



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3141601

Semester – IV

Subject Name: Operating System and Virtualization

**Type of course:** Undergraduate

**Prerequisite:** Linear and non-linear data structures, working experience of any one structured programming language

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
4	0	2	5	70	30	30	20	150

**Syllabus:**

Sr. No.	Content	Total Hrs	% Weightage
1	<b>Introduction:</b> 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.	5	10
2	<b>Process and Threads Management:</b> 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.	8	15
3	<b>Concurrency:</b> Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Pipes, Message Passing, Signals, and Monitors.	4	08
4	<b>Inter Process Communication:</b> 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, Dining Philosopher Problem etc., Scheduling, Scheduling Algorithms.	8	15
5	<b>Deadlock:</b> Principles of Deadlock, Starvation, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, System calls.	4	08
6	<b>Memory Management:</b> 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. <b>Virtual Memory:</b> Concepts, VM management, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing.	8	15



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7	<b>I/O Management &amp; Disk scheduling:</b> I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache.	6	10
8	<b>Unix/Linux Operating System:</b> Development Of Unix/Linux, Role & Function Of Kernel, System Calls, Elementary Linux command & Shell Programming, Directory Structure, System Administration Case study: Linux, Windows Operating System	4	07
9	<b>Virtualization Concepts:</b> Virtual machines; supporting multiple operating systems simultaneously on a single hardware platform; running one operating system on top of another. True or pure virtualization.	3	05
10	Approaches to Virtualization: Processor Issue, Memory Management, I/O Management, VMware ESXi, Microsoft Hyper-V and Xen Variants, Java VM, Linux VServer Virtual Machine Architecture, Android Virtual Machine.	5	8

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

**Course outcomes:** Students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Learn and understand the concepts, core structure of Operating Systems and basic architectural components involved in operating systems design.	
CO-2	Understand the process management policies and scheduling of processes by CPU.	
CO-3	Evaluate the requirement for process synchronization and coordination handled by operating system.	
CO-4	Describe and analyze the memory management and its allocation policies.	
CO-5	Analyze various device and resource management techniques for timesharing	
CO-6	Conceptualize the components involved in designing a contemporary Operating Systems	

### Reference Books:

1. Operating Systems: Internals & Design Principles, 8<sup>th</sup> Edition, William Stallings, Pearson Education India
2. Operating System Concepts, 9<sup>th</sup> edition Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
3. Modern Operating Systems-By Andrew S. Tanenbaum (PHI)



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1. **List of Experiments:** Study of Basic commands of Linux/UNIX.
2. Study of Advance commands and filters of Linux/UNIX.
3. Write a shell script to generate marksheet of a student. Take 3 subjects, calculate and display total marks, percentage and Class obtained by the student.
4. Write a shell script to display multiplication table of given number
5. Write a shell script to find factorial of given number n.
6. Write a shell script which will accept a number b and display first n prime numbers as output.
7. Write a shell script which will generate first n fibonnacci numbers like: 1, 1, 2, 3, 5, 13, ...
8. Write a menu driven shell script which will print the following menu and execute the given task.
  - a. Display calendar of current month
  - b. Display today's date and time
  - c. Display usernames those are currently logged in the system
  - d. Display your name at given x, y position
  - e. Display your terminal number
9. Write a shell script to read n numbers as command arguments and sort them in descending order.
10. Write a shell script to display all executable files, directories and zero sized files from current directory.
11. Write a shell script to check entered string is palindrome or not.
12. Shell programming using filters (including grep, egrep, fgrep)
13. Study of Unix Shell and Environment Variables.
14. Write a shell script to validate the entered date. (eg. Date format is : dd-mm-yyyy).
15. Write an awk program using function, which convert each word in a given text into capital.
16. Write a program for process creation using C. (Use of gcc compiler).
17. Study of Basic commands of Linux/UNIX.
18. Study of Advance commands and filters of Linux/UNIX.
19. Write a shell script to generate marksheet of a student. Take 3 subjects, calculate and display total marks, percentage and Class obtained by the student.
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25. Write a shell script to read n numbers as command arguments and sort them in descending order.
26. Write a shell script to display all executable files, directories and zero sized files from current directory.
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**List of Open Source Software/learning website:- [www.nptel.ac.in](http://www.nptel.ac.in)**