COURSE CONTENT

Distributed Systems								
V Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
24X0522	**Foundation**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisites: A course on "Operating System" A course on "Computer Organization & Architecture"								

Course Overview:

This course introduces the principles, architectures, and design techniques of Distributed Systems. It covers resource sharing, communication protocols, distributed objects, operating system support, file systems, peer-to-peer systems, synchronization, coordination, transactions, replication, and distributed shared memory. Students will gain a strong understanding of building, managing, and analyzing distributed systems for scalability, reliability, and fault tolerance in real-world computing environments.

Course Objectives:

1. Understand distributed system concepts, architectures, and remote invocation techniques like RPC and Java RMI.
2. Analyze operating system support for distributed systems and distributed file system architectures.
3. Apply peer-to-peer models, synchronization, global states, and coordination algorithms in distributed systems.
4. Implement transaction management, concurrency control, and deadlock handling in distributed systems.
5. Create replication strategies and design distributed shared memory with consistency models

Course Outcomes: After Completion of the Course, Students should be able to

1. Demonstrate knowledge of distributed architectures, communication models, and remote object invocation.
2. Apply OS-level support mechanisms and distributed file system concepts for resource sharing.
3. Analyze peer-to-peer systems, synchronize distributed processes, and implement coordination protocols.
4. Design and evaluate transaction processing and concurrency control mechanisms.
5. Develop fault-tolerant replicated systems and manage distributed shared memory consistency.

UNIT - I: Characterization of Distributed Systems: Examples of Distributed systems, Resource sharing and web, challenges System models: Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication Distributed objects and Remote Invocation: Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI

UNIT - II: Operating System Support- OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture. Distributed File Systems-Introduction, File Service architecture.

UNIT - III: Peer to Peer Systems Napster and its legacy, Peer to Peer middleware Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement- Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

UNIT - IV: Transactions and Concurrency Control- Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering. Distributed Transactions-Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions Distributed deadlocks: Transaction recovery.

UNIT - V: Replication: Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data. Distributed shared memory: Design and Implementation issues, Consistency models.

TEXT BOOKS:

1. Distributed Systems Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education
2. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani and Mukesh Singhal, Cambridge, rp 2010.

REFERENCE BOOKS:

1. Distributed Systems: An Algorithmic Approach — Sukumar Ghosh A balanced treatment of theory and algorithm design in distributed computing.
2. Distributed Systems: Concepts and Design — George Coulouris, Jean Dollimore, Tim Kindberg & Gordon Blair
3. Distributed Systems: An Algorithmic Approach — Sukumar Ghosh A balanced treatment of theory and algorithm design in distributed computing.

ELECTRONIC RESOURCES:

1. **https://www.distributed-systems.net/index.php/books/ds3/**
2. **https://freecomputerbooks.com/Distributed-Systems-3rd-**
3. **https://www.geeksforgeeks.org/computer-networks/what-is-a-distributed-system/**
4. **https://www.tutorialspoint.com/distributed-systems**

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)