**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**New Scheme Based On AICTE Flexible Curricula**

**CSE-Artificial Intelligence and Machine Learning/ Artificial Intelligence and Machine Learning, V-Semester**

**AL-501Operating Systems**

**COURSE OBJECTIVES:**

To makestudentsunderstand the importance and overall functioning of an Operating System; To acquaint the students with the concepts and principles that underlie the modern Operating Systems, and to provide them an insight in the working of its various modules.

**COURSE OUTCOMES:**

**After completing the course, student should be able to:**

1. Get clear understanding about the need and objectives of an Operating System and various services provided by the Operating Systems.
2. Gain a detailed knowledge about the functions of different modules of an Operating System, viz. process management, file system management, memory management, device management etc.
3. Visualize the internal implementation of various modules of Operating System and correlate the same with the actual implementation of these modules in Unix/Linux and other contemporary Operating Systems.
4. Acquire the ability to design and implement small modules of Operating System, Shell and Commands, using system calls of Unix/Linux or some educational Operating System.

**COURSE CONTENTS:**

**UNIT1**: **Introduction to Operating Systems**: Function, Evolution, Different types of Operating Systems, Desirable Characteristics and features of an O/S.
**Operating Systems Services**: Types of Services, Different ways of providing these Services– Commands, System Calls.Need of System Calls, Low level implementation of System Calls, Portability issue, Operating System Structures.

**UNIT II: File Systems (Secondary Storage Management):** File Concept, User's and System Programmer's view of File System, Hard Disk Organization, Disk Formatting and File System Creation, Different Modules of a File System, Disk Space Allocation Methods – Contiguous, Linked, Indexed. Disk Partitioning andMounting; Directory Structures, File Protection; Virtual and Remote File Systems. Case Studies of File Systems being used in Unix/Linux & Windows; System Calls used in these Operating Systems for file management.

**UNITIII: Process Management**: Concept of a process, Process State Diagram, Different type of schedulers, CPU scheduling algorithms, Evaluation of scheduling algorithms, Concept of Threads: User level & Kernel level Threads, Thread Scheduling;Multiprocessor/Multicore Processor Scheduling.Case Studies of Process Management in Unix/Linux& Windows; System Calls used in these Operating Systems for

Process Management.
**Concurrency& Synchronization:**Real and Virtual Concurrency, Mutual Exclusion, Synchronization, Critical Section Problem, Solution to Critical Section Problem: Mutex Locks; Monitors; Semaphores,WAIT/SIGNAL operations and their implementation;Classical Problems of Synchronization;Inter-Process Communication.
**Deadlocks:**Deadlock Characterization, Prevention, Avoidance, Recovery.

**UNIT IV**: **Memory Management**: Different Memory Management Techniques –Contiguous allocation; Non-contiguous allocation: Paging, Segmentation, Paged Segmentation; Comparison of these techniques.
**Virtual Memory** – Concept, Overlay, Dynamic Linking and Loading, Implementation of Virtual Memory by Demand Paging etc.; Memory Management in Unix/Linux& Windows.

**UNIT V: Input/Output Management**: Overview of Mass Storage Structures, Disk Scheduling;I/O Systems: Different I/O Operations- Program Controlled, Interrupt Driven, Concurrent I/O, Synchronous/Asynchronous and Blocking/Non-Blocking I/O Operations, I/O Buffering,Application I/O Interface, Kernel I/O Subsystem, Transforming I/O requests to hardware operations.

Overview of Protection & Security Issues and Mechanisms; Introduction to Multiprocessor, Real Time, Embedded and Mobile Operating Systems; Overview of Virtualization.

**TEXTBOOKSRECOMMENDED**:


1. Silberschatz, Galvin, Gagne, “Operating System Concepts’’,John Wiley& Sons.
2. William Stalling, “Operating Systems: Internals and Design Principles”, Pearson.


**REFERENCEBOOKS**:


1. Andrew S. Tanenbaum, “Modern Operating Systems”, Prentice Hall.
2. Robert Love, “Linux Kernel Development”, Pearson.
3. Maurice J. Bach, “The Design of Unix Operating System”, Pearson.
4. Bovet &Cesati, “Understanding the Linux Kernel”, O'Reilly.