FACULTY OF ENGINEERING SCIENCES AND TECHNOLOGY

HIET, Hamdard University
CS223: Operating Systems (3+1)
Spring 2019

Instructor: **Iqbal Uddin khan**
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Office Hours: **08:20Hrs** – **16:00Hrs**
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Prerequisites: **CS – 111: Introduction to Computing**

Introduction:

This course intended as a general introduction to the techniques used to implement operating systems and related kinds of systems software. Among the topics covered will be process management (creation, synchronization, and communication); processor scheduling; deadlock prevention, avoidance, and recovery; main-memory management; virtual memory management (swapping, paging, segmentation and page-replacement algorithms); control of disks and other input/output devices; file-system structure and implementation; and protection and security. Most importantly, the interactions between these concepts are examined.

Course Objectives:

- To understand the services provided by and the design of an operating system.
- To understand the structure and organization of the file system.
- To understand what a process is and how processes are synchronized and scheduled.
- To understand different approaches to memory management.
- Students should be able to use system calls for managing processes, memory and the file system.
- Students should understand the data structures and algorithms used to implement an OS.

Course Learning Outcomes

By the end of the course student should be able to:

- Describe the general architecture of computers
- Describe, contrast and compare differing structures for operating systems
- Understand and analyze theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files

In addition, during the practical exercise and associated self-study, student will:

- Become familiar with the C language, gcc compiler, and Makefiles
- Understand the high-level structure of the Linux kernel both in concept and source code
- Acquire a detailed understanding of one aspect (the scheduler) of the Linux kernel

Overall Grading Policy	
Assessment Items	**Percentage**
Class Performance (Quizzes, Assignments)	**20%**
Midterm Exam	**30%**
Final Exam	**50%**
Lab	**50 Marks**

Recommended Book:

Operating Systems Concepts
9th Edition by Silberchatz and Galvin, ISBN-10: 1118063333, Publisher: **WILEY,** 2013

Reference Books:

- Operating Systems, Internal and Design Principles
  8th Edition by William Stallings, ISBN-10: 0133805913, Publisher: **PEARSON**, 2015
- Modern Operating Systems
  4th Edition by Andrew S. Tanenbaum, Herbert Bos, Prentice Hall, 2014

Course Break-Up

Week	Topics
01	Operating System Introduction ▪ Overview, what does an Operating System do? ▪ Computer System Organization ▪ Computer System Architecture
	▪ Operating System Structure ▪ Operating System Operations ▪ Computing Environments
	▪ Process Management ▪ Memory Management ▪ Storage Management
02	Operating System Structures ▪ Operating System Services ▪ User and Operating System Interface
	▪ System Calls ▪ System Programs
	▪ System Boot ▪ Operating System Generations
03	Processes ▪ Process Concept ▪ Process Control Block
	▪ Operations over Processes ▪ Process Scheduling
	▪ POSIX - FORK Process Creation Example Code ▪ Inter Process Communication
04	Threads ▪ Concept of Threads ▪ Multi-Core Programming
	▪ Multithreading Models
	▪ Thread Libraries
05	▪ Implicit Treading and Example Code ▪ POSIX Thread Libraries
	Process Synchronization ▪ Concept of Synchronization ▪ Synchronization Example Codes
	▪ Critical Section Problem ▪ Scheduling Algorithms
06	▪ Scheduling Algorithms (Continued) ▪ Peterson's Solution
	▪ Semaphores ▪ Semaphores Example Codes
	▪ Monitors ▪ Problems of Synchronization

Week	Topic
07	CPU Scheduling ▪ Concept of Scheduling ▪ Scheduling Algorithms
	▪ Examples and Gant Charts for Scheduling Algorithms ▪ Thread Scheduling
	▪ POSIX – PTHREAD Scheduling (Coding) ▪ Multi-Processor Scheduling
08	Deadlocks ▪ System Model ▪ Deadlock Characterization
	▪ Deadlock Prevention ▪ Deadlock Avoidance
	▪ Deadlock Detection ▪ Recovering from Deadlock
09	**Mid Term**
10	Main Memory ▪ Introduction of Main Memory ▪ Address Binding and Address Spaces
	▪ Swapping
	▪ Contiguous Memory Allocation
11	▪ Segmentation
	▪ Paging ▪ Structure of Page Table
	Virtual Memory ▪ Introduction of Virtual memory ▪ Demand Paging
12	▪ Copy on Write ▪ Page Replacement
	▪ Allocation of Frames ▪ Thrashing
	▪ Memory Mapped File ▪ Allocation of Kernel Memory
13	Mass Storage Structure ▪ Overview of Mass Storage Structure
	▪ Disk Structure ▪ Disk Attachment ▪ Disk Scheduling
	▪ Disk Management ▪ Swap Space Management

Week	Topic
14	▪ Swap Space Management (Continued)
	▪ RAID Structure ▪ Stable Storage Management
	File System Interface ▪ File Concepts ▪ Access Methods ▪ Directory and Disk Structure
15	▪ File System Mounting ▪ File Sharing ▪ Protection
	File System Implementation ▪ File System Structure ▪ File System Implementation ▪ Directory Implementation
	▪ Allocation Methods ▪ Free Space Management ▪ Recovery
16	I / O Systems ▪ I / O Hardware ▪ Application I / O Interface
	▪ Kernel I / O Subsystem ▪ I / O Requests to Hardware Operation Transformation
	▪ STREAMS ▪ Performance
	Final Examination

Chairman
Department of Computing

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Lab Practical

S. No	Objective
1	Introduction to Operating Systems
2	Bootloader
3	Introduction to Command Line Interface
4	System Calls (Linux and Windows)
5	Adding Modules in Kernel
6	Inter - Processes Communication
7	Race Condition and Zombie Processes
8	Process Synchronization
9	Windows and Linux Thread Libraries
10	Scheduling Schemes
11	Deadlocks
12	Memory Management
13	Virtual Memory
14	File System Access and Control Systems
15	Disk Management Algorithms