CSE4001	PARALLEL AND DISTRIBUTED COMPUTING	L	T	P	J	C
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Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To introduce the fundamentals of parallel and distributed computing architecturesand paradigms.
2. To understand the technologies, system architecture, and communication architecture that propelled the growth of parallel and distributed computing systems.
3. To develop and execute basic parallel and distributed application using basicprogramming models and tools.

Expected Course Outcome:

Students who complete this course successfully are expected to:

1. Design and implement distributed computing systems.
2. Asses models for distributed systems.
3. Design and implement distributed algorithms.
4. Experiment with mechanisms such as client/server and P2P algorithms, remoteprocedure calls (RPC/RMI), and consistency.
5. Analyse the requirements for programming parallel systems and critically evaluate the strengths and weaknesses of parallel programming models.
6. Differentiate between the major classes of parallel processing systems.
7. Analyse the efficiency of a parallel processing system and evaluate the types of application for which parallel programming is useful.

Module:1	**Parallelism Fundamentals**	**2 hours**

Motivation – Key Concepts and Challenges – Overview of Parallel computing – Flynn‟s Taxonomy – Multi-Core Processors – Shared vs Distributed memory.

Module:2	**Parallel Architectures**	**3 hours**

Introduction to OpenMP Programming – Instruction Level Support for Parallel Programming – SIMD – Vector Processing – GPUs.

Module:3	**Parallel Algorithm and Design**	**5 hours**

Preliminaries – Decomposition Techniques – Characteristics of Tasks and Interactions – Mapping Techniques for Load balancing – Parallel Algorithm Models.

Module:4	**Introduction To Distributed Systems**	**4 hours**

Introduction – Characterization of Distributed Systems – Distributed Shared Memory – Message Passing – Programming Using the Message Passing Paradigm – Group Communication – Case Study (RPC and Java RMI).

Module:5	**Coordination**	**6 hours**

Time and Global States – Synchronizing Physical Clocks – Logical Time and Logical Clock – Coordination and Agreement – Distributed Mutual Exclusion – Election Algorithms – Consensus and Related Problems.

Module:6	**Distributed Transactions**	**6 hours**

Transaction And Concurrency Control – Nested Transactions – Locks – Optimistic Concurrency Control – Timestamp Ordering Distributed Transactions – Flat and Nested – Atomic – Two Phase Commit Protocol – Concurrency Control.			
Module:7	**Distributed System Architecture and its Variants**		**2 hours**
Distributed File System: Architecture – Processes – Communication Distributed Web-based System: Architecture – Processes – Communication. Overview of Distributed Computing Platforms.			
Module:8	**Recent Trends**		**2 hours**
	Total Lecture hours:	**30 hours**	

Text Book(s)		
1.	George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair, "Distributed Systems: Concepts and Design", 5th Edition, Pearson / Addison – Wesley, 2012	
2.	Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, "Introduction to Parallel Computing", Pearson, 2nd Edition, 2008.	
Reference Books		
1.	Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems: Principles and Paradigms", Pearson, 2nd Edition, 2006	
2.	Pradeep K. Sinha, "Distributed Operating System: Concepts and Design", PHI Learning Pvt. Ltd., 2007	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Challenging Experiments (Indicative)		
1.	OpenMP – Basic programs such as Vector addition, Dot Product	2 hours
2.	OpenMP – Loop work-sharing and sections work-sharing	2 hours
3.	OpenMP – Combined parallel loop reduction and Orphaned parallel loop reduction	2 hours
4.	OpenMP – Matrix multiply (specify run of a GPU card, large scale data … Complexity of the problem need to be specified)	3 hours
5.	MPI – Basics of MPI	3 hours
6.	MPI – Communication between MPI process	3 hours
7.	MPI – Advanced communication between MPI process	3 hours
8.	MPI – Collective operation with „synchronization"	3 hours
9.	MPI – Collective operation with „data movement "	3 hours
10.	MPI – Collective operation with „collective computation "	3 hours
11.	MPI – Non-blocking operation	3 hours
	Total Laboratory Hours	30 hours
Mode of assessment: Project/Activity		

Recommended by Board of Studies	19-11-2018		
Approved by Academic Council	No. 53	Date	13-12-2018