

**M.Tech(IT) : Group A**  
**Paper Code : MT24A**  
**Paper Title: Parallel Computing**

**SYLLABUS**

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**1. INTRODUCTION**

Introduction to Parallel Computing , Evolution of Parallel Computing , Application in Parallel Computing, Trends in Microprocessor Architectures, Limitations, Implicit Parallelism, Memory Constraints, Multithreading, Prefetching techniques, Communication Model, Interconnection Network, Cache Coherence, Communication Cost, Message Passing Techniques in Parallel Computing

**2. PARALLEL ALGORITHM DESIGN**

Introduction to process, processor, thread, Granularity, Concurrency Decomposition Techniques, Parallel Algorithm Models,

**3. ANALYTICAL MODELING OF PARALLEL PROGRAMS**

Performance Metrics, Granularity and its Effect and Data Mapping on Performance, Scalability Issue, Time Cost Analysis, Asymptotic Analysis.

**4. ALGORITHM'S**

Dense Matrix Algorithms, Matrix Operations Transposition, Multiplication, Matrix-Vector Multiplication, Linear Equations Gaussian Elimination algorithms: Sorting, Sorting Networks, Bitonic Sort ,Bubble Sort, Quick sort, Bucket and Sample Sort , Enumeration sort, Radix sort Graph Algorithms, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs, DFS, BFS in Parallel Computing

**5. PROGRAMMING TECHNIQUES**

Programming Shared Address Space Platforms ,API ,Synchronization Primitives in POSIX, Controlling Thread and Synchronization Attributes, Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: A Standard for Directive Based Parallel Programming , Programming Message Passing Platforms, Message Passing Interface (MPI) Basics, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators, Static Distributions: Block, Cyclic, and Block-Cyclic, Unstructured Communication,

**6. OPTIMIZATION TECHNIQUES**

Discrete Optimization Problems Search Algorithms, Limitation , Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms , Dynamic Programming, the Shortest path problem , 0/1 Knapsack problem, The Longest Common subsequences Problem.

**Reference Book:**

1. Introduction to Parallel Computing: Design and Analysis of Parallel Algorithms by Vipin Kumar, Ananth Grama, Anshul Gupta, George Karpis

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2. Applied Parallel Computing, Chaves H Z

Recommended reading:

- "Designing and Building Parallel Programs". Ian Foster.  
<http://www-unix.mcs.anl.gov/dbpp/>
- "Introduction to Parallel Computing". Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar.  
<http://www-users.cs.umn.edu/~karypis/parbook/>
- "Overview of Recent Supercomputers". A.J. van der Steen, Jack Dongarra.  
[www.phys.uu.nl/~steen/web03/overview.html](http://www.phys.uu.nl/~steen/web03/overview.html)