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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
I YEAR I SEMESTER M.Tech (Computer Science)

COURSE STRUCTURE

SL.NO	SUBJECT	L	P	C	INT	EXT	TOTAL
MCS1.1	Data Structures and Algorithm Analysis	4	-	8	40	60	100
MCS1.2	Mathematical Foundations of Computer Science	4	-	8	40	60	100
MCS1.3	Computer Organization and Architecture	4	-	8	40	60	100
MCS1.4	Database Management Systems	4	-	8	40	60	100
MCS1.5	Operating Systems	4	-	8	40	60	100
MCS1.6	Object Oriented Programming	4	-	8	40	60	100
MCS1.7	Data structures lab	-	4	4	40	60	100
MCS1.8	Systems Lab- 1(Covering the experiments Operating systems, Database Management systems)	-	4	4	40	60	100

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MCS1.1 DATA STRUCTURES AND ALGORITHM ANALYSIS

Unit I:

Introduction to data structures, singly linked lists, doubly linked lists, circular list - Algorithms.
Stacks and queues: algorithms implementation using linked list.
Algorithms - performance analysis – time complexity and space complexity.

Unit II:

Searching – Linear and binary search methods
Sorting – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort.

Unit III:

Trees - Binary tress, properties, representation and traversals (DFT, BFT), expression trees (infix, prefix, postfix).
Graphs – basic concepts, storage structures and traversals.

Unit IV:

Dictionaries, ADT, The list ADT, Stack ADT, Queue ADT, hash table representation, hash functions, collision resolution - separate chaining, open addressing - linear probing, double hashing.

Unit V:

Priority Queues – Definition, ADT, Realizing a Priority Queue using Heaps, Definition, insertion, Deletion.
External Sorting - Model for external sorting, Multiway merge.

Unit VI:

Search Trees: Binary Search Trees, Definition, ADT, Implementation, Operations - Searching, Insertion and Deletion

Unit VII:

Search Trees: AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching

Unit VIII:

Search Trees: Introduction to Red – Black and Splay Trees, B - Trees, height of a B - Tree, insertion, deletion and searching, Comparison of Search Trees.

Text Books:

1. Data Structures: A Pseudocode Approach, 2/e, Richard F. Gilberg, Behrouz A. Forouzan, Cengage.
2. Data Structures, Algorithms and Applications in JAVA, 2/e, Sartaj Sahni, University Press.

Reference Books:

1. Data structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data structures and Algorithms, 3/e, Adam Drozdek, Cenage.
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B. Venkateswarlu , E.V. Prasad, S Chand & Co, 2009.
4. Data Structures, Algorithms and OOP, Heileman, TMH.
5. Introductions to Algorithms, 2/e , Cormen, PHI, 2001.
6. Fundamentals of Computer Algorithms, 2/e, Horowitz, Sahni, Rajasekaran, University Press.
7. Design and Analysis , Dave, Dave, Pearson,2008.
8. Design and Analysis Algorithms , Panneerselvam , PHI, 2007.
9. Data Structures , Seymour Lipschutz, Schaum's outlines , TMH.

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I YEAR I SEMESTER M.Tech (Computer Science)

MCS1.2 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Unit I:

Mathematical Logic: Statements and notations, Connectives, Well formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Theory of inference for the statement calculus

Unit II:

Rules of inference, Consistency of premises and indirect method of proof, Automatic Theorem Proving

Predicate calculus: Predicates, statement functions, variables and quantifiers, predicate formulas, free & bound variables, universe of discourse, inference theory of predicate calculus

Unit III:

Set theory & Relations: Introduction, Relations and ordering, Properties of binary Relations, Equivalence, Compatibility Relations, Partial ordering, Hasse diagram.

Functions: composition of functions, Inverse Function, Recursive Functions, Lattice and its Properties, Pigeon hole Principles and its application.

Unit IV:

Algebraic structures: Algebraic systems, Examples and general properties, Semi groups and monoids, groups, sub groups, Definitions, Examples, homomorphism, Isomorphism and related problems.

Unit V:

Elementary Combinatorics: Basis of counting, Enumeration of Combinations & Permutations, Enumerating of Combinations & Permutations with repetitions and constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, principles of Inclusion – Exclusion.

Unit VI:

Recurrence Relations: Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, Solving recurrence relation by substitution and Generating functions, The method of Characteristic roots, Solution of Inhomogeneous Recurrence Relation.

Unit VII:

Graph Theory: Representation of Graph, Spanning Trees, BFS, DFS, Kruskals Algorithm, Binary trees, Planar Graphs

Unit VIII:

Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers

Text Books:

1. Discrete Mathematical Structures with Applications to computer science J.P Tremblery, R.Manohar, TMH.
2. Discrete Mathematical for computer Scientists & Mathematicians J.L. Molt, A.Kandel ,T.P.Baker, PHI.

Reference Books:

1. Elements of Discrete Mathematics, 3/e, C L Liu, D P Mohanpatra, TMH.
2. Discrete Mathematics, Schaum's Outlines, Lipschutz, Lipson TMH.
3. Discrete Mathematical Structures, 6/e, Kolman, Busby, Ross, PHI, 2009.
4. Discrete Mathematics, 6/e, Johnsonbaugh, Pearson, 2005.
5. Discrete Mathematics, 6/ e, Malik, Sen, Cengage Learning, 2004.
6. Discrete Mathematics for computer science, Bogart, Stein , Drysdale, Springer, 2005.
7. Discrete Mathematics and Combinatorics, Sengadir, Pearson, 2009.
8. Discrete and Combinatorial Mathematics, 5 /e, Grimaldi, Ramana, Pearson, 2006.
9. Discrete Mathematics, 2 /e, J K Sharma, Macmillan, 2005.
10. Discrete Mathematics with Graph Theory, 3/e, Edgar G. Goodaire, Michael M.Parmenter, PHI.

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MCS1.3 DATABASE MANAGEMENT SYSTEMS

Unit I: Data base System Applications, data base System VS file System – View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor – History of Data base Systems. Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model – Conceptual Design for Large enterprises.

Unit II: Relational Model: Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.

Relational Algebra and Calculus: Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

Unit III: Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOTR – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.

Unit IV: Schema refinement – Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – forth Normal Form.

Unit V: Overview of Transaction Management: ACID Properties – Transactions and Schedules – Concurrent Execution of transaction – Lock Based Concurrency Control – Performance Locking – Transaction Support in SQL – Introduction to Crash recovery.

Unit VI: Concurrency Control: Serializability, and recoverability – Introduction to Lock Management – Lock Conversions – Dealing with Dead Locks – Specialized Locking Techniques – Concurrency without Locking. Crash recovery: Introduction to ARIES – the Log – Other Recovery related Structures – the Write-Ahead Log Protocol – Check pointing – re3covering from a System Crash – Media recovery – Other approaches and Interaction with Concurrency control.

Unit VII: Overview of Storage and Indexing: Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – Indexes and Performance Tuning.

Unit VIII: Overview of Query Evaluation: The System Catalogue – Introduction to Operator Evaluation – Algorithm for Relational Operations. Tree Structured Indexing: Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure. Hash Based Indexing: Static Hashing – Extendable hashing – Linear Hashing – Extendable vs. Liner hashing.

Text Books:

1. Data base Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH
2. Data base System Concepts, 4/e, Silberschatz, Korth, TMH

Reference Books:

1. Introduction to Database Systems, 8/e, C.J.Date, Pearson
2. Data base Systems design, Implementation, and Management,5/e, Rob , Coronel, Thomson
3. Data base Management System, 5/e, Elmasri Navathe, Pearson,

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MCS1.4 OPERATING SYSTEMS

Unit I: Introduction to Operating Systems and its Structures- Simple Batch Processing, Multiprogrammed, Time-shared, Personal computer, Parallel and Distributed Systems, System components, OS Services, System calls, Virtual machines, System design and implementation.

Unit II: Unix Utilities: Introduction to Unix file system, Vi editor, File handling utilities, security by file permissions, process utilities, disk utilities, Networking commands, cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, umask, ulimit, ps, who, w, finger, arp, telnet, rlogin. Text processing utilities and backup utilities detailed commands to be covered are: cat, tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, more, pg, comm., cmp, diff, tr, awk, tar, cpio

Unit III: Shell Programming: What is a shell, shell responsibilities, pipes and input redirection, Output redirection and here documents, the shell as programming Language shell variables, conditions, history and control structures and shell programming

Unit IV: Process and CPU Scheduling – Process concepts and Scheduling, Operation on processes, Co-operating process, Threads and Interprocess Communication, Scheduling criteria, Scheduling algorithm, Multiple-processor Scheduling, Real-Time Scheduling.

Unix Internals 1: process structure, starting new process, waiting for a process, zombie process, process control, process identifiers, fork function, vfork, exit, wait, exec, system, functions, user identification, process times.

Unit V: Memory Management and Virtual Memory- Logical Vs Physical address space, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging, Demand paging, Performance of demand paging, Page Replacement, Page Replacement algorithm, Allocation of frames, Thrashing.

Unit VI: Process management and Synchronization – The Critical Section problem, Synchronization Hardware, Semaphores and Classical problem of Synchronization, Critical regions, Monitors.

Unix internals 2: Signals – Signal functions, reliable signals, interrupted system calls, kill and raise functions, alarm, pause functions, abort, system, sleep functions.

Unit VII: File System Interface and Implementation – Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-Space Management, Directory Management, Directory implementation, Efficiency and performance.

Unix internals 3: Data Management – Management Memory (simple memory allocation, freeing memory) file locking (creating lock files, locking regions, use of read/ write locking, competing locks, other commands, deadlocks).

Unit VIII: Unix Internals 4:

Inter-process – Pipe, process pipes, the pipe call, parent-child process, named pipes: FIFOs, Semaphores, message queues and shared memory applications of IPC.

Text Books:

1. Operating Systems Concepts, 5/e, Abraham Silberschatz, Galvin, John Wiley & Sons, Inc.
2. Advanced Programming in Unix Environment, W. Richard Stevens, AWL /PHI
3. Unix Network Programming, W. Richard Stevens, PHI

Reference Books:

1. Operating systems, 6/e, William Stallings, PHI/Pearson
2. Operating Systems, 2/e, Dhamdhere, TMH
3. Advanced Unix Programming, N.B. Venkateswarlu, BS Publications

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MCS1.5 COMPUTER ORGANIZATION AND ARCHITECTURE

Unit I: Number Systems and Computer Arithmetic
Signed and unsigned numbers Addition & subtraction, multiplication, division, Floating point representation logical operation, Gray code, BCD codes, Error detecting codes.
Boolean algebra, Simplification of Boolean expressions - Maps.

Unit II: Combinational and Sequential Circuits
Decoders, Encoders, Multiplexers, Half and Full adders, shift registers, flip-flops, binary counters, memory Unit.

Unit III: Memory Organization
Memory hierarchy, Main memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory Concept.

Unit IV: Intel 8086 CPU Architecture
Diagram, code and segment registers, internal operations, machine language instructions (addressing modes, instruction formats), Instruction execution timing.

Unit V: Intel 8086 Assembly Language Instructions
Data transfer instructions – input output instructions, address transfer, Flags, arithmetic, logical, shift and rotate instructions.

Unit VI: Intel 8086 Assembly Language Programming
Conditional and unconditional transfer, iteration control, interrupts and process control instructions assembler directives Programming with assembly language instructions.

Unit VII: ALU Design
Addition and subtraction, sign and unsigned numbers, multiplication and division algorithms, BCD Adders.

Unit VIII: Input-Output Organization
Peripheral devices, input-output interface, Asynchronous data transfer, Modes of transfer, priority interrupts, DMA, Input output processor, Serial communication.

Text Books:

1. Computer System Architecture, 3/e, Moris Mono, Pearson / PHI.
2. Micro processor and interfacing, 2/e, Douglas V. Hall, TMH.

Reference Books:

1. Digital Logic and computer organization, Rajaraman, Radha Krishnan, PHI.
2. Micro computer systems: 8086/8088 family, 2/e, Liu, Gibson, PHI
3. Computer Organization and Architecture, 7/e, stallings, pearson
4. Computer Organization, 5/e, Hamacher, Vranesic, TMH
5. Computer systems organization and architecture, carpinelli, pearson
6. Computer organization and Design, pal chowdary, PHI
7. Computer system organization, jotwani, TMH

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MCS 1.6 OBJECT ORIENTED PROGRAMMING

Unit I: Basics of Object Oriented Programming (OOP): Need for oop paradigm, A way of viewing world – Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of oop concepts, coping with complexity, abstraction mechanisms.

Unit II: Java Basics : data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

Unit III: Inheritance: Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes.

Unit IV: Packages and Interfaces: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

Exploring packages – Java.io, java.util.

Unit V: Exception handling and Multithreading: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

Unit VI: Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scrollpane, dialogs, menubar, graphics, layout manager – layout manager types – boarder, grid, flow, card and grid bag.

Unit VII: Applets and Swing: Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Swing: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Unit VIII: Networking: Basics of network programming, addresses, ports, sockets, simple client server program, multiple clients, Java .net package.

Text Books:

1. Java - The complete reference, 7/e, Herbert schildt, TMH.

Reference Books:

1. Java: How to Program, 8/e, Dietal, Dietal, PHI
2. Introduction to Java programming, 6/e, Y. Daniel Liang, Pearson .
3. Core Java 2, Vol 1, Fundamentals, 7/e, Cay.S.Horstmann, Gary Cornell, Pearson.
4. Core Java 2, Vol 2, Advanced Features, 7/e, Cay.S.Horstmann, Gary Cornell, Pearson.
5. Object Oriented Programming through Java, P. Radha Krishna, University Press.

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MCS1.7 DATA STRUCTURES LAB

Implementation of data structures and algorithms using C/ C++/ Java covered in the Course MCS1.1.

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MCS1.8 SYSTEMS LAB - 1

Covering experiments of Operating systems (using UNIX) and Database Management systems (Any Data base software) in the courses MCS 1.4 and 1.5.