

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B.E. SEMESTER : VIII

### COMPUTER SCIENCE & ENGINEERING

Subject Name: **PARALLEL PROCESSING**

Sr. No.	Course Contents	Total Hrs
1.	<b>Parallel Programming Platforms</b> <ul style="list-style-type: none"> <li>• Implicit Parallelism: Trends in Microprocessor Architectures</li> <li>• Limitations of Memory System Performance</li> <li>• Dichotomy of Parallel Computing Platforms</li> <li>• Physical Organization of Parallel Platforms</li> <li>• Communication Costs in Parallel Machines</li> <li>• Routing Mechanisms for Interconnection Networks</li> <li>• Impact of Process-Processor Mapping and Mapping Techniques</li> </ul>	04
2.	<b>Principles of Parallel Algorithm Design algorithms</b> <ul style="list-style-type: none"> <li>• Preliminaries</li> <li>• Decomposition Techniques</li> <li>• Characteristics of Tasks and Interactions</li> <li>• Mapping Techniques for Load Balancing</li> <li>• Methods for Containing Interaction Overheads</li> <li>• Parallel Algorithm Models</li> </ul>	06
3.	<b>Basic Communication Operations, algorithms</b> <ul style="list-style-type: none"> <li>• One-to-All Broadcast and All-to-One Reduction</li> <li>• All-to-All Broadcast and Reduction</li> <li>• All-Reduce and Prefix-Sum Operations</li> <li>• Scatter and Gather</li> <li>• All-to-All Personalized Communication</li> <li>• Circular Shift</li> <li>• Improving the Speed of Some Communication Operations</li> </ul>	08
4.	<b>Analytical Modeling of Parallel Programs</b> <ul style="list-style-type: none"> <li>• Sources of Overhead in Parallel Programs</li> <li>• Performance Metrics for Parallel Systems</li> <li>• Effect of Granularity and Data Mapping on Performance</li> <li>• Scalability of Parallel Systems</li> <li>• Minimum Execution Time and Minimum Cost-Optimal Execution Time</li> <li>• Asymptotic Analysis of Parallel Programs</li> <li>• Other Scalability Metrics</li> </ul>	06
5.	<b>Programming Using the Message Passing Paradigm</b> <ul style="list-style-type: none"> <li>• Principles of Message-Passing Programming</li> <li>• The Building Blocks: Send and Receive Operations</li> <li>• MPI: The Message Passing Interface</li> <li>• Topologies and Embedding</li> <li>• Overlapping Communication with Computation</li> <li>• Collective Communication and Computation Operations</li> <li>• Groups and Communicators</li> </ul>	08
6.	<b>Programming Shared Address Space Platforms Thread Basics</b> <ul style="list-style-type: none"> <li>• Why Threads?</li> <li>• The POSIX Thread Application Programmer Interface</li> <li>• Synchronization Primitives in POSIX</li> <li>• Controlling Thread and Synchronization Attributes</li> <li>• Thread Cancellation</li> <li>• Composite Synchronization Constructs</li> </ul>	08

<b>7.</b>	<b>. Dense Matrix Algorithms</b> <ul style="list-style-type: none"> <li>• Matrix-Vector Multiplication</li> <li>• Matrix-Matrix Multiplication</li> </ul>	<b>06</b>
<b>8.</b>	<b>Sorting</b> Issues in Sorting on Parallel Computers <ul style="list-style-type: none"> <li>• Sorting Networks</li> <li>• Bubble Sort and its Variants</li> <li>• Quick sort</li> </ul>	<b>06</b>
<b>9.</b>	<b>Graph Algorithms</b> <ul style="list-style-type: none"> <li>• Definitions and Representation</li> <li>• Minimum Spanning Tree: Prim's Algorithm</li> <li>• Single-Source Shortest Paths: Dijkstra's Algorithm</li> <li>• All-Pairs Shortest Paths</li> </ul>	<b>08</b>

#### **Text Books:**

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, By Pearson Publication
2. Introduction to Parallel Processing, M. SasiKumar, Dinesh Shikhare, P.Raviprakash By PHI Publication

#### **Reference Books:**

- 1 Introduction To Parallel Programming - By Steven Brawer
- 2 Introduction To Parallel Processing – By M.Sasikumar, Dinesh Shikhare And P. Ravi Prakash
- 3 Parallel Computers – Architecture And Programming – By V. Rajaraman And C. Siva Ram Murthy