



# MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

## COURSE CONTENT

PARALLEL COMPUTING LAB								
II Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2525883	Foundation	0	0	4	2	40	60	100
		Practical Classes: 60			Total Classes: 60			
Contact Classes: Nil	Tutorial Classes: Nil							
Prerequisites: Computer Organization & Architecture, Operating Systems, Programming for problem solving.								

### Course Overview:

This is a practical, hands-on laboratory course designed to reinforce and extend the theoretical concepts of advanced data structures through implementation and experimentation. The course focuses on understanding complex data structures, analyzing their performance, and applying them to solve real-world problems efficiently.

### Course Objectives:

1. To understand the fundamentals of parallel computing architectures and programming models.
2. To develop parallel programs using MPI, OpenMP, and Pthread programming techniques.
3. To implement parallel algorithms for sorting, graph traversal, and matrix computations.
4. To analyze the performance, speedup, and efficiency of parallel computing solutions.
5. To apply parallel programming concepts for solving real-world scientific and computational problems.

### Course Outcomes: After Completion of the Course, Students should be able to

1. Implement parallel programs using MPI, OpenMP, and Pthreads to solve computational problems efficiently.
2. Apply parallel programming constructs to implement sorting and graph for performance improvement.
3. Analyze the speedup and efficiency of parallel programs, with sequential implementations to evaluate performance gains.
4. Decompose computational problems into tasks suitable for parallel execution, and synchronize tasks effectively using threads and message passing.
5. Demonstrate the use of parallel computing in real-world applications and research scenarios, including matrix computations, graph processing, and scientific simulations.

### List of Programs.

1. Design a parallel program to implement Matrix-Vector and Matrix-Matrix Multiplication using MPI library.
2. Design a parallel program to implement Bubble Sort using OpenMP and Pthread Programming Constructs.
3. Design a parallel program to implement Quick Sort using OpenMP and Pthread Programming Constructs.
4. Design a parallel program to implement Bucket Sort using OpenMP and Pthread Programming Constructs.
5. Design a parallel program to implement Prim's Algorithm using OpenMP and Pthread Programming Constructs.

6. Design a parallel program to implement DFS Algorithm using OpenMP and Pthread Programming Constructs.
7. Design a parallel program to implement BFS Algorithm using OpenMP and Pthread Programming Constructs.
8. Design a parallel program to implement Dijkstra's Algorithm using MPI library.

#### TEXT BOOKS:

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, 2nd Edition, Pearson Education.
2. Parallel Computing: Theory and Practice, Michael J. Quinn, 2nd Edition, McGraw-Hill Education.
3. Using MPI: Portable Parallel Programming with the Message Passing Interface, William Gropp, Ewing Lusk, Anthony Skjellum, 3rd Edition, MIT Press.

#### REFERENCE BOOKS:

1. Parallel Programming in C with MPI and OpenMP, Michael J. Quinn, 1st Edition, McGraw-Hill Education.
2. An Introduction to Parallel Programming, Peter Pacheco, 1st Edition, Morgan Kaufmann.
3. Using OpenMP: Portable Shared Memory Parallel Programming, Barbara Chapman, Gabriele Jost, Ruud Van Der Pas, 1st Edition, MIT Press.

#### ELECTRONIC RESOURCES:

1. <https://www.coursera.org/learn/parallel-concurrent-distributed-java>
2. <https://www.classcentral.com/subject/high-performance-computing>
3. <https://www.udacity.com/course/intro-to-parallel-programming--cs344>
4. <https://www.edx.org/learn/high-performance-computing/>

#### MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)