COURSE CODE	COURSE TITLE	L	T	P	C
UCS1701	DISTRIBUTED SYSTEMS	3	0	0	3

OBJECTIVES

- To introduce the computation and communication models of distributed systems
- To illustrate the issues of synchronization and collection of information in distributed systems
- To educate distributed mutual exclusion and distributed deadlock detection techniques
- To elucidate agreement protocols and Fault Tolerance mechanisms in Distributed Systems
- To explain the features of Peer-to-Peer systems and memory consistency models.

UNIT I INTRODUCTION 8

Introduction: Definition-Relation to computer system components -- Motivation -- Relation to parallel multiprocessor/multicomputer systems -- Message-passing systems versus shared memory systems -- Primitives for distributed communication -- Synchronous versus asynchronous executions -- Design issues and challenges; A model of distributed computations: A distributed program -- A model of distributed executions -- Models of communication networks – Global state of a distributed system -- Cuts of a distributed computation -- Past and future cones of an event -- Models of process communications.

UNIT II LOGICAL TIME AND GLOBAL STATE 10

Logical Time: Physical clock synchronization: NTP -- A framework for a system of logical clocks -- Scalar time -- Vector time; Message ordering and group communication: Message ordering paradigms -- Asynchronous execution with synchronous communication – Synchronous program order on an asynchronous system -- Group communication -- Causal order (CO) Total order; Global state and snapshot recording algorithms: Introduction -- System model and definitions – Snapshot algorithms for FIFO channels.

UNIT III DISTRIBUTED MUTEX AND DEADLOCK 10

Distributed mutual exclusion algorithms: Introduction – Preliminaries -- Lamport’s algorithm -- Ricart–Agrawala algorithm -- Quorum-based mutual exclusion algorithms -- Maekawa's algorithm -- Token-based algorithms -- Suzuki–Kasami’s broadcast algorithm; Deadlock detection in distributed systems: Introduction -- System model – Preliminaries -- Models of deadlocks -- Knapp’s classification of distributed deadlock detection algorithms -- Mitchell and Merritt’s algorithm for the single resource model -- Chandy–Misra–Haas algorithm for the AND model -- Chandy–Misra–Haas algorithm for the OR model.

UNIT IV CONSENSUS AND RECOVERY 10

Consensus and agreement algorithms: Problem definition -- Overview of results -- Agreement in a failure-free system (synchronous or asynchronous) -- Agreement in (message-passing) synchronous systems with failures; Check pointing and rollback recovery: Introduction -- Background and definitions -- Issues in failure recovery --Checkpoint-based recovery -- Log-based rollback recovery -- Koo–Toueg coordinated check pointing algorithm -- Juang–Venkatesan algorithm for asynchronous checkpointing and recovery.

UNIT V PEER TO PEER AND DISTRIBUTED SHARED MEMORY 7

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays -- Tapestry; Distributed shared memory: Abstraction and advantages -- Memory consistency models -- Lamport's Bakery Algorithm.

TOTAL PERIODS: 45

OUTCOMES

On successful completion of this course, the student will be able to

- Realize the foundations of Distributed Systems (K2)
- Able to solve synchronization and state consistency problems (K3)
- Demonstrate the resource sharing techniques in Distributed systems (K3)
- Comprehend the working model of consensus and reliability of Distributed Systems (K3)
- Identify the fundamentals of Peer-to-Peer Systems (K2)

TEXTBOOKS

1. Kshemkalyani Ajay D, Mukesh Singhal.“Distributed computing: Principles, Algorithms and Systems”. Cambridge University Press, 2011.
2. Mukesh Singhal,Niranjan G Shivaratri. “Advanced Concepts in Operating Systems”. McGraw-Hill, 1994.

REFERENCE BOOKS

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition,Pearson Education, 2012.
2. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, PrenticeHall of India,2007.
3. Tanenbaum A S, Van Steen M, “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
4. Liu M L, “Distributed Computing, Principles and Applications”, PearsonEducation, 2004.
5. NancyA Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.