Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Second Year Bachelor of Engineering (CE/IT) – Semester IV

(With effect from: Academic Year 2018-19)

Subject Code: CT404-N	**Subject Title:** Operating Systems
Pre-requisite	

Teaching Scheme (Credits and Hours)

Teaching Scheme				**Total Credit**	**Evaluation Scheme**					
L	**T**	**P**	**Total**		**Theory**		**Mid Sem Exam**	**CIA**	**Practical**	**Total**
Hours	**Hours**	**Hours**	**Hours**		**Hours**	**Marks**	**Marks**	**Marks**	**Marks**	**Marks**
04	00	04	08	06	03	70	30	20	30	150

Learning Objectives:

To learn the fundamentals of Operating Systems

- To learn the mechanisms of OS to handle processes and threads and their communication
- To learn the mechanisms involved in memory management in contemporary OS
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
- To know the components and management aspects of concurrency management

Outline of the Course:

Sr. No	**Title of the Unit**	**Minimum Hours**
1	Introduction	07
2	Process	12
3	Inter-process Communication	12
4	Deadlock	07
5	Memory Management	13
6	I/O Hardware	13
	Total	**64**

Total hours (Theory): 64
Total hours (Lab): 64
Total hours: 128

Detailed Syllabus:

No.	Topic	Lect (Hrs)	Weightage(%)
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. Case study on UNIX and WINDOWS Operating System.	06	12
2	**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; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	11	15
3	**Inter-process Communication:** Critical Section, Race Conditions, 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.	11	15
4	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	06	11
5	**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).	12	15
6	**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, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms 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.	11	15
7	**Security & Protection:** Security Environment, Design Principles Of Security, User Authentication, Protection Mechanism : Protection Domain, Access Control List	3	8
8	**Unix/Linux Operating System:** 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	9
	Total	64	100

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

On successful completion of the course, the student will learn:

- Creation of processes and threads.
- Design algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time.
- For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
- Design and implement file management system.
- For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

E-Resources:

- www.nptel.ac.in/courses/106108101/
- https://www.youtube.com/playlist?list=PLFN0Qcc8RnU62xhyLF4KEe5fxneHPAkog
- https://www.youtube.com/playlist?list=PLTZbNwgO5ebqnympIYe2GX4hjjsS9Psdm
- https://www.youtube.com/playlist?list=PLEbnTDJUr_If_BnzJkkN_J0Tl3iXTL8vq
- http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts---9th2012.12.pdf
- http://dinus.ac.id/repository/docs/ajar/Operating_System.pdf

Reference Books:

- Operating System Concepts Essentials, 9th Edition by Abraham Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
- Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

- Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
- Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
- Design of the UNIX Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
- Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

List of experiments:

Sr. No.	Name of Experiment
1	Study of Editor and Shell's Command
2	Implementation of Shell's Script
3	Implementation of Looping Structure in Shell's Script
4	Implementation of String and Command Line Argument in Shell's Script
5	Implementation of FCFS (First Come First Serve) CPU Scheduling Algorithm
6	Implementation of SJF (Shortest Job First) CPU Scheduling Algorithm
7	Implementation of Priority CPU Scheduling Algorithm
8	Implementation of RR (Round Robin) CPU Scheduling Algorithm
9	Implementation of First Fit, Best Fit, Next Fit and Worst Fit algorithms for memory allocation.
10	Implementation of any two Page Replacement algorithms from the following. FIFO (First in First Out) Page Replacement Algorithm, SC (Second Chance) Page Replacement Algorithm, LRU (Least Recently Used) Page Replacement Algorithm, OPTIMAL Page Replacement Algorithm, NRU (Not Recently Used) Page Replacement Algorithm, Clock Page Replacement Algorithm
11	Implementation of any two Disk Scheduling algorithms from the following. FCFS(First Come First Serve), SSF(Shortest Seek First), ELEVATOR Algorithm, LOOK Algorithm C-LOOK Algorithm, SCAN Algorithm, C-SCAN Algorithm
12	Study various file management system calls in UNIX. Write a program to implement Create a file, Delete a file, Link a file, Copy one file to another file, Read
	As part of experimentation, a small project / model / seminar / poster / other should be prepared / presented by student(s) based on the practical knowledge gained by this course at the end of the curriculum. The concerned laboratory faculty (in consultation with course coordinator) is empowered to design/decide the type/execution of this experiment. The student(s) are expected to present the same before their batch-mates.