary source for announcements and submitting assignments.
Lab Conduct:	The labs will be conducted for three hours every week. A lab handout will be given in advance for study and analysis. The lab handouts will also be placed on LMS. The students are to submit their lab tasks at the end of lab for evaluation. One submission per group will be required. However, students may also be evaluated by oral viva during the lab.
Plagiarism:	Collaboration and group wok is encouraged but each student is required to submit his/her own contribution(s). Your writings must be your own thoughts. You must cite and acknowledge all sources of information in your assignments. Cheating and plagiarism will not be tolerated and will lead to strict penalties including zero marks in assignments as well as referral to the Dean for appropriate action(s).