

**Course Objective:** 1) To provide students with a solid foundation in the principles and practices of distributed and cloud computing.

2) To equip students with the knowledge and skills to design, develop, and manage distributed systems and cloud-based applications.

3) To introduce students to distributed algorithms, middleware, and data consistency mechanisms.

4) To explore cloud architecture, storage solutions, and cloud security challenges.

5) To examine advanced topics in distributed and cloud computing, including edge computing, containerization, and big data.

S. NO	Course Outcomes (CO)
CO1	Understand the fundamental concepts and architectures of distributed and cloud computing.
CO2	Design and implement distributed algorithms and middleware solutions.
CO3	Develop and manage cloud-based applications, leveraging cloud architecture and storage solutions.
CO4	Apply security measures to protect distributed and cloud systems.
CO5	Explore advanced topics and emerging trends in distributed and cloud computing, preparing for future challenges in the field.

S. NO	Contents	Contact Hours
UNIT 1	<b>Unit 1: Introduction to Distributed Systems</b> Overview of Distributed Computing: Definitions, Characteristics, and Applications Distributed System Architectures: Client-Server, Peer-to-Peer, and Hybrid Models Communication in Distributed Systems: RPC, RMI, and Message Passing Synchronization in Distributed Systems: Clock Synchronization, Logical Clocks, and Distributed Mutual Exclusion Fault Tolerance and Recovery in Distributed Systems: Checkpointing, Replication, and Consensus Algorithms	10
UNIT 2	<b>Unit II: Introduction to Cloud Computing</b> Overview of Cloud Computing: Definitions, Characteristics, and Service Models (IaaS, PaaS, SaaS) Cloud Deployment Models: Public, Private, Hybrid, and Community Clouds Virtualization in Cloud Computing: Concepts, Hypervisors, and Virtual Machine Management Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) Economic and Business Models of Cloud Computing: Cost-Benefit Analysis, Pricing Models, and SLA Management	12
UNIT 3	<b>Unit III: Distributed Algorithms and Middleware</b> Distributed Algorithms: Leader Election, Consensus Algorithms (Paxos, Raft), and Distributed Hash Tables (DHTs) Middleware for Distributed Systems: Definition, Components, and Examples Data Consistency and Replication in Distributed Systems: CAP Theorem, Consistency Models, and Quorum-Based Protocols Security in Distributed Systems: Threats, Encryption, and Authentication Mechanisms Case Studies: Middleware Platforms (CORBA, Java RMI, Microsoft DCOM) and their Applications.	10
UNIT 4	<b>Unit IV: Cloud Architecture and Storage</b> Cloud Architecture: Cloud Infrastructure, Resource Management, and Virtualization Cloud Storage: Data Storage Systems in Cloud, Distributed File Systems (HDFS, GFS), and NoSQL Databases Cloud Security: Security Issues, Data Protection, and Identity and Access Management (IAM) Cloud Application Development: Tools, Frameworks, and Best Practices Case Studies: Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure	10

<b>UNIT 5</b>	<b>Unit V: Advanced Topics in Distributed and Cloud Computing</b> Edge and Fog Computing: Concepts, Architectures, and Use Cases Serverless Computing: Function as a Service (FaaS) and Event-Driven Architectures Containerization and Orchestration: Docker, Kubernetes, and Microservices Big Data and Cloud Computing: Hadoop, Spark, and Data Analytics in the Cloud Future Trends in Distributed and Cloud Computing: AI Integration, Blockchain, and Quantum Computing	<b>10</b>
	<b>TOTAL</b>	<b>42</b>

### REFERENCES

S.No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
<b>1</b>	Coulouris, G., Dollimore, J., & Kindberg, T. Distributed Systems: Concepts and Design (6th ed.). Pearson. ISBN: 978-0132143011.	2022
<b>2</b>	Tanenbaum, A. S., & Van Steen, M. Distributed Systems: Principles and Paradigms (3rd ed.). Pearson. ISBN: 978-0132392275.	2021
<b>3</b>	Rajkumar, B., Yeo, C. S., & Venugopal, S. Cloud Computing: Principles and Paradigms (2nd ed.). Wiley. ISBN: 978-1119524984.	2020
<b>4</b>	Erl, T., Puttini, R., & Mahmood, Z. Cloud Computing Design Patterns (1st ed.). Prentice Hall. ISBN: 978-0133858567.	2023
<b>5</b>	Hwang, K., Dongarra, J., & Fox, G. C. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things (2nd ed.). Morgan Kaufmann. ISBN: 978-0128002049.	2022

### B.Tech. Information Technology

Course code: Course Title	Course Structure			Pre-Requisite
<b>Pattern Recognition</b>	<b>L</b>	<b>T</b>	<b>P</b>	Linear Algebra, Probability Theory
	<b>3</b>	<b>0</b>	<b>2</b>	