**Faculty of Engineering & CS**

***Department of Engineering***

**Course Title: Operating Systems**

**Credit Hours: 3+1**

**Program: BS Software Engineering (Morning)**

**Semester: IV**

**Course Instructor: Naveed Ahmad**

1. **Course content:**

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| 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) |

**ii. Course objectives and learning outcomes.**

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| 1. Objectives.  * To provide a good understanding of the concepts those underlying operating systems. * Provide an opportunity to use basic concepts to solve real world problems. * Provide an opportunity to apply the concepts learned through implementation of the components of operating systems. * Define and list the functions of an operating system * List and explain common features of operating systems * Explain the historical reasons why different features of operating systems were developed * Contrast batch, on-line (interactive) and real-time processing * Contrast real-time transaction processing and process-control operating systems * Differentiate between multiprocessing, multiprogramming, and multitasking * Explain the purpose and examples of spooling of input and output * Explain the developments of different versions of popular operating systems, including DOS/Windows and UNIX/Linux * Compare a monolithic kernel with a microkernel * Justify the use of layers of abstraction and explain the concept of hardware-OS boundary transparency * Explain benefits of object-oriented design in operating systems  1. Learning Outcomes  * Compare the functionality of different computing hardware structures and Operating Systems Structures. * Discuss issues of Process Management including process structure, synchronization, scheduling and communication. * Demonstrate memory management issues including advance techniques of paging, segmentation and virtual memory. * Explain the operation of various File Management Algorithms. * Discuss the issues related to I/O Sub-systems, Threats and specialized operating systems. |

**iii. Weekly lecture logs**

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| Week no | Topics |
| 1 | Introduction to Operating system, Computer system organization |
| 2 | Computer hardware review, OS structure. Computing environments  I/O Controllers, Methods of I/O, Programmed Driven I/O, Interrupt Driven I/O, DMA Driven I/O |
| 3 | Types of I/O Controllers in detail, |
| 4 | Hardware Protection Issues |
| 5 | System calls and device drivers, operating systems structures |
| 6 | Process Management, Intro to processes, the process model |
| 7 | Process creation, process termination, process hierarchies.  Process states, Implementation of processes. |
| *Online Classes* | |
| 8 | Modeling multiprogramming. Intro to threads. |
| 9 | Threads usage, classical thread model, Context switching.  Inter-process communication |
| 10 | Scheduling Concepts, Types of Schedulers. |
| 11 | CPU Scheduling, Scheduling Algorithms in detail |
| 12 | Dead Locks  File system Management, Data structures for File Management.  FAT, Drive parameter Block, File Control Block. |
| 13 | Memory Management, Data structures related to Memory Management. |
| 14 | Paging, Segmentation. |
| 15 | Paging Model for 32 word memory with 4 word pages |
| 16 | Security Issues related to Operating systems |

**iv. Course material /Lecture notes**

* PPT with Audio
* Videos (desktop recordings)
* E Classroom recordings etc

**v. Assessment and grading**

**1. Quiz 10% marks**

**2. Assignments 10% marks**

**3. Mid+End Term Examination 30%+50% marks**

**vi. Assignments with submissions deadlines.**

Starting from 20th November.

**vii. No. of video scripts/online lectures** : Equivalent to 3 credit hours per week. Number of video files may vary due to keeping the file size small.

**viii. Electronic resources**

Zoom, Google Meet, WhatsApp, YouTube channel, reference videos.

**ix. Database for Quiz, Assignments and End-term Questions with answers.**

Will be maintained on LMS time-to-time

**x. Recommended Text Book(s)**

* Silberschatz, Galvin and Gagne, ‘Operating System Concepts’, 10th Edition, 2018, John Wiley & Sons, Inc.

**xi. Reference Book(s) if any.**

* Andrew S. Tanenbaum, ‘Modern Operating Systems’, 4th Edition, 2014, Prentice Hall, Inc.