

INSTITUTE	FACULTY OF ENGINEERING AND TECHNOLOGY
PROGRAM	BACHELOR OF TECHNOLOGY (COMPUTER SCIENCE AND ENGINEERING - ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
SEMESTER	4
COURSE TITLE	OPERATING SYSTEM & VIRTUALIZATION
COURSE CODE	01AI0403
COURSE CREDITS	4

Objective:

- 1 Understand Modern Operating System and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of processes, CPU scheduling, memory management, file system, storage subsystem, input/output management and virtualization.
- 2 Student will understand Modern Operating System and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of processes, CPU scheduling, memory management, file system, storage subsystem, input/output management and virtualization.

Course Outcomes: After completion of this course, student will be able to:

- 1 Learn and understand the concepts, core structure of Operating Systems and basic architectural components involved in operating systems design.
- 2 Understand deadlock, prevention and avoidance algorithms.
- 3 Compare and contrast various memory management schemes.
- 4 Understand the functionality of file systems.
- 5 Familiar with the basics of virtualization concepts

Pre-requisite of course:Data structures like stack, queue, linked list, tree, graph, hashing, file structures, any structured programming language (like C or python)

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Operating System Overview Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization, Operating system overview-objectives and functions, Evolution of Operating System, Computer System Organization Operating System Structure and Operations- System Calls, System Programs,, OS Generation and System Boot	7
2	Process Management Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	11
3	Memory Management 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., Virtual Memory: Concepts, VM management, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing	8
4	File Systems And I/O Systems: Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization,, File system mounting, File Sharing and Protection, File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance	9
5	Virtualization Concepts & Approaches to Virtualization Virtual machines, supporting multiple operating systems simultaneously on a single hardware platform, running one operating system on top of another., True or pure 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.Processor Issue, Memory Management, I/O Management, Microsoft Hyper-V and Xen Variants, Java VM, Linux VServer Virtual Machine Architecture, Android Virtual Machine	8
Total Hours		43

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Practical 1 a. Write a shell script to print welcome to Marwadi University. b. Write a shell script which takes following details of two students and prints them: Name, Rollno, Class, Branch, Batch, City, Cgpa	2
2	Practical 2 a. Write a shell script to perform arithmetic operations. b. Write a shell script to find greater from two numbers. c. Write a script to find the smallest of three numbers as well as largest among three numbers.	2
3	Practical 3 . Write a shell script to calculate simple interest. b. Write a shell script to find that the accepted number is Negative, or Positive or Zero. c. 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.	2
4	Practical 4 a. Write a menu driven shell script for Copy a file, remove a file, Move a file in Linux b. Shell Script to make a menu driven calculator using case. c. Write a shell script which will print days of a week	2
5	Practical 5 a. Write a shell script to find factorial of given number n. b. Write a shell script to print all natural numbers from 1 to n. c. Write a shell script to print all even and odd numbers between n numbers - using while loop	2
6	Practical 6 a. Write a shell script to enter a number and print its reverse. b. Write a shell script to check whether a number is Prime number or not. c. Write a script to check entered string or a number is palindrome or not	2
7	Practical 7 a. Write a shell script which will generate first n Fibonacci numbers like: 1, 1, 2, 3, 5, 13,... b. Write a script to translate the string from capital letters to small and small letters to capital using awk command.	2
8	Practical 8 Simulate the following CPU scheduling algorithms – FCFS and SJF.	2
9	Practical 9 Write a program to simulate producer-consumer problem using Semaphores.	2
10	Practical 10 Write a program to simulate the concept of Dining-philosophers problem.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
11	Practical 11 Write a program to simulate the following contiguous memory allocation Techniques - Worst fit, Best fit and First fit.	2
12	Practical 12 Simulate all page replacement algorithms – FIFO and LRU.	2
13	Practical 13 Simulate all File Organization Techniques - Single level directory and Two level directory	2
14	Practical 14 Write a program to simulate disk scheduling algorithms – FCFS and SCAN.	2
Total Hours		28

Textbook :

- 1 Operating Systems, Harvey M. Deitel, Pearson Education,, 2004

References:

- 1 Operating System Concepts, Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, , John Wiley and Sons Inc., 2012
- 2 Operating Systems – A Spiral Approach, Operating Systems – A Spiral Approach, Ramaz Elmasri, A. Gil Carrick, David Levine,, Tata McGraw Hill Edition, 2010
- 3 Operating Systems, Operating Systems, Achyut S.Godbole, Atul Kahate, Mc Graw Hill Education, 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	30.00	30.00	5.00	5.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brain storming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Instructional Method:

- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

- 1 <http://williamstallings.com/OS/Animation/Animations.html>
- 2 <http://nptel.ac.in/courses/106106144/>
- 3 <http://nptel.ac.in/courses/106108101/>
- 4 <http://codex.cs.yale.edu/avi/os-book/OS9/slide-dir>