Operating Systems

Code	Credit Hours
CS-330	3-1

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.

Text Book:

1. Operating Systems: Three Easy Pieces, Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, Arpaci-Dusseau Books, November 2023 (Version 1.10).
2. Avi Silberschatz, Peter Baer Galvin, and Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley & Sons, 2021.

Reference Book:

3. William Stallings, “Operating Systems: Internals and Design Principles”, 9th Edition, Pearson, 2021.
4. Andrew S Tanenbaum, Herbert Bos, “Modern Operating Systems”, 5th Edition, 2022.

Prerequisites

n/a

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Mid Terms	30%
ESE	50%

ASSESSMENT SYSTEM FOR LAB

Lab Work and Report	70%
Lab ESE/Viva	30%

Teaching Plan

Week No	Topics	Learning Outcomes
1	Introduction	Introduction OS and basic concepts
2-6	Abstraction and synchronization	Thread, process, and process management Files, I/O, Sockets and IPC Concurrency, Mutual Exclusion, Lock Implementation, Atomic Instructions Lock Implementation, Atomic Instructions, Futex Semaphores, Monitors, and Readers/Writers
7-8	Scheduling	Concepts and Classic Policies Policies and Case Studies Real-time, Starvation, Deadlock
9	**MID TERM EXAM**	
10-12	Memory Management and General I/O	Address Translation, Virtual Memory, Segments, and Page Tables Caching, TLBs, and Demand Paging Policies General I/O, Device Drivers, Storage Devices, Performance
13-17	File systems and distributed decision-making	Queueing Theory, File system Design File system Case Studies, Buffering Reliability, Transactions Distributed Decision Making, Networking, and TCP/IP
18	**End Semester Exam**	

Practical:

Experiment No	Description
1	Linux Introduction, Environment, and Basic Commands
2	Introduction to Shell Programming
3	Introduction to OS, Shell, and System Calls
4	Processes
5	Inter-process communication using pipes
6	Programming Threads
7	CPU Scheduling
8	Synchronizing Threads: Mutex
9	Synchronizing: Semaphores
10	Address Translation
11	Filesystem: understanding files and links
12	Filesystem: advanced file operations
13	Socket programming basics
14	Data transfer over the network using UDP
15	Data transfer over the network using TCP
16	Advanced CPU Scheduling