SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech IV (Semester VII)

Subject Name: Distributed Systems **Subject Code:** BTIT13702
Type of course: Professional Core Course
Prerequisite (if any): Data Structure and Algorithm, Operating System, Computer Network

Rationale: A distributed system is a system whose components are located on different networked computers, which communicate and coordinate their actions by passing messages to one another. The components interact with one another in order to achieve a common goal. Three significant characteristics of distributed systems are: concurrency of components, lack of a global clock, and independent failure of components. From this course, students may learn foundations of distributed systems, idea of peer to peer services and file system, and security issues in distributed system.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments / projects / open book tests / closed book tests) CA2: Sincerity in attending classes / class tests / timely submissions of assignments / self-learning attitude / solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work / Quality of work submitted / Active participation in lab sessions / viva on practical skills learned in course.

Contents:

Sr. No.	Contents	Total Hours
1.	**Fundamentals of Distributed System** Definition of a Distributed System, Goals of a Distributed System, Types of Distributed Systems, Basics of Operating System and Networking	03
2.	**Basics of Architectures, Processes, and Communication** Architectures - Types of System Architectures, Processes - Basics of Threads, Virtualization, Roles of Client and Server, Code Migration; Communication - Types of Communications, Remote Procedure Calls, Message-Oriented Communication, Stream-Oriented Communication, Multicasting	12
3.	N**aming** - Names, Identifiers, And Addresses, Flat Naming, Structured Naming, Attribute-Based Naming	03
4.	**Synchronization** - Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning Of Nodes, Election Algorithms	04

5.	**Consistency, Replication and Fault Tolerance**-Introduction To Replication, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, Consistency Protocols, Basics of Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery	15
6.	**Security:** Introduction to Security- Security Threats, Policies, and Mechanisms, Design Issues, Basics of Cryptography, Secure Channels- Authentication, Message Integrity and Confidentiality, Secure Group Communication; Access Control- General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service; Security Management-Key Management, Secure Group Management, Authorization Management	08

Suggested Specification table with Marks (Theory): (For B. Tech only)

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	20	10	10	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (Revised Bloom's Taxonomy)

Reference Books:

Sr no	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**	**Year of publication**	**Publication Edition**
1	Distributed systems: principles and paradigms	Andrew S. Tanenbaum and Maarten Van Steen	Pearson	2007	3rd Edition
2	Distributed Operating Systems: Concepts and Design	Pradeep K. Sinha	PHI Learning Pvt. Ltd 978-81-203-1380-4	2012	-
3	Distributed computing: principles and applications	Liu, M.L.,	Pearson Education	2003	1st Edition
4	Distributed algorithms	Nancy A. Lynch	Elsevier	1996	-

5	Distributed systems Concepts and Design	George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair	Pearson	2005	5th Edition

Course Outcomes (CO):

Sr. No.	CO statements	Marks % weightage
CO-1	Understand architecture and communication systems in Distributed Systems.	30%
CO-2	Understand synchronization and various election algorithms in Distributed Systems.	20%
CO-3	Analyze various consistency and replication protocols and methods.	30%
CO-4	Recognize security threats and apply cryptography methods for security in Distributed Systems.	20%

Suggested List of Experiments:

Sr. No	Practical Statements
1.	Implement a simple client and server program that communicate over sockets
2.	Implement a TCP server and client. Also implement a UDP server and client.
3.	Implement multi-threaded server which can handle multiple clients concurrently using threading.
4.	Implement file transfer where the client can send a file to the server, and the server saves it.
5.	Implement Remote Procedure call.
6.	Implement Remote Method Invocation.
7.	Implement a distributed lock service that allows multiple processes or nodes to acquire and release locks on a shared file.
8.	Implement a leader election algorithm(Bully) in a distributed system. Simulate scenarios where nodes join, leave, or fail, and observe how the system elects and maintains a leader.
9.	Study of Distributed File systems.
10.	Study of Distributed Object-based System.