Operating System (203105203) /

Operating System Laboratory(203105204)

Type of Course: BTech

Prerequisite: Data Structures and Algorithms, Good working knowledge of C, and Fundamentals of Computer Systems.

Rationale: This course is an introduction to the theory and practice behind modern computer operating systems. Topics will include what an operating system does (and doesn't) do, system calls and interfaces, processes, concurrent programming, resource scheduling and management, virtual memory, deadlocks, and algorithms, programming, and security. We will approach the subject from both a theoretical perspective as well as a practical one.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Interna			
LectHrs/Week	Tut Hrs/Week	Lab Hrs/Week		T	P	T	CE	P	
3	0	2	4	60	30	20	20	20	150

Lect- Lecture, **Tut**- Tutorial, **Lab**- Lab, **T** - Theory, **P** - Practical,**CE**- CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**INTRODUCTION:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered,Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.	5%	3
2	**PROCESSES, THREAD & PROCESS SCHEDULING:** **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. **Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR.	20%	9
3	**INTER-PROCESS COMMUNICATION:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ ConsumerProblem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	15%	6
4	**DEADLOCKS**: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	10%	5

5	**MEMORY MANAGEMENT & VIRTUAL MEMORY**: **Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. **Virtual Memory:** Basics of Virtual Memory – Hardware and control structures– Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	30%	15
6	**I/O SYSTEMS, FILE & DISK MANAGEMENT:** **I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software. **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. **Disk Management:** Disk structure, Disk scheduling algorithms - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	20%	10

***Continuous Evaluation:**

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

Reference Books:

1. Operating System Concepts Essentials
   9th Edition byAviSilberschatz, Peter Galvin,Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles
   5th Edition, William Stallings, Prentice Hall of India
3. Operating System: A Design-oriented Approach
   1st Edition by Charles Crowley, Irwin Publishing
4. Operating Systems: A Modern Perspective
   2nd Edition by Gary J. Nutt, Addison-Wesley
5. Design of the Unix Operating Systems
   8th Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel
   3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcome:

After learning the course the students shall be able to:

1. Distinguish different styles of operating system design.
2. Understand device and I/O management functions in operating systems as part of a uniform device abstraction.
3. Have an understanding of disk organisation and file system structure
4. Give the rationale for virtual memory abstractions in operating systems.
5. Understand the main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.
6. Understand the main mechanisms used for inter-process communication.
7. Understand the main problems related to concurrency and the different synchronization mechanisms available.

List of Practical:

1. Study of Basic commands of Linux.
2. Study the basics of shell programming.

3. Write a Shell script to print given numbers sum of all digits.
4. Write a shell script to validate the entered date. (eg. Date format is: dd-mm-yyyy).
5. Write a shell script to check entered string is palindrome or not.
6. Write a Shell script to say Good morning/Afternoon/Evening as you log in to system.
7. Write a C program to create a child process
8. Finding out biggest number from given three numbers supplied as command line arguments
9. Printing the patterns using for loop.
10. Shell script to determine whether given file exist or not.
11. Write a program for process creation using C. (Use of gcc compiler).
12. Implementation of FCFS &Round Robin Algorithm.
13. Implementation of Banker's Algorithm.

FACULTY OF ENGG. & TECH. – PIET							
PARUL INSTITUTE OF ENGINEERING & TECHNOLOGY **DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING** **SEMESTER: 3RD**							
Name of Teachers: Abhijit Parmar(ATP), Manish Kumar(MK), Sudhir Kumar(SDK), Yassir Farooqui(YF), Prasanna Barot(PB), Gulbakshee Dharmale(GD), Prachi Verma(PV), Swapnil Umbarkar(SU) **Subject:** Operating System (203105203)		**Hrs./Week: 4 Planned Date**					
Sr.No.	**Name of Topic**	**3B10[A]**	**3B10[B]**	**3B11[A]**	**3B11[B]**	**3B12[A]**	**3B12[B]**
		PV	**PV, GD**	**SU**	**SU**	**GD**	**GD**
UNIT-1	**INTRODUCTION**						
1	Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems.	15/06	15/06	15/06	15/6	15/6	15/6
2	OS Services, System calls	16/06	16/06	17/06	16/6	18/06	16/06
3	Structure of an OS-Layered,	18/06	18/06	18/06	16/6	19/06	17/06
4	Monolithic, Microkernel Operating Systems, Concept of Virtual Machine	19/06	19/06	19/06	17/6	22/06	18/06
UNIT-2	**PROCESSES, THREAD & PROCESS SCHEDULING**						
5	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions	22/06	22/06	22/06	20/6	25/06	22/6
6	Process Control Block (PCB), Context switching	23/06	23/06	24/06	22/6	26/06	23/06
7	**Thread:** Definition, Various states, Benefits of threads, Types of threads,	23/06 & 25/06	23/06 & 25/06	25/06	22/6	29/06	24/06
8	Concept of multithreads. Process Scheduling: Foundation and Scheduling objectives	25/06	25/06	26/06	23/6	02/07	25/06
9	Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;	25/06 & 26/06	25/06 & 26/06	29/06	24/6	03/07	29/06

10	Scheduling algorithms: Pre-emptive and Non pre-emptive,	29/06	29/06	01/07	27/6	03/07	29/06
11	FCFS, SJF	29/06 & 30/06	29/06 & 30/06	2/7 & 03/07	29/6 & 30/6	06/07	30/06
12	RR	02/07 & 03/07	02/07 & 03/07	06/07	1/7 & 4/7	09/07	30/06
UNIT-3	**INTER-PROCESS COMMUNICATION**						

14	Critical Section, Race Conditions, Mutual Exclusion,	06/07	06/07	08/07	6/7	09/07	01/07
15	Hardware Solution, Strict Alternation, Peterson's Solution,	07/07	07/07	09/07	7/7	10/07	02/07
16	The Producer\ Consumer Problem,	09/07	09/07	10/07	7/7	13/07	06/07
17	Semaphores, Event Counters, Monitors	10/07	10/07	13/07	8/7	13/07	06/07
18	Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	13/07	13/07	15/07	11/7	16/07	07/07
UNIT-4	**DEADLOCKS**						
19	Definition, Necessary and sufficient conditions for Deadlock,	14/07	14/07	16/07	13/7	17/07	08/07
20	Deadlock Prevention	14/07& 16/07	14/07& 16/07	17/07	14/7	17/07	09/07
21	Deadlock Avoidance: Banker's Algorithm	16/07& 17/07	16/07& 17/07	20/07 & 22/07	15/7	20/07	13/07
22	Deadlock detection, Deadlock Recovery	20/07	20/07	23/07	18/7	23/07	14/07
UNIT-5	**MEMORY MANAGEMENT & VIRTUAL MEMORY**						
23	**Memory Management:** Basic concept, Logical and Physical address map	21/07	21/07	24/07	20/7	24/07	15/07
24	Memory allocation: Contiguous Memory allocation, Fixed and variable partition	23/07	23/07	27/07	21/7	24/07	15/07
25	Internal and External fragmentation and Compaction	24/07	24/07	29/07	22/7	27/07	16/07
26	Paging: Principle of operation, Page allocation	24/07 & 27/07	24/07 & 27/07	30/07	25/7	30/07	20/07
27	Hardware support for paging, Protection and sharing, Disadvantages of paging.	27/07 & 28/07	27/07 & 28/07	30/07	27/7	30/07	21/07
28	**Virtual Memory:** Basics of Virtual Memory, Hardware and control structures,	30/07	30/07	31/07	28/7	31/07	22/07
29	Locality of reference, Page fault, Working Set	31/07	31/07	05/08	29/7	06/08	23/07
30	Dirty page/Dirty bit, Demand Paging	04/08	04/08	06/08	1/8	07/08	27/07
31	Page Replacement algorithms: Optimal, First in First Out (FIFO),	04/08 & 06/08	04/08 & 06/08	07/08	1/8	07/08	28/07
32	Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	06/08	06/08	10/08	5/8	10/08	29/07

UNIT-6	**I/O SYSTEMS, FILE & DISK MANAGEMENT**						
33	**I/O Hardware:** I/O devices, Device controllers,	07/08	07/08	13/08	8/8	13/08	30/07
34	Direct memory access,	07/08	07/08	14/08	8/8	13/08	04/08
35	Principles of I/O Software: Goals	10/08	10/08	19/08	10/8	14/08	05/08

	of Interrupt handlers						
36	Device drivers, Device independent I/O software	10/08	10/08	17/08	17/7	17/08	06/08
37	**File Management:** Concept of File, Access methods, File types	11/08	11/08	19/08	17/8	17/08	10/08
38	File operation, Directory structure, File System structure	13/08	13/08	19/08	18/8	20/08	11/08
39	Allocation methods (contiguous, linked, indexed)	14/08	14/08	20/08	18/8	20/08	12/08
40	Free-space management (bit vector, linked list, grouping)	17/08	17/08	20/08	19/8	21/08	13/08
41	Directory implementation (linear list, hash table), efficiency and performance.	18/08	18/08	21/08	19/8	21/08	17/08
42	**Disk Management:** Disk structure, Disk scheduling algorithms – FCFS	20/08	20/08	21/08	19/8	24/08	18/08
43	SSTF, SCAN, C-SCAN	21/8	21/8	31/8	31/8	24/8	19/8
44	Disk reliability, Disk formatting, Boot-block, Bad blocks	31/8	31/8	31/8	31/8	27/8	20/8