# TEERTHANKER MAHAVEER UNIVERSITY

**(Established under Govt. of U. P. Act No. 30, 2008)**

**Delhi Road, Moradabad (U.P.)**

## PhD PROGRAMME

## SYLLABUS FOR DISCIPLINE-SPECIFIC COURSE COMPUTER APPLICATIONS/ COMPUTER SCIENCE & ENGINEERING

| **Course Code: PDS240135** | **CLOUD COMPUTING AND DISTRIBUTED SYSTEM** | **L** | **T** | **P** | **C** |
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| **Objective:** | The objective of this course is to equip students with a comprehensive understanding of cloud computing and distributed architectures, technologies, and protocols. | | | | |
| **Course Outcomes:** | | | | | |
| **CO 1:** | Understanding the need of computing and cloud-enabling technologies service-oriented architecture. | | | | |
| **CO 2:** | Understanding cloud architecture, services, and storage. Apply resource management and security in a cloud-based architecture. | | | | |
| **CO 3:** | Understanding the role of distributed systems analyzing different distributed mutual exclusion strategies. | | | | |
| **CO 4:** | Applying different agreement protocols. and analyzing different distributed resource management techniques in file management. | | | | |
| **CO 5:** | Understanding failure recovery in distributed systems and evaluating transactions and concurrency control mechanisms. | | | | |
| **Course Content:** | | | | | |
| **Unit 1:** | **Introduction to Cloud Computing:** Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning. **Cloud Enabling Technologies Service Oriented Architecture:** REST and Systems of Systems – Web Services – Publish, Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery | | | | |
| **Unit 2:** | **Cloud Architecture, Services and Storage:** Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3. **Resource Management and Security In Cloud:** Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards | | | | |
| **Unit 3:** | **Distributed Systems:** Introduction, Examples of distributed Systems, Resource sharing, and the Web Challenges. Architectural models, | | | | |

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| | Fundamental Models. Theoretical Foundation for Distributed System,<br>**Distributed Mutual Exclusion:** Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token-based and non token-based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection. |
| **Unit 4:** | **Agreement Protocols:** Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Application of Agreement problem, Atomic Commit in Distributed Database system.<br>**Distributed Resource Management:** Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory. |
| **Unit 5:** | **Failure Recovery in Distributed Systems:** Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems. **Fault Tolerance:** Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols<br>**Transactions and Concurrency Control:** Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. |
| **Textbooks:** | 1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.<br>2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press, 2017.<br>3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata MacGraw Hill, 2013. |
| **Reference Books:** | 1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata McGraw Hill, 2009.<br>2. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill<br>3. Ramakrishna, Gehrke," Database Management Systems", McGraw Hill |