OPERATING SYSTEMS (SEOS-225)

I. Course Details

Credit Hours	3 (2+1)
Pre-requisites	Data Structures and Algorithms
Course Leader	Dr. Jaweria Kanwal
Recommended Textbook(s)	Operating system by Albert shilberschatz, Latest Edition, 2021
Recommended Reference (Books/Websites/Articles)	1. Modern Operating Systems, Andrew Tanenbaum, Thirteen Edition, Prentice Hall, 2021 2. Operating System by William Stalling, Latest Edition, 2021

II. Course Learning Outcomes (CLOs)

CLOs	Description	Domain	Taxonomy Level	PLOs	Assessment Artifacts
CLO-1	**Explain** the characteristics and services of different structures of operating systems to state its main ideas.	Cognitive	2	2	A1, Q1, Mid term
CLO-2	**Demonstrate** basic structures, functions, and algorithms of OS to perform comparative analysis of algorithms.	Cognitive	2	2	A2, Q2, Midterm, Final Term
CLO-3	**Examine** algorithms of system resource management to select appropriate algorithms for resource management.	Cognitive	4	3	A3/Project, Q3, Final Term

III. Course Assessment

Evaluation Methods	Weight (%)
Quizzes	10
Assignments	10
Presentation/Project	5
Midterm	25
Final Term	50
Total	**100**

IV. Grading Policy

For students admitted in Fall 2021 and onwards

Grade	A+	A	B+	B	C+	C	D+	D	F
%age	>=90	80-89	75-79	70-74	65-69	60-64	55-59	50-54	<50
GPA	4.00	4.00	3.50-3.99	3.00-3.49	2.50-2.99	2.00-2.49	1.50-1.99	1.00-1.49	0.00

V. Course Contents

Introduction to Operating Systems, What is an OS, Single User Systems, Batch Systems, Multi programmed Systems, Time Sharing Systems, Multiprocessor Systems, Real Time Systems Computer System Structures (Computer System Operation, I/O Structure, Storage Structure, Storage Hierarchy, Hardware Protection) Operating System Structures (Operating Systems Concepts, System Calls) Processes & Threads (Process Concept, Process Scheduling, Operation on Processes, Cooperating Processes, Threads) CPU Scheduling (Introduction to Scheduling, Scheduling Criteria, Scheduling Algorithms) Process Synchronization (The Critical Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization) Deadlocks (Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection) Memory Management (Logical vs. Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging) Virtual Memory (Demand Paging, Page Replacement, Page Replacement Algorithms, Allocation of frames, Thrashing) File System Interface and Implementation (File Concept, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Implementation)

VI. Weekly Breakdown

Week No.	CLOs	Topics	References
1	CLO-1	Types of software, Application Software and System software, Application software categories, System software categories.	Chapter 1
2		Introduction to OS, Single user, Multi user and Network OS, H/W dependent and independent OS, Important OS components, Kernel, Shell, Shell types	Chapter 1
3		Type of services provided by OS, Uni- programming and Multi-programming, Uni-tasking and Multi-tasking, Uni- processing and Multi-processing.	Chapter 2
4		Distributed systems and its types, Reason for building distributed systems,	Chapter 2
5		SPOOLing, Buffering, Real-Time systems, Booting mechanism.	Chapter 3
6	CLO-2	Process and process states. Process Control Block, Independent and Cooperating processes, Process and Threads, Hierarchy of processes.	Chapter 3
7		Inter Process Communication, Process Synchronization, Race condition, Mutual exclusion, Critical section, Achieving process synchronization.	Chapter 3
8		Scheduler and scheduling queues, Types of schedulers, CPU and I/O bound processes, Context switching, Criteria for comparing CPU scheduling algorithms.	Chapter 4
9		**Midterm Exams**	
10	CLO-2	Multi-level queue scheduling, Multi-level feedback queue (MLFBQ) scheduler, Multi-processor scheduling, and CPU Scheduling Algorithm evaluation.	Chapter 5
11		Introduction to Deadlocks, Deadlock characterization, Deadlock prevention, Deadlock avoidance.	Chapter 5

12		Introduction to Banker's Algorithm and importance of its usage, Deadlock detection in single resource of each resource type.	Chapter 6
13		Deadlock detection in multiple resources of each resource type, Deadlock Recovery, Techniques used to recover processes from deadlock.	Chapter 6
14	CLO-3	Introduction of memory management, Swapping, Single partition allocation and Multiple partition allocation memory management schemes. Multiprogramming with Fixed partition.	Chapter 7
15		Multiprogramming with Variable partition, First-Fit, Best-Fit, Next-Fit and Worst-Fit algorithms. External fragmentation, Compaction, Paging, Segmentation.	Chapter 7
16		Virtual Memory, Demand Paging, Page Replacement, Page Replacement algorithms, Thrashing, Introduction to File System, Directory structure, Single and Two level directory, Tree structured directory, Acyclic graph directories, General graph directories, File protection.	Chapter 8

OPERATING SYSTEMS (SEOS-225) – LAB

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II. Lab Learning Outcomes (CLOs)

CLOs	Description	Domain	Taxonomy level	PLOs	Assessment Artifacts
CLO-1	**Demonstrate** the task by interpreting, summarizing, and explaining key concepts/ principles / relationships within the domain, enabling them to apply acquired knowledge effectively in diverse contexts.	Cognitive	2	2	Lab Task, Lab Report, Final Exam, Semester Project
CLO-2	**Practice** theoretical concepts for conducting the experiments / projects of varying complexities to achieve desired outcomes.	Psychomotor	3	4	Lab Task, Lab Report, Final Exam, Semester Project
CLO-3	**Practice** underlying theoretical concepts through modern tool usage to achieve desired outcomes.	Psychomotor	3	5	Lab Task, Final Exam, Semester Project
CLO-4	**Contribute** actively and responsibly individually or in teams during laboratory activities, demonstrating a positive attitude and willingness to participate.	Affective	2	6	Lab Task, Final Exam, Semester Project

III. Lab Assessment

Evaluation Methods	Weight (%)
Internal Evaluation (Lab Report/Lab Task/Lab Project)	60
Open Ended Lab	15
Final Term Exam	25
Total	**100**

IV.Weekly Breakdown (All CLOs shall be assessed in every lab)

Week No.	Topics
1	Introduction to Linux. Advantages of Linux and different versions of UNIX. Tutorial on installation of Linux. Getting started with your Linux and general overview of the OS
2	A brief introduction to a few of the basic commands of Linux.
3	Exploring the Linux file system, including the basic concepts of files and directories and their organization in a hierarchical tree structure.
4	Overview of The Bourne Again Shell
5	Performing Basic File Management (copy command (cp), move command (mv), rm, touch). Directory utilities (mkdir, rmdir) and wildcard patterns.
6	An introduction to Processing of Text Streams using Text Processing Filters.
7	Parameters passing in Linux.
8	Use of Unix Streams, Pipes and Redirects.
9	**Midterm Exams**
10	Implementation of Environment variables in Linux, Searching Text Files Using Regular Expressions (grep)
11	Programming Fundamentals, if-else, for, While, do while loop shell scripts.
12	Implementing Switch case structure, functions and Various Programming related exercises in Linux. fork (), getpid(), getppid(), wait(), opendir(), readdir(), closedir() system calls implementation using Linux.
13	File handling in Linux using System calls, Implementation of System calls using GCC Compiler in Linux.
14	**Open Ended Lab**
15	Implementation of various CPU scheduling algorithms
16	**Final Lab Exam**