# Amrita School of Engineering, Amritapuri Campus, Amrita Vishwa Vidyapeetham

**Department of Computer Science and Engineering Course Plan November 2023- March 2024**

**22AIE202 OperatING SYSTEMS**

**OPerating Systems L-T-P-C: 2- 0- 3- 3**

**S3 B.Tech. CSE\_AIE**

## Faculty Information

Name: Prathibhamol C P

## Course Objectives

* This course gives an insight to the important problems in operating system design and implementation.
* This course helps the students to understand the operating system responsibilities like sharing resources, files, memory and process scheduling.
* This course covers the major components of most operating systems and the trade-offs between performance and functionality in the design and implementation of an operating system.
* In this course, emphasis will be given to three major OS subsystems: process management, memory management, and file systems; and on operating system support for distributed systems.

## Course Syllabus

**Syllabus**

**Unit 1**

Operating systems, structure, operating systems services, system calls. Process and Processor management: Process concepts, process scheduling and algorithms, threads, multithreading. CPU scheduling and scheduling algorithms

**Unit 2**

Process synchronization, critical sections, Deadlock: Shared resources, resource allocation and scheduling, resource graph models, deadlock detection, deadlock avoidance, deadlock prevention algorithms, mutual exclusion, semaphores, monitors, wait and signal procedures. Memory management: contiguous memory allocation, virtual memory, paging, page table structure, demand paging, page replacement policies, thrashing, segmentation, case study.

**Unit 3**

Disk scheduling algorithms and policies, File management: file concept, types and structures, directory structure, Case study on Unix (about process management, Thread management and Kernel) and Mobile OS – iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System)

**Textbooks/References**

*Silberschatz and Galvin, “Operating System Concepts”, 9th Edition, Wiley India, 2009.*

*Tannenbaum A S, “Modern Operating Systems”, Prentice Hall India, 2003.*

*W. Stallings, “Operating Systems: Internals and design Principles”, Pearson Ed., LPE, 6th Ed., 2009*

*M.J. Bach, “Design of Unix Operating system”, Prentice Hall, 1986*

## Course Outcomes (CO)

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| --- | --- | --- |
|  | **Course Outcome** | **Bloom’s Taxonomy Level** |
| CO 1 | Apply system calls to implement basic OS functionalities | L2 |
| CO 2 | Apply the algorithms for resource management and scheduling | L3 |
| CO 3 | Apply semaphores and monitors for synchronization problems. | L4 |
| CO 4 | Implement memory management schemes. | L4 |

1. **Lecture Plan**

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| **Lecture Hours** | **Topics** | **Keywords** | **Objectives** | **CO** |
| 01-03 | Introduction to operating system. | Overview –operating systems services – system calls – system structure | Introduction to Operating Systems  Understand and study the operating system structures.  Study of system calls and implementation of system calls | CO1 |
| Lab 1 | Linux | Linux commands | Basic linux command, | CO1 |

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|  | commands |  | booting |  |
| 04-06 | Process management | Process concepts, Process scheduling, Operation on processors, Inter process communication, cooperating process | Introduction to the concept of processes, operations on processes.  Overview of Interprocess Communication and how to implement it. | CO1, CO2 |
| Lab 2 | Shell scripting | SH, Bash | Programs using shell | CO1 |
| 7-11 | CPU  scheduling | Concepts, scheduling algorithms-FCFS, SJF, priority, RR, Multilevel queue, Multilevel feedback queue | Introduction to CPU scheduling concepts  Understand various CPU scheduling algorithms and solve problems and compare the performance of various scheduling algorithms | CO2 |
| Lab 3 | Shell Scripting | SH, Bash | Program using shell | CO1 |
| 12-16 | Process synchronizat ion | Critical section problem, Synchronization hardware, Semaphore, classical problems, critical regions, monitors | Understand the concurrency concepts, critical-section problem and various solutions for CS problem.  Solve classical and real- world synchronization scenarios using semaphores and monitor concepts | CO3 |
| Lab 4 | System calls | Parent process, child process creation | Program using system calls like fork(), exit() and exec() | CO1 |
| **Midterm Examination** | | | |  |
| 17- 21 | Deadlocks | Characterization, handling deadlocks, prevention,  avoidance, detection, Recovery | Overview of deadlock concepts and ways for handling deadlocks  Understand and apply Banker’s algorithm for handling deadlocks | CO3 |
| Lab 5 | System calls | Parent process, child process | Program using system calls | CO1 |

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| 22 - 26 | Storage management  - Memory managemen | Swapping , continuous memory allocation, paging, segmentation, segmentation with paging | Introduction to memory management concepts  Working of paging and segmentation concepts | CO4 |
| Lab 6 | Inter process communication mechanisms | System calls for communication between processes | Programs with pipe() system call | CO1 |
| 27-29 | Virtual memory | Demand paging, process creation, page replacement, thrashing | Study of Demand paging and various page replacement algorithms for virtual memory management | CO4 |
| Lab 7 | Inter process communication mechanisms | System calls for communication between processes | Programs with pipe() system call | CO1 |
| 30 | File systems | Directory structure, implementation, disk scheduling | Study of various I/O structure and how to implement it. | CO4 |
|  | Case Study | Case study on Unix (about process management, Thread management and Kernel) and Mobile OS – iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System) |  | CO2 |
| **END SEMESTER EXAMINATIONS** | | | |  |

1. **Evaluation and Grading**

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| **Assessment** | **Internal/External** | **Weightage (%)** |
| Assignments (Minimum 2)  Case study Presentation-10  Lab Exam- 10  Timely submission of Lab Assignments-3  Lab Viva-7 | Internal | 30 |
| Quizzes (Minimum 2)  2 Online Exam-20 | Internal | 20 |
| Mid-Term Examination | Internal | 20 |
| End Semester Examination | External | 30 |

## CO – PO Affinity Map

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| PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO |
| CO1 | 2 | 1 | 2 | 3 | 1 | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO2 | 2 | 1 | 2 | 3 | 1 | - | - | - | 3 | 3 | - | 3 | 3 | 2 | - |
| CO3 | 2 | 1 | 2 | 3 | 1 | - | - | - | 3 | 3 | - | 3 | 3 | 3 | - |
| CO4 | 1 | - | - | 1 | 3 | - | - | - | 3 | 3 | - | 3 | - | 1 | - |