**GUJARAT TECHNOLOGICAL UNIVERSITY**

**Syllabus for Integrated M.Sc. (Computer Science)**
**(With Specialization: AI and Data Science/IoT/ Cyber Security)**

**With effective from academic year 2022-23**

**Subject Code: 1330301**
**Semester- III**
**Subject Name: Operating System**

## Teaching and Examination Scheme

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE(E) | PA (M) | PA (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

## Content:

| Sr. No. | Content | Teaching Hours | Module Weightage (%) |
|---|---|---|---|
| 1. | **Introduction:** Computer system overview, Architecture, Goals & Structures of O.S, Basic functions, Interaction of O.S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real-time O.S. | 4 | 12 |
| 2. | **Process and Threads Management:** Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR, Priority, Thread Scheduling, Real Time Scheduling. System calls like ps, fork, join, exec family, wait. | 7 | 17 |
| 3. | **Concurrency:** Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Pipes, Message Passing, Signals, Monitors. | 5 | 14 |
| 4. | **Inter Process Communication:** Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc., Scheduling, Scheduling Algorithms. | 7 | 16 |
| 5. | **Deadlock:** Principles of Deadlock, Starvation, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, System calls. | 5 | 12 |
| 6 | **Memory Management:** Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Swapping, Paging and Fragmentation. Demand Paging, Security Issues.<br>Virtual Memory: Concepts, VM management, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing. | 7 | 15 |
| 7 | **I/O Management & Disk Scheduling:** I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, | 5 | 14 |

| | | | |
|---|---|---|---|
| | Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache. | | |

**Reference Books:**

1. Operating Systems: Internals & Design Principles, 9th Edition, William Stallings, Pearson Education India.
2. Operating System Concepts, 9th Edition Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
3. Modern Operating Systems, Andrew S. Tanenbaum (PHI).

**Course outcomes:**

After learning the course, the students should be able to:

| No. | CO statement |
|---|---|
| CO-1 | Analyze the structure of OS and basic architectural components involved in OS design. |
| CO-2 | Compare and contrast various CPU scheduling algorithms. |
| CO-3 | Evaluate the requirements for the process synchronization and co-ordination in contemporary operating system. |
| CO-4 | Analyze various algorithms for memory management, I/O management and security aspects of operating system. |
| CO-5 | Write shell scripts in Unix/Linux O.S and write simple programs using kernel system calls. Also understand virtualization concept. |