



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3140702

Semester – IV

Subject Name: Operating System

**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, 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
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



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8	<b>Security &amp; Protection:</b> Security Environment, Design Principles Of Security, User Authentication, Protection Mechanism : Protection Domain, Access Control List	4	07
9	<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
10	<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

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

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	35	15	0	0	0

**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	Analyze the structure of OS and basic architectural components involved in OS design	10
CO-2	Compare and contrast various CPU scheduling algorithms.	20
CO-3	Evaluate the requirements for the process synchronization and co-ordination in contemporary operating system.	30
CO-4	Analyze various algorithms for memory management, I/O management and security aspects of operating system.	30
CO-5	Write shell scripts in Unix/Linux O.S and write simple programs using kernel system calls. Also understand virtualization concept.	10

### Reference Books:

1. Operating Systems: Internals & Design Principles, 9<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)

### List of Experiments: Study of Basic commands of Linux/UNIX.

1. Study of Advance commands and filters of Linux/UNIX.
2. 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.
3. Write a shell script to display multiplication table of given number
4. Write a shell script to find factorial of given number n.
5. Write a shell script which will accept a number b and display first n prime numbers as output.



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6. Write a shell script which will generate first n fibonacci numbers like: 1, 1, 2, 3, 5, 13, ...
  7. 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
  8. Write a shell script to read n numbers as command arguments and sort them in descending order.
  9. Write a shell script to display all executable files, directories and zero sized files from current directory.
  10. Write a shell script to check entered string is palindrome or not.
  11. Shell programming using filters (including grep, egrep, fgrep)
  12. Study of Unix Shell and Environment Variables.
  13. Write a shell script to validate the entered date. (eg. Date format is : dd-mm-yyyy).
  14. Write an awk program using function, which convert each word in a given text into capital.
  15. Write a program for process creation using C. (Use of gcc compiler).
  16. Study of Basic commands of Linux/UNIX.
  17. Study of Advance commands and filters of Linux/UNIX.
  18. 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.
  19. Write a shell script to display multiplication table of given number
  20. Write a shell script to find factorial of given number n.
  21. Write a shell script which will accept a number b and display first n prime numbers as output.
  22. Write a shell script which will generate first n fibonacci numbers like: 1, 1, 2, 3, 5, 13, ...
  23. Write a menu driven shell script which will print the following menu and execute the given task.
    - a. Display calendar of current month
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    - c. Display usernames those are currently logged in the system
    - d. Display your name at given x, y position
    - e. Display your terminal number
  24. Write a shell script to read n numbers as command arguments and sort them in descending order.
  25. Write a shell script to display all executable files, directories and zero sized files from current directory.
  26. Write a shell script to check entered string is palindrome or not.
  27. Shell programming using filters (including grep, egrep, fgrep)
  28. Study of Unix Shell and Environment Variables.
  29. Write a shell script to validate the entered date. (eg. Date format is : dd-mm-yyyy).
  30. Write an awk program using function, which convert each word in a given text into capital.
  31. Write a program for process creation using C. (Use of gcc compiler).
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