Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Engineering (M. Tech)
Course Code	:	1MSE06
Course Title	:	Distributed System & Applications (PE - I)
Type of Course	:	Professional Elective (PE)
Year of Introduction	:	2023-24

Prerequisite	:	Networking, OS, DBMS, Web technology and Software Engineering Principles.
Course Objective	:	The course objectives for a Distributed Systems and Applications course can vary depending on the educational institution and instructor. However, here are some common objectives you might find in such a course: Distributed System and model, Communication and Middleware, Distributed Algorithm, Scalability and Performance, Distributed File System etc.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	To Explain the basic fundamentals of Distributed OS. like models, features, concept, design issues and fundamentals of distributed system. (Understand).
	CO2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems. (Understand).
	CO3	Demonstrate Synchronization the deadlock detection and agreement protocol of distributed OS. (Apply).
	CO4	Design and Implement Distributed applications using Technologies like RMI, threads. (Create)
	CO5	Demonstrate the application of XML in distributed communications enabling, enterprise systems assurance, web enabling, application enabling, and enterprise data enabling. (Create).
	CO6	Understand and explain the basic concepts of Grid Computing, Cluster computing and cloud computing.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
3	0	2	4	70	30	30	20	150

Legends: ***L****-Lecture;* ***T****–Tutorial/Teacher Guided Theory Practice;* ***P*** *– Practical,* ***C*** *– Credit,* ***SEE*** *– Semester End Examination,* ***CIA*** *- Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.))*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with CO
1	**Fundamentals of Distributed System** Architectures for Distributed Systems, Distributed Computing, Models, Workstation Model, Workstation-Server Model, Processor-pool Model , Comparison of the Distributed Computing Models, Advantages of Distributed Systems, Disadvantages of Distributed Systems, Software Concepts, Network Operating System, Distributed Operating System, Multiprocessor Time-Sharing System, Comparison of Different Operating Systems, Transparency, Flexibility, Reliability, Performance, Scalability, Security, Fault Tolerance, Client-Server Model, Client-Server Addressing, Client-Server Implementation Client-Server Architecture.	09	18%	CO1
2	**Inter-process Communication** Message Passing, Introduction to Message Passing, Advantages and Features of Message-Passing Systems, IPC Message Format, IPC Synchronization, Message Buffering Strategies, Multi-datagram Messaging, Process Addressing Techniques Failure Handling Mechanism, Group Communication, Types of Group Communication, Group Management, Group Addressing and Message Delivery, Reliability Mechanism, Message Ordering.	10	20**%**	CO2
3	**Synchronization** Clock Synchronization, Physical Clocks, Clock Synchronization Algorithms ,Use of Synchronized Clocks ,Logical Clocks, Event Ordering, Implementation of Logical Clocks, Lamport's Timestamps, Vector Timestamps, Global State, Mutual Exclusion, Centralized Algorithm, Distributed Algorithm, Token Ring Algorithm, Comparison of Various Algorithms, Election Algorithms, Bully Election Algorithm, Ring Election Algorithm, Election in a Wireless Network, Deadlocks in Distributed Systems, Deadlock Modelling, Handling Deadlocks in Distributed Systems, Distributed Deadlock Prevention, Distributed Deadlock Detection, Distributed Deadlock Recovery.	10	20%	CO3
4	**XML and XML Web services** Introduction to XML, APIs for XML Processing, XML Web services.	06	12%	CO5
5	**Enterprise Application Integration, Web Services** Web services: Concepts, Protocols: SOAP, WSDL, UDDI, Development of Web services, J2EE and .Net Interoperability.	10	20%	CO4

6	**Introduction to Cluster Computing, Grid Computing and Cloud Computing** Overview of Cluster Computing: The Role of Clusters, Definition and Taxonomy, Distributed Computing, Limitations, Cluster Planning, Architecture and Cluster Software, Design Decisions, Network Hardware, Network Software, Protocols, Distributed File Systems, Virtualization technologies, Benchmarks. Introduction: What is a grid?, Infrastructure of hardware and software, Main Projects and Applications, The Open Grid Forum, International Grid Trust Federation, Grid Architecture: Overview of Resource Managers, Overview of Grid Systems, Application Management, Grid Application Description Languages, Application Partitioning, Meta- scheduling, Mapping, Monitoring, Web Services, Grid Portals. What is Cloud computing and its history and evolution? Cloud Computing architecture and industry frameworks such as Map Reduce, Cloud computing infrastructure requirements and limitations, Practical applications of cloud computing for various industries, including a case study.	04	08%	CO6
7	**Advanced Research Topics** Advanced Research Topics & Issues.	02	04%	

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**40**	**20**	**20**	**10**	**-**	**10**

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	Write a Program to implement Concurrent Echo Client Server Application.	2
2	Write a Program to implement Concurrent Day Time Server Application.	2
3	Write a program to solve Producer-Consumer Problem using thread.	2
4	Write a program to implement Calculator using Socket in java.	2
5	Implement RPC Programming.	2
6	Implementation of Server that adds given two values by the clients using Java RMI.	2

7	Write a program to create CORBA based client server application.	2
8	Implementing Bully Election algorithm for synchronization.	2
9	Implementing Ring Election algorithm for synchronization.	2
10	Write a Program to Increment a Counter in Shared Memory.	2

Reference Books

Sr. No.	Name of Reference Books
1	Karanjit S. Siyan, "Inside TCP/IP", third edition, New Riders Publishing, ISBN: 1-56205-714-6.
2	Marko Boger "Java in Distributed System" , John Wiley and Sons Ltd.
3	David Reilly and Michael Reilly " Java Network Programming and Distributed Computing" , Addison-Wesley.