GOVT. HOLKAR [MODEL, AUTONOMOUS] SCIENCE COLLEGE INDORE

Academic Year 2024-2025

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for M.Sc.

Computer Science

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

M.Sc. Computer Science

Academic Year 2024-2025

Govt. Holkar (Model Autonomous) Science College, Indore

Computer Science Department

Syllabus Session 2024-25

Programme: M.Sc. Computer Science **Class :M.Sc. II Sem.**

S.No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External Assessment Max.	External Assessment Min.	Total Max.	Total Min.
1	Core 5	Computer Networks	CS21	4	25	9	75	26	100	35
2	Core 6	Data Structures using C++	CS22	4	25	9	75	26	100	35
3	Core 7	Computer Oriented Numerical and Statistical Method	CS23	4	25	9	75	26	100	35
4	Core 8	Database Management Systems	CS24	4	25	9	75	26	100	35
5	Practical 3	Practical based on Theory paper 5 & 6		3			75		75	26
6	Practical 4	Practical based on Theory paper 7 & 8		3			75		75	26
7	Seminar 3			1			25		25	9
8	Seminar 4			1			25		25	9
				24	100		500		600	

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M.Sc. (CS) II -Semester
CS 21: Computer Networks
Academic Year 2024-2025

Min. Marks: 26 **Max. Marks: 75**

Course Outcomes:

1. Student will acquire knowledge of the importance of data communications and the Internet in supporting business Communications and daily activities.
2. Student will be able to analyze the services and features of the various layers of data networks.
3. Explain how communication works in data networks and the Internet.
4. Recognize the different internetworking devices and their functions.
5. Explain the role of protocols in networking.

Unit	Topic
I	**Introduction:** Computer Network, Goals and Applications, Reference models – OSI and TCP/IP. A Comparative study. Network hardware – LAN, MAN and WAN and topologies. LAN components – File server, Workstations, Network Adapter Cards. Connection Oriented and Connection less services, Switching Techniques – Circuit Switching, Packet Switching, Message Switching.
II	**Design Issues:** Framing, Error Control, Flow Control, Error Detection and Correction, Data Link Protocols, Sliding window protocol, Data link layer in the Internet – SLIP and PPP
III	**Multiple Access Protocols:** Aloha, CSMA Protocols, Collision-Free Protocols, Ethernet: Cabling, Manchester Encoding, MAC Sublayer Protocol, Token bus : MAC Sublayer Protocol, Token Ring. MAC Sublayer Protocol, High speed LANs – Fast Ethernet, FDDI, Wireless LANs, Bridges.
IV	**Network Layer:** Design issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Flooding ,Distance Vector Routing, Link State Routing , Hierarchical Routing, Broadcasting Routing, Multicast Routing, The Network Layer in the Internet: Internet Protocol, Internet addressing and Internet Control protocols.
V	**Transport Layer:** Services, The Internet, Transport Protocols: TCP and UDP. **Application Layer:** DNS Name Space, Name Servers, FTP, TELNET, WWW, SNMP, HTTP, SMTP, Network Security: Cryptography, Symmetric- key Algorithms, Public- key Algorithms, Digital Signatures, E-mail Security.

Required Text(s)

- A. Tanenbaum, Computer Networks, 5th Edition, Addison-Wesley, 2003.
- W. Stallings , Data and Computer Communications, Prentice-Hall, 5th Edition, 1997
- Michael A. Miller Data and Network Communication, Delmar Thomson Learning Inc.
- Introduction to Computer Networks: Douglas E. Comer, Prentice-Hall.
- James F. Kurore & Keith W. Rose, Computer Networking ,3rd Edition Pearson Education, 2005.
- Alberto Leon-Garcia and Indra Widjaja, Communication Networks : Fundamentals Concepts and Key Architecture, Tata McGraw-Hill Publishing Company Limited

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M.Sc. (CS) II -Semester
CS 22: Data Structures using C++
Academic Year 2024-2025

Min. Marks: 26 **Max. Marks: 75**

Course Outcomes:

1. Introduction to C++, key concepts of object-oriented programming, unformatted & formatted console I/O operations.
2. Parts of C program, tokens, operators, Control structures.
3. Function overloading, demonstration of Classes and objects, implementing abstraction using access specifiers.
4. Operator overloading, reusing code through Inheritance and its types.
5. Pointer & Arrays of classes, implementing Polymorphism, Template, Handling Exceptions

Unit	Topic
I	Introduction to C++, Definition of data structures and abstract data types. Static and Dynamic implementations. Examples and real life applications, Data Structures: Arrays, Address calculation in a single and multi dimensional array. Sparse matrices.
II	Definition, Array based implementation of stacks, Linked List based implementation of stacks, Examples. Infix, postfix, prefix representation .Applications: Mathematical expression Evaluation. Definition: Queues & Lists: Array based implementation of Queues / Lists, Linked List implementation of Queues / Lists, Circular implementation of Queues and singly linked Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority queues, Applications.
III	Definition of trees and Binary trees, Properties of Binary trees and Implementation, Binary Traversal - preorder, post order, in order traversal, Binary Search Trees, Implementations. Threaded trees, balanced multi way search trees, AVL Trees, Implementations, Applications. Definition of Undirected and Directed Graphs and Networks, The Array based implementation of graphs, Adjacency matrix, path matrix implementation, The Linked List representation of graphs, Shortest path Algorithm, Graph Traversal – Breadth first Traversal, Depth first Traversal, Connectivity of graphs; Connected components of graphs, Weighted Graphs, Applications.
IV	Definition: Hash function, Collision Resolution Techniques, Hashing Applications. Time Complexity, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Evaluating time Complexity.
V	Introduction, Sorting by exchange, selection, insertions, Bubble sort, Selection sort, Insertion sort, Pseudo code algorithm and their C++ implementation, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays, merge sort Algorithms Quick sort Algorithm. Analysis of Quick sort, Picking a Pivot, A

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	partitioning strategy, Heap sort, Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach, Radix sort. Straight Sequential Search, Array implementations, Linked List representations, Binary Search, non – recursive Algorithms, recursive Algorithms, Indexed Sequential Search.

Required Text(s)

- Jr. Symour Lipschetz, Schaum's outline of Theory & Problems of Data Structures, McGraw-Hill, 1986.
- Ellis Horowitz & Sartaj Sahni, Dinesh Mehta: Fundamentals of Data structures in C++,2nd Edition, Universitys Press,2008.
- Sartaj Sahni, Data Structure: Algorithms and application in C++, International edition, WCB/McGraw Hill, 2000.

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M.Sc. (CS) II -Semester

CS 23: Computer Oriented Numerical and Statistical Method

Academic Year 2024-2025

Min. Marks: 26 **Max. Marks: 75**

Course Outcomes:

1. To develop the mathematical skills of the students in the areas of numerical methods.
2. To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems.
3. Finding Eigen values, eigenvectors, interpolation and applications, solving ODEs, PDEs.
4. To lay foundation of computational mathematics for post-graduate courses specialized studies and research.
5. Dealing with statistical problems like testing of hypotheses.

Unit	Topic
I	**Solution of non-linear & transcendental equations:** Computer Arithmetic: Floating-point representation of numbers, arithmetic operations with normalized floating-point numbers and their consequences, significant figures. Error in number representation-inherent error, truncation, absolute, relative, percentage and round-off error. Iterative Methods: Bisection method, method of false position, newton rapson method, secant method, method of successive approximation, concept oriented theoretical consideration of above methods.
II	**Solution of linear equations:** Meaning, conditions for solutions, solution of equation by direct methods - (Gaussian elimination, Gaussian jordan), iterative methods - (Jacobi method, gaussian seidel), ill-conditional equations and solution.
III	**Interpolation and approximation:** Introduction, finite differences, Newton's formulae, Central difference formulae, interpolation with unevenly spaced points, divided difference and their properties, inverse interpolation and double interpolation.
IV	**Numerical integration & solution of ordinary differential equations:** Concept of numerical integration with geometrical representation, trapezoidal method, simpson - 1/3 rule, simpson - 3/8 rule, veddle's rule, understanding and solution of Ordinary Differential Equation and theoretical consideration, euler method, modified euler's method, R-K 2nd order & 4th order method, predictor corrector methods.
V	**Statistics** Graphical representation, Frequency distributions, Measures of central tendency, Measures of dispersions, Correlation, Regression.

TEXT BOOK:

- V. Rajaraman, Computer Oriented Numerical Methods, Prentice Hall, India.
- S. S. Sastry, Introductory Methods of Numerical Analysis.
- M. K. Jain, S.R.K. Iyengar & R. K. Jain, Numerical Methods for Scientific and Engineering Computation.
- H. C. Saxena, Finite Differences and Numerical Analysis.
- Modes A., Numerical Analysis for Computer Science.

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M.Sc. (CS) II -Semester

CS 24: Database Management Systems

Academic Year 2024-2025

Min. Marks: 26 **Max. Marks: 75**

Course Outcomes:

1. Demonstrate the basic elements of a relational database management system.
2. Identify the data models for relevant problems.
3. Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.
4. Demonstrate their understanding of key notions of query evaluation and optimization techniques.
5. Extend normalization for the development of application software's.

Unit	Topic
I	**Introduction:** Purpose of DBMS, view of data, data independence, data model, data base languages, traditional/flat files versus database approach, merits and demerits of both approaches. Profile of people working in DB environment, database administration, and overall system structure. **Entity-relationship model:** Basic concepts of entities and relationships, design issues, mapping constraints, keys, super key, entity-relationship (E-R) diagram, weak entity sets, extended E-R features, design of E-R database schema and reduction of E-R schema to tables.
II	**Relational –model:** Structure of relational database, relational algebra, tuple relational calculus, and extended relational algebra operators. **Integrity Constraints:** Domain constraints, referential integrity, foreign key. **Structure Query Language(SQL):** Basic structure ,set operations, aggregate functions, Null values nested and correlated sub queries ,derived relations,views,Data Definition Language(DDL) Embedded SQL,and other SQL features, introduction to(other relational query languages),Query –By-Example(QBE) and QUEry Language(QUEL), assertions, triggers and stored procedures.
III	**Design theory of relational databases:** Functional Dependencies, Design issues problem faced in designing an application, decomposition, Normalization using multivalve dependencies, Normalization using join dependencies, Domain key normal form and alternative approaches to database design.
IV	**Concurrent operation on database:** Locked based protocols, Time-stamp based protocols, multiple granularity, multiversion schemes, deadlock handling, Insert and delete operation, Thomas Writing Rule and concurrency in index structures.
V	**Crash recovery systems:** Failure classification, storage structure, recovery and Atomicity, Log Based Recovery mechanisms, Shadow paging, Recovery with concurrent transactions, and advanced recovery techniques.

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	Introduction to distributed and Object Oriented Databases. **Case study :** Oracle.

Required Text(s):

- Henry F. Kourth, Abraham Silverschatz, S. Sudarshan "Database System Concepts",5th Edition TataMcGraw Hills Publishing Co.,2005
- Ramez Elmasri, shamkant B. Navathe, Fundamentals of Database System, 5th edition, addition Wesley, 2006.
- An Introduction to Database system- Bipin C. Desai.
- SQL, PL/SQL the Programming Language of Oracle- Ivan Bayross.
- An Introduction to Database system- C.J. Date.

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