Department of Computer Science and Engineering
Institute of Technical Education & Research, SOA Deemed to be University

LESSON PLAN

Design of Operating System (CSE 4049)

Session: Oct' 2021 - Feb' 2021

1. **Course Number and Name:**

   CSE 4049, `Design of Operating System`

2. **Credits and Course Format:**

   Grading Pattern = 1

   Credits = 4

   Course format: 5 hours/week (1 PS/week, 2hr/PS, 3 classes/week, 1hr/class)

3. **Target Students:**

   Programme: B.Tech. (5^{th} Semester)

   Branch: CSE,CSIT

4. **Instructor's Names:**

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5. **Text Book(s):**

   (1) Abraham Silberschatz, Peter B. Galvin & Greg Gagne, ***Operating System Concepts***, Wiley.

   (2) Daniel P. Bovet & Marco Cesati, ***Understanding the Linux kernel***, SPD.

6. **Specific Course Information:**

   (a) **Course Description:** The course introduces the concepts relating to operating systems. The course covers the topics: Introduction, Operating System structures, Processes, Threads, Process Synchronisation, CPU Scheduling, Deadlocks, Main memory, virtual memory, file system interface, file system implementation, I/O systems, Introduction to LINUX, Memory addressing, Processes, threads, Interrupts, exceptions, kernel synchronization, Timing measurements, process scheduling, memory management, Process address space, system calls, signals, virtual file system, I/O, page cache, accessing files.. After the completion of this course the student should have the thorough knowledge of various operating system services along with a case study of LINUX operating system.

   (b) **Co-requisites:**

   ☞ Unix Systems Programming (CSE 3041)

7. **Course Outcomes (COs) :**
   By the end of course through lectures, readings, homeworks, laboratory, assignments and exams students will be able to:

   CO 1. Understand the different components of Operating System and various ways of structuring an operating system .

   CO 2. Analyze the mechanisms involved in handling, scheduling, synchronizing processes and threads

   CO 3. Learn the different methods used to prevent and deal with deadlock

   CO 4. Explore various memory management, file handling and input output schemes, analyzing their effectiveness in different scenario

   CO 5. Gain knowledge about various data structures and functions used for process management, scheduling, synchronization, memory and file management in Linux operating system

8. **Brief List of Topics to Be Covered: (L: Lecture, P: Laboratory)**

Contact hour	***Topics to be covered***	***Remarks (if any)***
Week#1:		

L-01	Introduction to the course and its motivation. Course description, objective, credit, grading pattern, class and Lab session of the course. NBA provided program outcomes and departmental specific program specific outcomes.	**(Class: w.e.f from 07-10-2021)**, Silberschatz, Galvin & Gagne
L-02	Introduction to Operating Systems, Computer system organization	**(Chapter1)**, Silberschatz, Galvin & Gagne
L-03	Computer system architecture, Operating system structure	**(Chapter1)**, Silberschatz, Galvin & Gagne
P-01	Introduction to Linux, basics of UNIX file system, basics of Linux kernel	**(Chapter1)**, Bovet & Cesati
Week#2:		
L-04	Operating system operations, Computing Environments	**(Chapter1)**, Silberschatz, Galvin & Gagne
L-05	Operating system services, user and operating system interface	**(Chapter2)**, Silberschatz, Galvin & Gagne
L-06	System calls, types of system calls, system programs,	**(Chapter2)**, Silberschatz, Galvin & Gagne
P-02	Process management in Linux	**(Chapter3)**, Bovet & Cesati
Week#3:		
L-07	Operating system structure: Simple structure, Monolithic kernel, layered approach, micro kernel, Modular approach	**(Chapter2)**, Silberschatz, Galvin & Gagne
L-08	Process concepts, Process state, Process control block	**(Chapter3)**, Silberschatz, Galvin & Gagne
L-09	Process scheduling: LTS,MTS,STS,Context switching	**(Chapter3)**, Silberschatz, Galvin & Gagne
P-03	Assignment 1	
Week#4:		

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L-10	Operations on processes, problem solving	**(Chapter3)**, Silberschatz, Galvin & Gagne
L-11	Co-Operating process and independent process , Inter process Communications, Shared memory solution to bounded buffer problem	**(Chapter3)**, Silberschatz, Galvin & Gagne
L-12	Message passing ,direct and indirect communication, synchronous and asynchronous message passing , Buffering	**(Chapter3)**, Silberschatz, Galvin & Gagne
P-04	Assignment 1 contd.	
Week#5:		
L-13	Thread concept overview, Multicore programming	**(Chapter4)**, Silberschatz, Galvin & Gagne
L-14	Multithreading models,	**(Chapter4)**, Silberschatz, Galvin & Gagne
L-15	CPU scheduling : Basic concepts, scheduling criteria, scheduling algorithm:FCFS with same Arrival time	**(Chapter6)**, Silberschatz, Galvin & Gagne
P-05	Assignment 2	
Week#6:		
L-16	FCFS with different Arrival time,SJF,SRTF	**(Chapter6)**, Silberschatz, Galvin & Gagne
L-17	Priority Scheduling, Round Robin Scheduling,	**(Chapter6)**, Silberschatz, Galvin & Gagne
L-18	Multilevel queue scheduling, Multilevel feedback queue scheduling,	**(Chapter6)**, Silberschatz, Galvin & Gagne
P-06	Assignment 2 contd..	
Week#7:		
L-19	Process Synchronization: Background, critical section problem	**(Chapter5)**, Silberschatz, Galvin & Gagne

L-20	Peterson solution to critical section problem	**(Chapter5)**, Silberschatz, Galvin & Gagne
L-21	Synchronization hardware,test-and-set and compare-and-swap, Mutex lock	**(Chapter5)**, Silberschatz, Galvin & Gagne
P-07	CPU Scheduling in Linux	**(Chapter7)**, Bovet & Cesati
Week#8:		
L-22	Semaphore,types of semaphore,semaphore implementation	**(Chapter5)**, Silberschatz, Galvin & Gagne
L-23	Classical problems of synchronization, Bounded buffer problem with semaphore	**(Chapter5)**, Silberschatz, Galvin & Gagne
L-24	First Readers writers problem, Dinning philosophers problem with semaphore solution,	**(Chapter5)**, Silberschatz, Galvin & Gagne
P-08	Assignment 3	
Week#9:		
L-25	Monitor, Monitor solutions to Dinning philosophers problem	**(Chapter5)**, Silberschatz, Galvin & Gagne
L-26	Deadlocks, Necessary condition, Deadlock prevention	**(Chapter7)**, Silberschatz, Galvin & Gagne
L-27	Deadlock avoidance, Banker's algorithm	**(Chapter7)**, Silberschatz, Galvin & Gagne
P-09	Assignment 3 contd..	
Week#10:		
L-28	Deadlock detection and recovery	**(Chapter7)**, Silberschatz, Galvin & Gagne
L-29	Memory management strategy,background, basic hardware	**(Chapter8)**, Silberschatz, Galvin & Gagne

L-30	Dynamic memory allocation, fragmentation, compaction	**(Chapter8)**, Silberschatz, Galvin & Gagne
P-10	Assignment 4	
Week#11:		
L-31	Paging	**(Chapter8)**, Silberschatz, Galvin & Gagne
L-32	Hardware support for paging ,protection structure for page table	**(Chapter8)**, Silberschatz, Galvin & Gagne
L-33	Multilevel paging , hash page table ,inverted page table	**(Chapter8)**, Silberschatz, Galvin & Gagne
P-11	Assignment 5	
Week#12:		
L-34	Segmentation	**(Chapter8)**, Silberschatz, Galvin & Gagne
L-35	Virtual memory management	**(Chapter9)**, Silberschatz, Galvin & Gagne
L-36	Demand paging, copy on write	**(Chapter9)**, Silberschatz, Galvin & Gagne
P-12	Assignment 5 contd..	
Week#13:		
L-37	Page replacement,FIFO,OPTIMAL,LRU	**(Chapter9)**, Silberschatz, Galvin & Gagne
L-38	LRU approximation page replacement , Counting based page replacement	**(Chapter9)**, Silberschatz, Galvin & Gagne
L-39	Page buffering , Frame allocation algorithm	**(Chapter9)**, Silberschatz, Galvin & Gagne
P-13	Assignment 6	

Week#14:		
L-40	Global vs local allocation , Thrashing	**(Chapter9)**, Silberschatz, Galvin & Gagne

9. **Evaluation scheme (under Grading Pattern-1) out of** 100**%:**

Attendance:	05%
Minor Assignments :	10%
Major Assignments :	10%
Mid-Term :	15%
End-Term Lab Test :	15%
End-Term Examination:	45%

10. **Program Outcomes & Program Specific Outcomes**
There are twelve program outcomes (1-12) and Two program specific outcomes for the Computer science & Engineering B. Tech program:
Program Outcomes (POs)

    1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
    2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
    3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
    4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
    5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
    6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specifis Outcomes (PSOs)

PSO 1. The ability to understand, analyze and develop computer programs in the areas related to business intelligence, web design and networking for efficient design of computer-based systems of varying complexities.

PSO 2. The ability to apply standard practices and strategies in software development using open-ended programming environments to deliver a quality product for business success.

11. **Correlation between the Course Outcomes(COs), the Program Outcomes(POs) , and the Program Specific Outcomes(PSOs)**

Course Articulation Matrix:

Design of Operating System (CSE 4049)													Session: 2020-2021	
	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	-	-	-	-	-	-	-	-	-	-	-	-	-	-