VIT BHOPAL www.vitbhopal.ac.in	**Parallel and Distributed Computing**	**Course Type**	**LTP**
Course Code:	**CSE3009**	**Credits**	**4**
Prerequisite:			

Course Objectives:

1. To provide contemporary knowledge to students in parallel and distributed environment.
2. To provide students with abilities to analyze and design parallel and distributed applications.
3. In the development of parallel and distributed applications, apply core computer science concepts and algorithms.
4. To illustrate middleware technologies to support distributed applications.
5. To identify Distributed and parallel programs to improve performance and reliability.

Course Outcomes:

Students will be able to

CO1: Analyze parallel and distributed system using the principles and concepts.[KL4]
CO2: Apply parallelize problems for load balancing. [KL3]
CO3 : Explain the challenges and opportunities that parallel and distributed systems present. [KL2]
CO4: Explain middleware technologies. RPC, RMI, and object-based[KL2]
CO5: Illustrate middleware technologies to support distributed applications. [KL2]
CO6: Identify Distributed and parallel programs to improve performance and reliability. [KL2]

Correlation of COs with POs

CO \ PO	CKL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PKL		3	5	6	5	6	3	3	3	NA	M	3	M	3	3	3
CO1	2	3	2	1	2	1	3	3	3	2	2	3	3	3	3	2
CO2	2	3	2	1	2	1	3	3	3	2	2	3	3	3	3	2
CO3	3	3	2	2	2	2	3	3	3	2	2	3	3	3	3	2
CO4	3	3	2	2	2	2	3	3	3	2	2	3	3	3	3	1
CO5	3	3	2	2	2	2	3	3	3	2	2	3	3	3	3	1

CO	Topics to be discussed	L. Hrs.
CO1	Parallelism Fundamentals – Key Concepts and Challenges – Overview of Parallel computing – Flynn's Taxonomy – Multi-Core Processors – Shared vs Distributed memory. Performance of Parallel Computers, Performance Metrics for Processors, Parallel Programming Models, Parallel Algorithms.	**8**
CO2	Parallel Algorithm and Design - Preliminaries – Decomposition Techniques – Mapping Techniques for Load balancing. Synchronous Parallel Processing – Introduction, Example-SIMD Architecture and Programming Principles	**8**
CO3	Introduction to Distributed Systems – Definition, Issues, Goals, Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept, Design Issues. Communication – Layered Protocols, Remote Procedure Call, Remote Object Invocation, Message Oriented Communication, Stream Oriented Communication – Case Study (RPC and Java RMI). Parallel Random Access Machine (PRAM) model, PRAM architechture.	**9**
CO4	Resource and Process Management – Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach, Introduction to process management, process-migration, Threads, Virtualization, Clients, Servers, Code Migration. Synchronization – Clock Synchronization, Logical Clocks, Election Algorithms, Consensus	**9**

	and Related Problems.	
CO5	Transaction and Concurrency Control – Nested Transactions – Locks – Optimistic Concurrency Control – Timestamp Ordering Distributed Transactions – Atomic – Two Phase Commit Protocol – Concurrency Control. Distributed File Systems. - Introduction, good features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Network File System(NFS), Andrew File System(AFS), Hadoop Distributed File System and Map Reduce.	**9**
CO6	Contemporary Topics (Virtualization and Cloud Environment)	**2**
	Total Lecture:	45

List of Experiments

1. OpenMP – Basic programs such as Vector addition, Dot Product
2. OpenMP – Loop work-sharing and sections work-sharing
3. OpenMP – Combined parallel loop reduction and Orphaned parallel loop reduction
4. OpenMP – Matrix multiply (specify run of a GPU card, large scale data … Complexity of the problem need to be specified)
5. MPI – Basics of MPI
6. MPI – Communication between MPI process
7. MPI – Collective operation with "synchronization"
8. MPI – Collective operation with "data movement"
9. MPI – Collective operation with "collective computation"
10. MPI – Non-blocking operation

Text Books:

1. M.R. Bhujade, “Parallel Computing”, 2nd edition, New Age International Publishers 2009.
2. Andrew S. Tanenbaum and Maarten Van Steen, “Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education, Inc., 2007

Reference books:

1. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems: Concepts and Design” (4th Edition), Addison Wesley/Pearson Education.
2. Pradeep K Sinha, “Distributed Operating Systems : Concepts and design”, IEEE computer society press

Recommendation by the Board of Studies on	27.12.2021
Approval by Academic council on:	
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