



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3163210

DISTRIBUTED COMPUTING

6th SEMESTER

Type of course: Undergraduate (Elective)

Prerequisite: Operating Systems, Data Communication and Networking

Rationale: Student has studied subject Operating Systems. The work of Operating System is different in the distributed environment. Student should understand Message passing, RPC, Synchronization, Load Balancing. Migration of processes, Deadlock management etc in distributed environment.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Contents

Sr. No	Contents	Teaching Hours	% Weightage
1	Concepts of Distributed Systems: Introduction, Distributed computing models, Software concepts, Design issues in distributed systems, Client-server model, Basics of Network communication, Network Models.	5	10
2	Inter-process Communication: Message Passing and its features, IPC message format, IPC synchronization, Buffering, multi datagram messaging, process addressing techniques, failure handling, Formal Models for message passing systems, Broadcast and converge cast on a spanning tree, Flooding and building a spanning tree, Constructing a DFS spanning tree with and without a specified root	8	20
3	Remote Communication: Introduction, RPC basics, RPC implementation, RPC Communication and Other issues, Sun RPC, RMI basics, RMI Implementation, Java RMI	6	15
4	Synchronization: Clock synchronization, Logical clocks, Global state, Mutual exclusion, Election algorithms: Bully algorithm, Ring algorithm, Leader election in rings, anonymous rings, Asynchronous rings, synchronous rings, election in wireless networks, Deadlocks in Distributed systems, Deadlocks in Message communication	8	15
5	Distributed System Management: Resource management, Task management approach, Load balancing approach, Load sharing approach, Process Management, Process migration, threads, fault tolerance	6	10
6	Distributed Shared Memory: Concepts, Hardware DSM, Design issues in DSM systems, Implementation issues, Heterogeneous and other DSM systems	4	10
7	Naming: Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Directory service	3	10
8	Google File system and Hadoop distributed file system	2	10



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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	10	10	0	0

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

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

Text Books:

1. Distributed Systems: Principles and Paradigms, Taunenbaum
2. Distributed Systems: Concepts and Design, G. Coulouris, J. Dollimore, and T. Kindberg, Pearson Education
3. Distributed Computing, Sunita Mahajan and Seema Shah, Oxford University Press
4. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, Hagit Attiya and Jennifer Welch, Wiley India
5. Distributed Operating System, Pradeep K Sinha, PHI

Course Outcome:

After learning the course the students should be able to

Sr. No.	CO Statement	Marks % Weightage
CO-1	Understand the concepts and fundamentals of distributed systems.	15
CO-2	Understand and implement the inter-process communication using RPC concepts.	25
CO-3	Understand and implement synchronization in client-server approach.	25
CO-4	Understand and implement the thread concepts.	20
CO-5	Understand the concept of distributed file system.	15

List of Experiments

1. Implement concurrent client-server application using socket programming in UNIX/LINUX.
2. Study of rpcgen protocol compiler.
3. Write a program to create a calculator using rpcgen utility.
4. Write a program to create a calculator using JAVA RMI.
5. Inter-process communication using shared memory in UNIX/LINUX
6. Inter-thread communication using POSIX thread library or JAVA.
7. Client-server programming using pthread library and socket programming.
8. Implement inter-thread synchronization using Mutual exclusion.
9. Implement Inter-thread communication using Semaphores.
10. Implement Lamport's logical clock
11. Implement leader election algorithm