

## IV Semester

OPERATING SYSTEMS			
Course Code:	21CS44	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
<b>Course Objectives:</b>			
CLO 1. Demonstrate the need for OS and different types of OS CLO 2. Apply suitable techniques for management of different resources CLO 3. Use processor, memory, storage and file system commands CLO 4. Realize the different concepts of OS in platform of usage through case studies			
<b>Teaching-Learning Process (General Instructions)</b>			
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.			
<ol style="list-style-type: none"><li>1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.</li><li>2. Use of Video/Animation to explain functioning of various concepts.</li><li>3. Encourage collaborative (Group Learning) Learning in the class.</li><li>4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.</li><li>5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.</li><li>6. Introduce Topics in manifold representations.</li><li>7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.</li><li>8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</li></ol>			
<b>Module-1</b>			
<b>Introduction to operating systems, System structures:</b> What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.			
<b>Operating System Services:</b> User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.			
<b>Process Management:</b> Process concept; Process scheduling; Operations on processes; Inter process communication			
<b>Textbook 1: Chapter - 1,2,3</b>			
<b>Teaching-Learning Process</b>	Active learning and problem solving <ol style="list-style-type: none"><li>1. <a href="https://www.youtube.com/watch?v=vBURt97EkA&amp;list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2Q">https://www.youtube.com/watch?v=vBURt97EkA&amp;list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2Q</a></li><li>2. <a href="https://www.youtube.com/watch?v=a2B69vCtjOU&amp;list=PL3-wYxht4yCjpcfUDz-TgD_ainZ2K3MUZ&amp;index=2">https://www.youtube.com/watch?v=a2B69vCtjOU&amp;list=PL3-wYxht4yCjpcfUDz-TgD_ainZ2K3MUZ&amp;index=2</a></li></ol>		
<b>Module-2</b>			
<b>Multi-threaded Programming:</b> Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor			

scheduling; Thread scheduling.

**Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

**Textbook 1: Chapter - 4,5**

**Teaching-Learning Process**

Active Learning and problem solving

1. <https://www.youtube.com/watch?v=HW2Wcx-ktsc>

2. <https://www.youtube.com/watch?v=9YRxhlvt9Zo>

### Module-3

**Deadlocks:** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

**Textbook 1: Chapter - 7,8**

**Teaching-Learning Process**

Active Learning, Problem solving based on deadlock with animation

1. <https://www.youtube.com/watch?v=MYgmmJJfdBg>

2. [https://www.youtube.com/watch?v=Y14b7\\_T3AEw&list=PLEJxKK7AcSEGPOCFtQTJhOEIU44J\\_JAun&index=30](https://www.youtube.com/watch?v=Y14b7_T3AEw&list=PLEJxKK7AcSEGPOCFtQTJhOEIU44J_JAun&index=30)

### Module-4

**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

**File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

**Textbook 1: Chapter - 9,10,11**

**Teaching-Learning Process**

Active learning about memory management and File system

1. <https://www.youtube.com/watch?v=pl6qrCB8pDw&list=PLIY8eNdw5tW-BxRY0yK3fYTYVqytw8qhp>

2. <https://www.youtube.com/watch?v=-orfFhvNBzY>

### Module-5

**Secondary Storage Structures, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems.

**Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

**Textbook 1: Chapter - 2,21**

**Teaching-Learning Process**

Active learning about case studies

1. <https://www.youtube.com/watch?v=TTBkc5eiju4>

2. [https://www.youtube.com/watch?v=8hkvMRGTzCM&list=PLEAYkSg4uSQ2PAch478muxnoeTNz\\_QeUJ&index=36](https://www.youtube.com/watch?v=8hkvMRGTzCM&list=PLEAYkSg4uSQ2PAch478muxnoeTNz_QeUJ&index=36)

3. <https://www.youtube.com/watch?v=mX1FEur4VCw>

**Course Outcomes (Course Skill Set)**

At the end of the course the student will be able to:

CO 1. Identify the structure of an operating system and its scheduling mechanism.

- CO 2. Demonstrate the allocation of resources for a process using scheduling algorithm.  
 CO 3. Identify root causes of deadlock and provide the solution for deadlock elimination  
 CO 4. Explore about the storage structures and learn about the Linux Operating system.  
 CO 5. Analyze Storage Structures and Implement Customized Case study

### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

#### Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

1. First test at the end of 5<sup>th</sup> week of the semester
2. Second test at the end of the 10<sup>th</sup> week of the semester
3. Third test at the end of the 15<sup>th</sup> week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

#### Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

### Suggested Learning Resources:

#### Textbooks

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006

#### Reference Books

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition
2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.

#### Weblinks and Video Lectures (e-Resources):

1. [https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk\\_OQAeuVcp2Q](https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2Q)

2. [https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE\\_f](https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f)
3. <https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeR-n6mk0>

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Real world problem solving using group discussion.
- Role play for process scheduling.
- Present animation for Deadlock.
- Real world examples of memory management concepts