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| **­Course Title and Code: Operating System (CS1108)** | |
| **Hours per Week** | L-T-P: 3-0-2 |
| **Credits** | 4 |
| **Students who can take** | B.Tech, Sem IV |
| **Prerequisites** | Computer Organisation and Architecture, C programming |
| **Weightage** | Theory 70%, Lab 30% |
| **Course Objectives:** The aim of this course is to describe the structure and functioning of operating systems. Students will learn the concepts that are used in modern OSes including process management, concurrency, scheduling, memory management, file systms and I/O. Students will also learn about low level Linux systems programming. | |
| **Course Outcome:**  On successful completion of this course, the students should be able to:  **CS1108.1** Understand the structure of OS and its interface with hardware.  **CS1108.2** Understand and use services and system calls provided by the Linux OS.  **CS1108.3** Understand the concepts of processes and threads, and their management, scheduling and synchronization.  **CS1108.4** Understand virtual memory, paging, segmentation and other memory management concepts.  **CS1108.5** Understand file systems and I/O. | |

**Evaluation:**

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| **S.No.** | **Specifications** | | **Marks** |
| 1 | Class Participation | | 5 |
| 2 | Assignments | | 10 |
| 3 | Lab Evaluation (Continuous) | | 20 |
| 4 | MidTerm I | | 15 |
| 5 | MidTerm II | | 15 |
| 6 | Final Exam | | 35 |
|  | **Total(100)** | | 100 |
| **Evaluation Scheme for Retest** | | | |
| 1 | Theory Exam – III | 35 | |
|  | **Total** | **35** | |

**Syllabus**

**Introduction:** Review of computer organisation and architecture, functions of operating systems.

**Linux system calls and services**.

**Processes:** Foundations, Process states, Context switching, Inter process communication, Threads and concurrency.

**Scheduling:** Foundations, Types of Schedulers, Scheduling criteria, Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, Priority, R-R scheduling, Multilevel queue scheduling.

**Synchronization:** Foundations, Classic Synchronization Problems: Readers-Writer Problem, Dinning Philosopher Problem

Critical section, Race condition, semaphores, monitors, message passing, **Deadlock:** Shared resources, resource allocation and scheduling, resource graph models, deadlock prevention, deadlock avoidance, deadlock detection, deadlock recovery algorithms.

**Memory Management** - Memory management schemes, Contiguous/Non-contiguous memory allocation, storage management, paging, page table structure, segmentation, segmentation with paging, virtual memory, demand paging, page fault, Page replacement algorithms.

**File Management** - File concept, types and structures, attributes of a file, operations performed on file, File organization and access method, file allocation methods, directory structure, file directories, directory implementation.

**I/O systems** - I/O devices, I/O hardware, device driver, Kernel I/O sub-system, Interrupt, Disk scheduling.

**Text Books:**

1. Silberschatz, Galvin and Gagne: Operating System Concepts. Wiley, 9th ed.
2. Arpaci-Dusseau and Arpaci-Dusseau: Operating Systems: Three Easy Pieces: available online at https://pages.cs.wisc.edu/~remzi/OSTEP/
3. Stevens and Rago: Advanced Programming in the UNIX environment. Addison-Wesley, 3rd ed.

**Reference Books:**

1. Andrew S. Tanenbaum and Herbert Bos. Modern Operating Systems, Pearson Education, 2014.
2. Thomas Anderson and Michael Dahlin. Operating Systems: Principles and Practice, Recursive Books, 2014.

**Reference Online Course:**

1. <https://nptel.ac.in/courses/106106144>
2. <https://nptel.ac.in/courses/106105214>

**Course Articulation Matrix: (Mapping of COs with POs)**

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| **Course Outcome** | **Correlation with Program Outcomes** | | | | | | | | | | | | | | | | **Correlation with Program Specific Outcomes** | | |
| PO 1 | PO 2a | PO 2b | PO 2c | PO 3a | PO 3b | PO 3c | PO 4a | PO 4b | PO 4c | PO 5a | PO 5b | PO 6 | PO 7a | PO 7b | PSO1 | | PSO2 |  |
| **CS1108.1** | 2 |  |  |  | 3 | 1 |  |  | 1 |  |  |  | 1 |  |  | 1 | | 3 |  |
| **CS1108.2** | 2 |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 1 |  |  | 1 | 1 | 2 | | 2 |  |
| **CS1108.3** | 2­ |  |  |  | 3 | 3 |  | 2 | 1 |  |  |  |  |  |  | 2 | | 2 |  |
| **CS1108.4** | 2 |  |  |  | 3 | 2 |  | 1 | 1 | 1 |  |  |  | 1 |  | 2 | | 2 |  |
| **CS1108.5** | 2 |  |  |  | 2 | 2 |  |  | 1 | 1 |  |  |  |  |  | 1 | | 2 |  |

**1: Low Correlation; 2: Moderate Correlation; 3: Substantial Correlation­**