Far WesternUniversity

Faculty of Engineering

Bachelor in computer engineering

(Course of Study)

Course Title: Operating System	**Credit: 3**
CourseCode: CT 356	**Number of lecture/week:3**
Year/Semester: Third/Fifth	**Tutorial/week:1**
Level:Bachelor of Engineering(Computer)	**Totalhours:45**

Course Introduction

The course aims to explore the importance of the operating system and its function.

Course Objectives

- Write all or parts of a simple operating system that performs interrupt processing (real or simulated), CPU management (scheduling), and memory management.
- Compare several different approaches to memory management, file management and processor management and also describe various problems related to concurrent operations and their solutions.
- Explain in detail virtual address translation and distinguish it from the use of cache.
- Discuss various file system organizations and their interaction with the rest of the operating system.
- Discuss various threats to system security and compare protection mechanisms which may be used against the threats.

Through this course, Students will learn different aspects of operating system and its functions and use the idea to design operating system.

Course Outline

Specific Objectives	Contents (UNIT/CHAPTER)	Duration (Time allocated)
Introduction to Operating System	**Chapter1. Introduction** Operating system and functions, Evolution, Types of Operating System(Batch, Interactive, Real Time), Booting, OS Structures (Monolithic, Microkernel, Layered, Virtual Machine), System Call, Shell commands and programming, Examples of OS	**6hr**
Process Management	**Chapter2. Process Management** Introduction to Process (Process description, states and PCB),	**8hr**

	Concept of Thread and Multithreading, Scheduling (preemptive and non preemptive) , Scheduling criteria, Scheduling algorithms used in batch system, interactive system and real time system, Multiprocessor Scheduling	
Process Communication and Synchronization	**Chapter3. Process Communication and Synchronization** Principles of Concurrency, Mutual Exclusion and critical section, Mutual Exclusion with Busy waiting, Semaphores and Mutex, Message Passing and Monitors, Classical Inter Process Communication problems: Producers Consumer problem, Dining Philosopher problem, Sleeping Barber Problem	**5hr**
Memory Management	**Chapter4. Memory Management:** Background, Basic Hardware for managing Memory, Address binding, Swapping, Contiguous allocation (based on fixed and variable partitions), Relocation and protection problems, Fragmentation, Non-contiguous allocation (Paging + hardware support, Segmentation) ,Multilevel Paging, Paging with Segmentation, Page Faults and Page Replacement Algorithms, Demand Paging, Thrashing	**8hr**
Deadlock Management	**Chapter5. Deadlock Management** Introduction, Deadlock Conditions, Deadlock Handling Strategies, Deadlock Detection, Prevention, Avoidance, Ignorance, Recovery	**5hr**
File System Management	**Chapter6. File System and I/o Management** File system structure, Implementation, Partition and mounting, Allocation methods (Contiguous, Linked List, Indexed), Free space Management (Bit vector, Linked list, Grouping, Counting), File System Performance, Efficiency reliability and file sharing, Principle of I/O Hardware and Software, I/O Software Layers, D|isk Arm Scheduling, Error Handling	**8hr**

System Security	**Chapter7. System Security** Principle of least privilege, Threats and vulnerabilities, Protection mechanisms - access and capability control, Attacks, Cryptography and Encryption Algorithms , User (subject) authentication, Levels of security in "trusted" systems, The confinement problem	**5hr**

Project work

If a single project is used, it should involve the writing of an operating system, most likely for a simulated machine. Such a project would be worked on by teams of students (2 or 3 per team) and needs to include authentication, memory management, device handling, CPU scheduling and some form of resource conflict (preferably over files).

If multiple small projects are used, they need to encompass the same topics or provide equivalent alternatives, such as interprocess communication instead of resource conflict or thread management instead of CPU scheduling. Small projects may be worked on by students individually or in pairs.

Tutorials/Assignments

Four to five class assignments will be provided to the students along with class works in classes.

Practical

Each practical lab is fully instructed and the lab manual consists of stepwise instruction necessary for carrying out lab work. Each lab consists of sets of questions that has to be answered and submitted to the instructor via eLearning.

SN	Topics	Hours	Remarks
1	Unix Commands and Shell Programming	3	
2	Process Scheduling Algorithms	3	
3	Bankers Algorithms	3	
4	Process Synchronization, Semaphores	3	
5	Page Replacement Algorithms	3	
6	Access control and Privilege, Authentication	3	

References

- Silberschatz, Galvin, & Gagne, Operating Systems Concepts, Seventh Edition, Wiley, 2005
- Stalling William, “Operating Systems”, 6th Edition, Pearson Education
- Andrew S. Tanenbaum, “Modern Operating Systems”, 3 rd Edition, PHI
- Charles Crowley, “Operating Systems: A Design-oriented Approach”, TMH

Evaluationscheme

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as possible as indicated in the table below:

Chapters	Hours	Marks distribution* (Tentative %)
Chapter 1. Introduction	6	14
Chapter 2. Process Management	8	18
Chapter 3. Process Communication and Synchronization	5	10
Chapter 4. Memory Management	8	18
Chapter 5. Deadlock Management	5	10
Chapter 6. File and I/O Management	8	18
Chapter 7. System Securities	5	12

* There may be minor variation in marks distribution

Internal Evaluation (Marks Weightage)		Final Exam (Marks Weightage)	Total	Remarks
Assessment/Class Performance/Attendance/Quizzes/ Tutorials/Presentation	Practical			
20	20	60	100	Internal marks will be of 20 if there are practicals in the course (20 marks will be allocated for Practicals)