

Subject Code:1ET2030103	Subject Title: DISTRIBUTED COMPUTING
Pre-requisite :	Fundamentals of Operating Systems and Computer Networks

Course Objective:

The objectives of this course are:

- To provide students with contemporary knowledge in distributed computing.
- To describe the various design issues in a distributed computing systems.
- To provide knowledge on principles and practice underlying in the design of distributed systems.
- To equip students with skills to design a distributed application.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
2	-	2	4	60	40	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	Introduction to Distributed Computing: Definition, Different forms of computing, Relation to parallel systems, Strengths and weaknesses of Distributed Computing, A Model of distributed computations	2	8
2	Message Passing: Inter process Communication(IPC), Desirable Features of Good Message-Passing Systems, Issues in IPC by Message, Synchronization, Buffering, Multidatagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication.	2	8
3	Remote Procedure Calls: The Remote Procedure Call (RPC) Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling. Arguments and Results, Server Management, Communication Protocols for RPCs, Complicated RPCs.	3	14
4	Distributed Objects and Remote Invocation : Introduction, Communication between distributed objects, Java RMI, CORBA	2	8
5	Distributed Shared Memory: Design and Implementation issues of Distributed Shared Memory (DSM), Granularity, Structure of Shared memory Space, Consistency Models, replacement Strategy, Thrashing, Advantages of DSM.	3	14
6	Synchronization: Clock Synchronization, Event Ordering, Mutual Exclusion, Election Algorithms.	3	12
7	Resource and Process Management: Desirable Features of a good global scheduling algorithm, Task assignment approach, Load Balancing approach, Load Sharing Approach, Process Migration	4	16
8	Distributed Transactions: Introduction, Flat and nested distributed transactions, Two-phase commit protocol, Concurrency control in distributed transactions	3	12
9	Security in distributed computing and application: Security threats, security mechanism, security policies, case study of Globus security architecture	2	8

Review Presentation: The student is expected to spend minimum 2 hours per week (as mentioned in the teaching and evaluation scheme) to refer at least two peer reviewed journal papers related to this domain/subject. The student is expected to identify issues/challenges and emerging trends in the domain/subject. Student is supposed to explore various video lectures (E.g. NPTEL) available in the domain/subject. Student is required to make a review-presentation on the work carried out for the same.

Recommended sites for journal papers are (1) dl.acm.org (2) springer.com (3) sciencedirect.com (4) elsevier.com (5) ieeexplore.ieee.org (6) scholar.google.co.in (7) scopus.com or others of similar repute.

Course Outcome:

At the end of the course the student will be able to:

- Analyze various components of distributed computing systems
- classify distributed shared memory models
- analyze algorithms for coordination, communication, synchronization in distributed systems
- Integrate OS and programming language concepts to solve/implement the (distributed) components of the systems

List of References:

1. Distributed Operating Systems Concepts and Design by Pradeep K. Sinha (PHI)
2. Distributed Systems Concepts and Design Fifth Edition George Coulouris, Jean Dollimore and Tim Kindberg, Addison-Wesley Inc./Pearson Education
3. Distributed Computing – Principles and Applications, by M. L. Liu (Pearson)
4. Distributed Systems Principles and Paradigms by Andrew S. Tanenbaum and Maarten Van Steen (PHI)
5. Distributed Computing: Principles, Algorithms, and Systems, Ajay Kshemkalyani and Mukesh Singhal

E-Resource / Web Links:

- <https://www.cs.uic.edu/~ajayk/DCS-Book>
- <http://cs-www.cs.yale.edu/homes/aspnes/classes/465/notes.pdf>
- <http://nptel.ac.in/courses/106106107/>

List of Experiments:

Note: The experiment list provided beneath is for reference only. The course teacher may change/formulate it as per his/her methodology and requirement.

1. Develop a Distributed application using socket. Application consists of a server which takes an integer value from the client, calculates its factorial and returns the result to the Client program.
2. Develop an application using RPC.
3. Design a distributed application using RMI where client submits two strings to the server and server returns the concatenation of the given strings.
4. Implement distributed telephone directory using Java RMI Programming. Implement concurrency control to distributed telephone directory.
5. Implementing election algorithm for synchronization
6. Implement Task assignment and load balancing scheme.
7. Implement two phase commit protocol.
8. Design a Distributed Application using Message passing Interface for remote computation.
9. Study the design of a Gnutella client.
10. Develop distributed enterprise application
11. Design web service in java.
12. Install Hadoop and implement a program to make use of map-reduce model.
13. Install Globus toolkit and implement any program on it.