

Branch Name:	Information and Communication Technology
Semester/Year:	Semester I / First Year
Subject Title:	Distributed Computing
Subject Code:	2ET2030103T
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 distributed computing systems and to equip students with skills to design a distributed application.

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCE		SEE		CCE		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

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 MukeshSinghal

E-Resource / Web Links:

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

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the design principles in distributed systems and the architectures for distributed systems.	1 Remembering, 2 Understanding
CLO2	Apply various distributed algorithms related to clock synchronization, concurrency control, deadlock detection, load balancing, voting etc.	2 Understanding, 3 Applying
CLO3	Analyze fault tolerance and recovery in distributed systems and algorithms for the same.	4 Analyze
CLO4	Analyze the design and functioning of existing distributed systems and file systems.	3 Applying
CLO5	Implement different distributed algorithms over current distributed platforms	4 Analyze
CLO6	To analyse the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.	4 Analyze

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO 4
CLO1	H	L	L	L	M							M	L	L		
CLO2	M	M	H	L	M							M	M	M		
CLO3	L	L	L	M	M							M	L	M		
CLO4	L	L	H	L	M							L	M	M	M	
CLO5	H	M	M	M	H							M	M	H	M	
CLO6	H	M	H	M	H							H	M	M	M	

H: High, M: Medium, L: Low