



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Information Technology

Course / Subject Code : DI03016061

Course / Subject Name : Operating Systems

W. e. f. Academic Year:	2024-25
Semester:	3 rd
Category of the Course:	PCC

Prerequisite:	Students should have basic computer knowledge, programming basics.
Rationale:	<p>The Operating Systems course is a fundamental component of Computer Science and Information Technology curricula. An operating system (OS) serves as the backbone of any computing environment, managing hardware resources, enabling software applications, and providing a user-friendly interface. Understanding the principles of operating systems is essential for students aiming to pursue careers in software development, system administration, cyber security, and cloud computing.</p> <p>This course provides students with in-depth knowledge of OS concepts, including process management, memory allocation and file systems. Students will gain practical experience in system operations and troubleshooting. The course also integrates hands-on lab exercises and projects to reinforce theoretical concepts through practical implementation.</p> <p>By the end of this course, students will develop a strong foundation in operating system design, functionality, and optimization, preparing them for advanced studies in system architecture, embedded systems, and distributed computing.</p>

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand the basic concepts of Operating System.	Understand
02	Illustrate various aspects of process scheduling and deadlock management.	Understand
03	Understand memory management concept.	Understand
04	Understand various file management and file allocation techniques.	Understand
05	Develop basic shell script using operators, control and loop statements.	Apply

**Revised Bloom's Taxonomy (RBT)*



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE (V)	
2	0	2	3	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to Operating System: 1.1 Definition and Functions of an Operating System. 1.2 Evolution of Operating System. 1.3 Types of Operating System: 1.3.1.1 Batch Operating System. 1.3.1.2 Time-Sharing Operating System. 1.3.1.3 Multiprogramming Operating System. 1.3.1.4 Multiprocessing Operating System. 1.3.1.5 Multitasking Operating System. 1.3.1.6 Real Time Operating System. 1.3.1.7 Network Operating System. 1.4 Services of Operating System. 1.5 Components of Operating System: Kernel, Shell, System Calls.	6	20
2.	Process Management and Inter Process Communication: 2.1 Concept of Process and Threads. 2.2 Process States and Lifecycle. 2.3 Process Control Block. 2.2 Process Scheduling: 2.2.1 Types of Schedulers. 2.2.2 Scheduling Criteria : CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time 2.2.3 Scheduling Algorithm: First Come First Serve, Shortest Job First, Round Robin. 2.3 Inter Process Communication 2.3.1 Critical Section 2.3.2 Semaphore	8	26



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	2.3.3 Race condition 2.3.4 Mutual Exclusion 2.4 Deadlock 2.4.1 Deadlock characteristics 2.4.2 Deadlock Prevention 2.4.3 Deadlock Avoidance 2.4.4 Deadlock Detection and Recovery		
3.	Memory Management: 3.1 Process Address Space. 3.2 Swapping. 3.3 Contiguous memory allocation. 3.4 Segmentation. 3.5 Paging.	5	17
4.	File Management: 4.1 File concept. 4.2 File attributes and file type. 4.3 File access method. 4.4 File allocation method. 4.5 File sharing 4.6 File protection.	6	20
5.	Linux commands and shell programming: 5.1 Installation of Linux Operating System. 5.2 Linux process command. 5.3 Linux calendar, date and sleep command. 5.4 Linux directory and file command. 5.5 Linux user command. 5.6 Linux networking command. 5.7 Shell scripts: 5.7.1 Basic operators. 5.7.2 Control and loop statements.	5	17
	Total	30	100

Suggested Specification Table with Marks (Theory):



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Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
26	43	31	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

Sr. No	Title of Book	Name of Author	Publication
1	Operating System Concepts.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne	9 th Edition, WILEY
2	Modern Operating Systems	Andrew S. Tanenbaum & Herbert Bos	5 th Edition, Pearson
3	Operating Systems: Internals and Design Principles	William Stallings	7 th Edition, Pearson
4	Linux Command Line and Shell Scripting Bible.	Richard Blum & Christine Bresnahan	3 rd Edition, WILEY
5	Operating Systems.	Dhananjay M. Dhamdhare	MGH, 2017 ISBN 978-0-07-295769-3
6	Principles of Operating Systems.	Naresh Chauhan,	Oxford University Press, New Delhi, 2014, ISBN : 9780198082873
7	Linux –Application And Administration	Ashok Kumar Harnal	TMH, 2009, ISBN - 1283188996, 9781283188999

(b) Open source software and website:

1. https://www.tutorialspoint.com/operating_system/index.htm
2. <https://www.tpointtech.com/operating-system>
3. <https://www.studytonight.com/operating-system/>
4. <https://linuxcommand.org/>
5. Linux basics: www.freeos.com/guides/lsst
6. Linux basics: www.linuxcommand.org/writing_asell_scripts.php
7. Linux basics: <https://nptel.ac.in/courses/117106113>
8. Linux basics : https://onlinecourses.swayam2.ac.in/aic20_sp24/preview



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9. <https://www.guru99.com/introduction-linux.html>

10. MINIX 3 (<https://www.minix3.org/>)

Suggested Course Practical List:

The following practical outcomes (PrOs) are the subcomponents of the COs. These PrOs need to be attained to achieve the COs.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required															
1	Compare following Operating System: a) Compare multiprogramming and multiprocessing Operating System. b) Compare multiprocessing and multitasking Operating System.	I	02*															
2	Implement CPU scheduling algorithm FCFS using Python programming for a given table and calculate average waiting time and average turnaround time. <table border="1"><thead><tr><th>Process</th><th>Arrival Time</th><th>Time required for completion</th></tr></thead><tbody><tr><td>P0</td><td>0</td><td>6</td></tr><tr><td>P1</td><td>1</td><td>4</td></tr><tr><td>P2</td><td>3</td><td>2</td></tr><tr><td>P3</td><td>5</td><td>1</td></tr></tbody></table>	Process	Arrival Time	Time required for completion	P0	0	6	P1	1	4	P2	3	2	P3	5	1	II	04*
Process	Arrival Time	Time required for completion																
P0	0	6																
P1	1	4																
P2	3	2																
P3	5	1																
3	Test and execute Linux process commands for following task: a) Execute top command to display the most CPU- and memory-intensive processes running on your system. b) Execute ps command to display information about currently running process on your system. c) Execute kill command to stop various running process on your system.	II & V	02*															
4	Test and execute Linux file and directory commands to perform following task: a) List the directory content of your system. b) Create “NEP2020” directory. c) Change your current directory to “NEP2020” directory. d) Display the full path of your current working directory. e) Rename “NEP2020” directory with “NewEdu”. f) Delete “NewEdu” directory.	IV & V	04*															



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	g) Write a Linux command to clear your screen. h) Display the list of 20 previously executed command.		
5	Test and execute calendar and date command in Linux to perform following task: a) Display the calendar for the month March 1927. b) Display the calendar for the year 2050. c) Display the date and time of your system. d) Display the date of your system in mm/dd/yyyy format for e.g. 07/14/2030. e) Sleep your system for 20 second.	V	02*
6	Test and execute the Linux user command and networking command to perform following task: a) Display the user id of the currently logged-in user of your system. b) Display the host name of your system. c) Execute the Linux commands: who, w and last. d) Display the IP address of your system.	V	02*
7	Test and execute Linux file and file editing commands to perform following task: a) Write a shell script to perform following task: 1) Read “NEP2020” from the command prompt and create directory “NEP2020”. 2) Read “NewEduPolicy” from the command prompt and rename “NEP2020” directory to “NewEduPolicy”. 3) Display the full path of your current working directory. b) Write a shell script to perform following task: 1) Read “Chandrayan2.txt” from the command prompt and create a blank file with the name “Chandrayan2.txt” 2) Read “Chandrayan2.txt” from the command prompt to open & write at least 10 lines in the “Chanrayan2.txt” file. 3) Read “Chandrayan2.txt” from the command prompt to display the content of “Chanrayan2.txt” file. c) Write a shell script to read two different file names from the command prompt and copy the content of first file into the second file. d) Write a shell script to read “Chandrayan2.txt” file name and “ISRO” word from the command prompt and search “ISRO” word from “Chandrayan2.txt” file.	III & V	04*



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8	Test and execute wc command: a) Write a shell script to accept the string “diploma in information technology” from the command prompt in the lower case letter and convert it into the upper case letter. b) Write a shell script to read the “Chandrayan2.txt” file from the command prompt and display the numbers of characters, words & lines of a given input file “Chandrayan2.txt”.	IV & V	02
9	Understand and Apply Arithmetic Operators: Write a shell script to perform arithmetic operations: a. Write a shell script to read two numbers from the command prompt and perform addition, subtraction, multiplication, division and modulus operation. b. Write a shell script to read the marks of five courses out of 100 from the command prompt and calculate the total marks and percentage (%) of the marks. c. Write a shell script to read radius (R) of circle in cm from the command prompt and calculate the area (A) of circle.	V	04*
10	Understand and apply control statements: Write a shell script to perform following operations: a) Write a shell script to read three numbers from the command prompt and display maximum number among three numbers. b) Write a shell script to read the marks of five courses out of 100 from the command prompt and calculate: 1) The total marks. 2) The percentage (%) of the marks. 3) The grade: First class, Second class, Third class based on percentage (%). 4) The result pass or fail based on the marks of five courses. c) Write a shell script to read N numbers from the command prompt and display the sum and average of N numbers. d) Create a shell script to read 6 digit number from the command prompt and display the reverse digits of a given 6-digit number. (For e.g. if the no. is 574291 then answer is 192475).	V	04*
			30Hrs.

List of Laboratory/Learning Resources Required:

Sr. No.	Laboratory/Learning Resources/Equipment Name with Broad Specifications	PrO. No.
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1	Computer system with Linux Operating System.	3 to 10
2	Python IDEs and Code Editors.	2

Suggested Project List:

- Simulate **SJF**, **Round Robin**, and **Priority Scheduling** using a Python program.
- Compare average waiting and turnaround time.
- Write a shell script to display top 5 memory-consuming processes.
- Script to back up a directory.
- Login welcome script using echo and system variables.
- Create users and groups using adduser, groupadd.
- Assign permissions and group memberships
- Use passwd to manage passwords.

Suggested Activities for Students:

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews. Following is the list of proposed student activities like:

- Prepare report on Android Operating System.
- Compare file operations of Windows and Linux Operating System.
- Case study on MacOS.
- Massive open online courses (**MOOCs**) may be used to learn various topics/sub topics.

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