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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
I YEAR I SEMESTER M.Tech (Information Technology)

COURSE STRUCTURE

SL.NO	SUBJECT	L	P	C	INT	EXT	TOTAL
MIT1.1	Advanced Data Structures and Algorithms	4	-	8	40	60	100
MIT1.2	Scalable Parallel Computing Architectures	4	-	8	40	60	100
MIT1.3	Distributed Operating Systems	4	-	8	40	60	100
MIT1.4	Data Mining and Knowledge Discovery	4	-	8	40	60	100
MIT1.5	Code Optimization	4	-	8	40	60	100
MIT1.6	Secured Database Application Development	4	-	8	40	60	100
MIT1.7	Adv. Data structures lab	-	4	4	40	60	100
MIT1.8	Software Lab (Covering experiments : Data Mining tools, Code Optimization using C, Parallel Algorithms)	-	4	4	40	60	100

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MIT1.1 ADVANCED DATA STRUCTURES AND ALGORITHMS

Unit I: Lists, Stacks, Queues and Trees

Lists, Stacks and Queues: Abstract Data Types (ADTs), The List ADT, vector and list in the STL, Implementation of vector, Implementation of list, The Stack ADT, The Queue ADT.

Trees: The Search Tree ADT - Binary Search Trees, AVL Trees, Splay Trees, B-Trees

Unit II: Hashing and Priority Queues

Hashing: General Idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing

Priority Queues: Implementations, Binary Heap, Applications of Priority Queues, d -Heaps, Leftist Heaps, Skew Heaps, Binomial Queues.

Unit III: Sorting

Sorting: A Lower Bound for Simple Sorting Algorithms, Shellsort, Heapsort, Mergesort, Quicksort, Indirect Sorting, A General Lower Bound for Sorting, Bucket Sort, External Sorting.

Unit IV: The Disjoint Set Class

Equivalence Relations, the Dynamic Equivalence Problem, Basic Data Structure, Smart Union Algorithms, Path Compression, Worst Case for Union-by-Rank and Path Compression, an Application

Unit V: Graph Algorithms

Definitions, Topological Sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, Introduction to NP-Completeness

Unit VI: Algorithm Design Techniques

Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms.

Unit VII: Amortized Analysis

An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees

Unit VIII: Advanced Data Structures and Implementation

Top-Down Splay Trees, Red-Black Trees, Deterministic Skip Lists, AA-Trees, Treaps, k -d Trees, Pairing Heaps

Text Books:

1. Data Structures and Algorithm Analysis in C++, 3/e, Mark Allen Weiss, Pearson, 2007.

Reference Books:

1. Data Structures Algorithms and Applications, 2/e, Sartaj Sahni, Universities Press, 2007.
2. Fundamentals of computer Algorithms, 2/e, Ellis Horowitz, Sartaj Sahni, Rajasekharan, Universities Press, 2008.
3. Data Structures and Algorithms, Aho, Ullman, Pearson.
4. Data Structures and Algorithms in JAVA, Adam drozdek, Cengage .
5. Data Structures with JAVA™, Hubbard, Huray, PHI,2009.

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MIT1.2 SCALABLE PARALLEL COMPUTING ARCHITECTURES

Unit I: Parallel Computer Models, Program and Network Properties

Parallel Computer Models: Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks

Program and Network Properties: Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures

Unit II: Principles of Scalable Performance

Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches

Unit III: Processors and Memory Hierarchy

Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology

Unit IV: Bus, Cache, and Shared Memory

Backplane Bus Systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models

Unit V: Pipelining and Superscalar Techniques

Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design Superscalar and Superpipeline Design

Unit VI: Multiprocessors and Multicomputers

Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers, Message-Passing Mechanisms

Unit VII: Multivector and SIMD Computers

Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, SIMD Computer Organizations: BSP and CM2 Architectures, The Connection Machine CM-5: CM5 Architecture and Inter process communication

Unit VIII: Parallel Models, Languages, and Compilers

Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays, Code Optimization and Scheduling, Loop Parallelization and Pipelining

Text Books:

1. Advanced computer Architecture: Parallelism, Scalability, Programmability. Kai Hwang, TMH, 2000.

Reference Books:

1. Computer Architecture – A quantitative approach, 4/e, John L. Hennessey , David A. Patterson, Morgan Kaufmann / Elsevier, 2007.
2. Parallel Computing Architecture: A hardware/ software approach , David E. Culler, Jaswinder Pal Singh, Morgan Kaufmann / Elsevier, 1997.
3. Computer Organization and Architecture – Designing for Performance, 7/e, William Stallings, Pearson, 2006.
4. Computer Organization and Design, 4/e, Patterson , Hennessy Elsevier India, 2008.
5. Computer Architecture & Parallel Processing, Kai Hwang, Faye A. Briggs, TMH.
6. Parallel programming, 2/e, Wikinson, Allen, Pearson

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MIT1.3 DISTRIBUTED OPERATING SYSTEMS

Unit I: Processes

THREADS: Introduction to Threads, Threads in Distributed Systems; CLIENTS: User Interfaces, Client-Side Software for Distribution Transparency SERVERS: General Design Issues, Object Servers; CODE MIGRATION: Approaches to Code Migration, Migration and Local Resources, Migration in Heterogeneous Systems, Example: D'Agents SOFTWARE AGENTS: Software Agents in Distributed Systems, Agent Technology

Unit II: Naming Systems

NAMING ENTITIES: Names, Identifiers, and Addresses, Name Resolution, The Implementation of a Name Space, Example: DNS, X.500

LOCATING MOBILE ENTITIES: Naming versus Locating Entities, Simple Solutions, Home-Based Approaches, Hierarchical Approaches

REMOVING UNREFERENCED ENTITIES: The Problem of Unreferenced Objects, Reference Counting, Reference Listing, Identifying Unreachable Entities

Unit III: Synchronization

Clock synchronization, logical clocks, global state, election algorithms, mutual exclusion, distributed transactions

Unit IV: Consistency and Replication

Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Distribution Protocols, Consistency Protocols, Examples: Orca and Causally-Consistent Lazy Replication

Unit V: Fault Tolerance

Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery

Unit VI: Distributed Object-Based Systems

CORBA, Distributed Com, Globe and Comparison of CORBA, DCOM, and Globe

Unit VII: Distributed File Systems

Sun Network File System, Coda File System, Plan9, XFS and SFS, Scalable Security, Comparison of Distributed File Systems

Unit VIII: Distributed Document-Based Systems and Coordination-Based Systems

Distributed Document-Based Systems: The World Wide Web, Lotus Notes, Comparison of WWW and Lotus Notes
Distributed Coordination-Based Systems: Introduction to Coordination Models, TIB/Rendezvous, JINI, Comparison of TIB/Rendezvous and JINI

Text Books:

1. Distributed Systems - Principles and Paradigms, 2/e, Andrew S. Tanenbaum, Maarten Van Steen, PHI, 2007.

Reference Books:

1. Advanced concepts in Operating Systems. Mukesh Singhal, Niranjana G. Shivaratri, TMH, 2005.
2. Distributed Systems Concepts and Design, 4/e, George Coulouris, Dollimore, Kindberg, Pearson, 2009.
3. Distributed Operating Systems, Pradeep K. Sinha, PHI, 2009.
4. Operating Systems, Internals & Design Principles, 6/e, William Stallings, Pearson.

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MIT1.4 DATA MINING AND KNOWLEDGE DISCOVERY

Unit I:

Introduction to Data Mining, Types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data : Data Set, Summary Statistics, Visualization, OLAP and multi dimensional data Analysis

Unit II:

Classification: Basic Concepts, Decision Trees, and model evaluation : General approach for solving a classification problem, Decision Tree induction, Model over fitting : Due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier.

Unit III:

Classification-Alternative techniques: Nearest Neighborhood classifier, Bayesian Classifier, Support Vector Machines: Linear SVM, Separable and Non Separable case.

Unit IV:

Association Analysis: Problem Definition, Frequent Item-set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithms.

Unit V:

Handling categorical, continuous attributes, concept hierarchy, sequential, sub-graph patterns

Unit VI:

Overview, K-means, Agglomerative Hierarchical clustering, DBSCAN

Unit VII:

Cluster Evaluation: Overview, Un supervised Cluster evaluation using cohesion and separation, using the proximity matrix, Scalable clustering algorithms.

Unit VIII:

Web Data mining: Introduction, Web terminology and characteristics, web content mining, web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of web pages, Enterprise search

Text Books:

1. Introduction to Data Mining : Pang-Ning tan, Michael Steinbach, Vipin Kumar, Addison – Wesley.
2. Introduction to Data Mining with Case Studies : GK Gupta; Prentice Hall.

Reference Books:

1. Data Mining: Introductory and Advanced Topics, Margaret H Dunham, Pearson, 2008.
2. Fundamentals of data warehouses, 2/e, Jarke, Lenzerini, Vassiliou, Vassiliadis, Springer.
3. Data Mining Theory and Practice, Soman, Diwakar, Ajay, PHI, 2006.
4. Data Mining ,Concepts and Techniques, 2/e, Jiawei Han , Micheline Kamber , Elsevier,2006.

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MIT1.5 CODE OPTIMIZATION

Unit I: Introduction

Review of Compiler Structure, Advanced Issues in Elementary Topics, The Importance of Code Optimization, Structure of Optimizing Compilers, Placement of Optimizations in Aggressive Optimizing Compilers

Unit II: Compiler Internal Representations and Run time support

Intermediate Representations: Issues in Designing an Intermediate Language, High-Level Intermediate Languages, Medium-Level Intermediate Languages, Low-Level Intermediate Languages, Multi-Level Intermediate Languages, Our Intermediate Languages: MIR, HIR, and LIR, Representing MIR, HIR, and LIR in ICAN, ICAN Naming of Data Structures and Routines that Manipulate Intermediate Code, Other Intermediate-Language Forms

Run-Time Support: Data Representations and Instructions, Register Usage, The Local Stack Frame, The Run-Time Stack, Parameter-Passing Disciplines, Procedure Prologues, Epilogues, Calls, and Returns, Code Sharing and Position-Independent Code, Symbolic and Polymorphic Language Support

Unit III: Control Flow Analysis

Approaches to Control-Flow Analysis, Depth-First Search, Preorder Traversal, Postorder Traversal, and Breadth-First Search, Dominators, Loops and Strongly Connected Components, Reducibility, Interval Analysis and Control Trees, Structural Analysis

Unit IV: Data-Flow Analysis

Reaching Definitions, Basic Concepts: Lattices, Flow Functions, and Fixed Points, Taxonomy of Data-Flow Problems and Solution Methods, Iterative Data-Flow Analysis, Lattices of Flow Functions, Control-Tree-Based Data-Flow Analysis, Structural Analysis, Interval Analysis, Other Approaches, Du-Chains, Ud-Chains, and Webs, Static Single-Assignment (SSA) Form, Dealing with Arrays, Structures, and Pointers, Automating Construction of Data-Flow Analyzers

Unit V: Dependence Analysis and Optimization

Dependence Analysis and Dependence Graph: Dependence Relations, Basic-Block Dependence DAGs, Dependences in Loops, Dependence Testing, Program-Dependence Graphs

Introduction to Optimization: Flow Sensitivity and May vs. Must Information, Importance of Individual Optimizations, Order and Repetition of Optimizations

Early Optimizations: Constant-Expression Evaluation, Scalar Replacement of Aggregates, Algebraic Simplifications and Reassociation, Value Numbering, Copy Propagation, Sparse Conditional Constant Propagation

Unit VI: Register Allocation

Register Allocation and Assignment, Local Methods, Graph Coloring, Priority-Based Graph Coloring, Other Approaches to Register Allocation

Unit VII: Control-Flow and Low-Level Optimizations

Unreachable-Code Elimination, Straightening, If Simplifications, Loop Simplifications, Loop Inversion, Unswitching, Branch Optimizations, Dead-Code Elimination, Branch Prediction

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Unit VIII: Procedural/Interprocedural Analysis and Optimizations

Tail-Call Optimization and Tail-Recursion Elimination, Procedure Integration, In-Line Expansion, Leaf-Routine Optimization and Shrink Wrapping

Interprocedural Control-Flow Analysis: The Call Graph, Interprocedural Data-Flow Analysis, Interprocedural Constant Propagation, Interprocedural Alias Analysis, Interprocedural Optimizations, Interprocedural Register Allocation

Text Book:

1. Advanced Compiler Design and Implementation, Muchnick, Elsevier India Private Limited, 2008.

Reference Books:

1. Engineering a Compiler, Keith D Cooper, Linda Torczon, Elsevier.
2. Compiler Design in C, Allen Holub, PHI, 1990.
3. Compilers Principles, Techniques and Tools, Aho, Sethi, Ullman, Pearson, 2006.
4. Crafting a compiler with C, Charles N. Fischer, Richard J. Leblanc, Benjamin Cummings, Addison-Wesley.

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MIT1.6 SECURED DATABASE APPLICATIONS DEVELOPMENT

Unit I: Security Architecture

Introduction, Security, Information Systems, Database management systems, Information security, Information security Architecture, database security, Asset types and their value, Security methods.

Unit II: Operating System Security Fundamentals

Introduction, operating systems overview, security environment, components, Authentication methods, user administration, password policies, Vulnerabilities of operating systems, E- Mail security.

Unit III: Administration of Users

Introduction, user authentication, operating system authentication, creating/removing/modifying users, default/remote users, Database links, Linked servers, remote servers.

Unit IV: Profiles, Password Policies, Privileges, and Roles

Introduction, Defining and using profiles, Designing and implementing password policies, Granting and revoking user privileges, creating, Assigning and revoking user roles.

Unit V: Database Application Security Models

Introduction, Types of users, security models, application types, application security models and Data encryption.

Unit VI: Virtual Private Databases (VPD)

Introduction, Overview, implementing a VPD using views and application context. Implementing oracle VPD, Viewing VPD policies and application context using: data dictionary, policy manager, implementing row and column level security with SQL server.

Unit VII: Database Auditing Models, Application Data Auditing

Database Auditing Models: Introduction, Auditing overview, environment, process, objectives, classification and types, benefits and side effects of auditing.

Application Data Auditing: Introduction, DML auction auditing architecture. Triggers, fine grained auditing, DML statement audit trail and auditing application errors with Oracle.

Unit VIII: Auditing Database Activities, Security and Auditing Project Cases

Auditing Database Activities: Introduction, usage of database activities, creating DLL triggers, auditing database activities with oracle

Security and Auditing project cases: Introduction, case study for developing an online database, taking care of payroll, tracking database changes and developing a secured authentication repository

Text Book:

1. Database Security and Auditing, Hassan Afyouni, Cengage Learning, 2007.

Reference Books:

1. Database Security, S. Castano, M. Fugini, G. Martella, P. Samarati, Addison-Wesley, 1994.
2. Implementing Database Security and Auditing, RonBen Natan: Elsevier, Indian reprint, 2006.
3. Principles of Distributed Database Systems, Prentice Hall, 2/e, M.TamerÖzsu, Patrick Valduriez, 1999.

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MIT1.7 ADV. DATA STRUCTURES LAB

Implementation of data structures and algorithms using C / C++ / Java covered in the Course MIT1.1.

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MIT1.8 SOFTWARE LAB

Covering experiments: Data Mining tools like Clementine, informatica, WEKA etc.,

Code Optimization using C, Parallel Algorithms