

Harcourt Butler Technological Institute, Kanpur-208002

(An Autonomous Institute Affiliated to U. P. Technical University, Lucknow)



Revised Syllabus

B. Tech. II Year Computer Science and Engineering & Information Technology

(Effective from the session 2014-15)

ICS-301
DATA STRUCTURES USING C

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Unit - I

Introduction: Basic Terminology, Elementary Data Organization, Structure operations, Algorithm Complexity and Time-Space trade-off.

Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters, Ordered List, Sparse Matrices and Vectors.

Stacks: Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack., Applications of recursion in problems like ‘Tower of Hanoi’.

UNIT - II

Queues: Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.

Linked list: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

UNIT – III

Trees: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm.

Searching and Hashing: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.

UNIT – IV

Sorting: Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Practical consideration for Internal Sorting.

Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees.

UNIT - V

Graphs: Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.

File Structures: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, B+ Tree index Files, B Tree index Files, Indexing and Hashing Comparisons.

Text Books:

1. Horowitz and Sahani, “Fundamentals of data Structures”, Galgotia Publication Pvt. Ltd., New Delhi.
2. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education Asia, Delhi-2002
3. A. M. Tenenbaum, “Data Structures using C & C++”, Prentice-Hall of India Pvt. Ltd., New Delhi.
4. K Loudon, “Mastering Algorithms with C”, Shroff Publisher & Distributors Pvt. Ltd.
5. Bruno R Preiss, “Data Structures and Algorithms with Object Oriented Design Pattern in C++”, Jhon Wiley & Sons, Inc.
6. Adam Drozdek, “Data Structures and Algorithms in C++”, Thomson Asia Pvt. Ltd.(Singapore)

ICS-302
OBJECT ORIENTED SYSTEMS

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UNIT – I

Principles of Elegant Programming, Basic concepts of Object-Oriented Programming.

Object Oriented Design and Modeling: The Unified Process, Its historical evolution. Introduction to UML.

Structural Modeling: Class & Object Diagrams, Links and Associations, Generalization and Inheritance, Aggregation, Abstract Classes, , Interfaces, Types and Roles, Packages.

UNIT- II

Behavioral Modeling: Use Cases and Use Case Diagrams, Interactions and Interaction diagrams, Activity Diagrams. Events and Signals, State Machines, Nested State Diagrams, Processes and Threads, Time and Space, State Chart Diagrams. Advanced Dynamic Modeling Concepts.

UNIT – III

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams. Elementary Design Patterns, The MVC Architecture Pattern.

Case Study: The Unified Library Application.

UNIT – IV

Java Programming: Introduction to Java Programming, Operator, Data type, Variable, Arrays, Control Statements, Methods & Classes, Inheritance, Package and Interface, Exception Handling, Multithread programming, I/O, Java Applet, String handling, Networking, Event handling,

UNIT- V

Introduction to Advance Java Programming: Demonstration of concepts through example programs for AWT, Java Swing, Java Beans, Java Servlets, JSP. Modern Object Technologies and Web Services.

Text and Reference Books:

1. Balagurusamy E, “Programming in JAVA”, TMH
2. Naughton, Schildt, “The Complete Reference JAVA2”, TMH
3. Rumbaugh, J.R., Premerlani, W. and Blaha, M., Object Oriented Modeling and Design with UML, Pearson Education (2005) 2nd ed.
4. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
5. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
6. Mark Priestley: Practical Object-Oriented Design with UML, TATA Mc-GrawHill
7. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

ICS-351
DATA STRUCTURES LAB

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Write Program in C or C++ for following.

1. Array implementation of Stack, Queue, Circular Queue, List.
2. Implementation of Stack, Queue, Circular Queue, List using Dynamic memory Allocation.
3. Implementation of Tree Structures, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.
4. Implementation of Searching and Sorting Algorithms.
5. Graph Implementation, BFS, DFS, Min. cost spanning tree, shortest path algorithm.

ICS-352
OBJECT ORIENTED SYSTEMS LAB

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Lab exercises are to be carried out using C++, Java, C# and tools like Visio, ARGOUML etc. Design and Implementation of an Object based application using any one of the above languages/tools is desirable

ICS-403
COMPUTER ORGANIZATION

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Unit-I (Representation of Information and Basic Building Blocks)

Introduction to Computer, Computer hardware generation, Number System: Binary, Octal, Hexadecimal, Character Codes (BCD, ASCII, EBCDIC), Logic gates, Boolean Algebra, K-map simplification, Half Adder, Full Adder, Subtractor, Decoder, Encoders, Multiplexer, Demultiplexer, Carry lookahead adder, Combinational logic Design, Flip-Flops, Registers, Counters (synchronous & asynchronous), ALU, Micro-Operation. ALU-Chip, Faster Algorithm and Implementation (multiplication & Division)

Unit-II (Basic Organization)

Von Neumann Machine (IAS Computer), Operational flow chart (Fetch, Execute), Instruction Cycle, Organization of Central Processing Unit, Hardwired & micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing modes, Instruction formats, data transfer & Manipulation, I/O Organization, Bus Architecture, Programming Registers

Unit-III (Memory Organization)

Memory Hierarchy, Main memory (RAM/ROM chips), Auxiliary memory, Associative memory, Cache memory, Virtual Memory, Memory Management Hardware, hit/miss ratio, magnetic disk and its performance, magnetic Tape etc.

Unit-IV (I/O Organization)

Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer, Strobe Control, Handshaking.

Unit-V (Process Organization)

Basic Concept of 8-bit micro Processor (8085) and 16-bit Micro Processor (8086), Assembly Instruction Set, Assembly language program of (8085): Addition of two numbers, Subtraction, Block Transfer, find greatest number, Table search, Numeric Manipulation, Introductory Concept of pipeline, Flynn's and Feng's Classification, Parallel Architectural classification. Concept of Pipelining, Multi-Core Architecture.

Text and Reference Books:

1. William Stalling, "Computer Organization & Architecture", Pearson education Asia
2. Mano Morris, "Computer System Architecture", PHI
3. Zaky & Hamacher, "Computer Organization", McGraw Hill
4. B. Ram, "Computer Fundamental Architecture & Organization", New Age
5. Tannenbaum, "Structured Computer Organization", PHI.

ICS-401
DATABASE MANAGEMENT SYSTEM

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Unit- I

Introduction: An overview of database management system, database system Vs file system, Database system concepts and architecture, data models schema and instances, data independence and database language and interfaces, Data definitions language, DML, Overall Database Structure.

Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

Unit- II

Relational data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus,

Introduction to SQL: Characteristics of SQL. Advantage of SQL. SQL data types and literals. Types of SQL commands. SQL operators and their procedure. Tables, views and indexes. Queries and sub queries. Aggregate functions. Insert, update and delete operations. Joins, Unions, Intersection, Minus, Cursors in SQL.

Unit- III

Data Base Design & Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependences, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

Unit- IV

Transaction Processing Concepts: Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

Unit- V

Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction.

Text Books

1. Date C J, "An Introduction To Database System", Addison Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
3. Elmasri, Navathe, "Fundamentals Of Database Systems", Addison Wesley
4. Leon & Leon, "Database Management System", Vikas Publishing House.
5. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication
6. Majumdar & Bhattacharya, "Database Management System", TMH
7. Ramakrishnan, Gehrke, "Database Management System", McGraw Hill
8. Kroenke, "Database Processing: Fundamentals, Design and Implementation", Pearson Education.
9. Maheshwari Jain, "DBMS: Complete Practical Approach", Firewall Media, New Delhi.

ICS-404
PRINCIPLES OF PROGRAMMING LANGUAGES

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Unit -I

Introduction: Characteristics of programming Languages, Factors influencing the evolution of programming language, developments in programming methodologies, desirable features and design issues. Programming language processors: Structure and operations of translators, software simulated computer, syntax, semantics, structure, virtual computers, binding and binding time.

Unit -II

Elementary and Structured Data Types: Data object variables, constants, data types, elementary data types, declaration, assignment and initialization, enumeration, characters, strings. Structured data type and objects: Specification of data structured types, vectors and arrays, records, variable size data structure, pointers and programmer constructed data structure, Sets files. Sub Program and programmer defined data types: Evolution of data types, abstractions, encapsulations, information hiding, sub programmes, abstract data types.

Unit -III

Sequence Control; Implicit and Explicit sequence control, sequence control with within expression and statements, recursive sub programmes, exception handling, co routines, Scheduled sub programmes, concurrent execution. Data control referencing environments, static and dynamic scope, local data local data referencing environment, shared data: Explicit common environment dynamic scope parameter passing mechanism.

Unit -IV

Storage Management: Major run time requirements, storage management phases, static storage management, stack based, heap based storage management. Syntax and translation: General syntactic criteria, syntactic element of a language, stages in translation, formal syntax and semantics.

Unit -V

Operating and Programming Environment: Batch Processing Environments, Embedded system requirements, Theoretical models, Introduction to Functional Programming, Lambda calculus, Data flow language and Object Oriented language, Comparison in various general and special purpose programming languages e.g. Fortran, C, Pascal, Lisp, etc.

Text and Reference Books:

1. Terrance W Pratt, "Programming Languages: Design and Implementation" PHI
2. Sebesta, "Concept of Programming Language", Addison Wesley
3. E Horowitz, "Programming Languages", 2nd Edition, Addison Wesley
4. "Fundamentals of Programming Languages", Galgotia.

ICS-402
SOFTWARE ENGINEERING

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Unit-I: Introduction

Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

Unit-II: Software Requirement Specifications (SRS)

Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS.

Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

Unit-III: Software Design

Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

Unit-IV: Software Testing

Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

Unit-V: Software Maintenance and Software Project Management

Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

Text and Reference Books:

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
3. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, Fundamentals of Software Engineering, PHI Publication.
5. Ian Sommerville, Software Engineering, Addison Wesley.
6. Pankaj Jalote, Software Engineering, Narosa Publication
7. Pfleeger, Software Engineering, Macmillan Publication.
8. A. Leon and M. Leon, Fundamentals of Software Engineering, Vikas Publication.

ICS-451
Database Management System LAB

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The Queries to be implemented on DBMS using SQL.

1. Write the queries for Data Definition and Data Manipulation language.
2. Write SQL queries using Logical operators (=,<,>,etc.).
3. Write SQL queries using SQL operators (Between.... AND, IN(List), Like, ISNULL and also with negating expressions).
4. Write SQL query using character, number, date and group functions.
5. Write SQL queries for Relational Algebra (UNION, INTERSECT, and MINUS, etc.).
6. Write SQL queries for extracting data from more than one table (Equi-Join, Non-Equi-Join , Outer Join)
7. Write SQL queries for sub queries, nested queries.
8. Write programs by the use of PL/SQL.
9. Concepts for ROLL BACK, COMMIT & CHECK POINTS.
10. Create VIEWS, CURSORS, and TRIGGRS & write ASSERTIONS.
11. Create FORMS and REPORTS.

*Students are advised to use **Developer 2000/Oracle-9i** version or other latest version for above listed experiments. However depending upon the availability of software's, students may use **Power Builder /SQL SERVER**. Mini Project may also be planned & carried out through out the semester to understand the important various concepts of Database.

ICS- 452
SOFTWARE ENGINEERING LAB

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1. Using any development tool like Rational Rose Perform SA/SD for the following types of problems.
 - Hotel Automation System
 - Book Shop Automation Software
 - Word processing Software
 - Software Component Cataloguing Software.
 - Payroll System
 - Banking System
 - Purchase Order System
 - Library Management System
 - Railway Reservation System
 - Bill Tracking System
 - College Admission System
2. Illustration of various activities of Software Project Management using MS Project 2000.