SCHEME AND SYLLABI
of
TWO YEAR POST GRADUATE PROGRAMME
M.SC.
in
COMPUTER SCIENCE

WITH EFFECT FROM THE
SESSION 2025-26

Chaudhary Bansi Lal University,
Prem Nagar-127031
Bhiwani
HARYANA, INDIA

Scheme and Syllabus of Two Year Post Graduate Programme M.Sc. in Computer Science w.e.f. 2025-26

Courses	Nomenclature of Course	Course Code	Credits Distribution			Total Credits	Total Contact Hours			Marks				Total Marks
			L	T	P		L	T	P	Theory		Practical		
										Internal	External	Internal	External	
SEMESTER-I														
CC-1 @ 4 credits	Mathematical Foundation of Computing	25MCS101	4	0	0	4	4	0	0	30	70	-	-	100
CC-2 @ 4 credits	Data Structure using C	25MCS102	3	0	1	4	3	0	2	20	50	10	20	100
CC-3 @ 4 credits	Database Management System	25MCS103	3	0	1	4	3	0	2	20	50	10	20	100
CC-4@ 4 credits	Fundamental of Web Designing	25MCS104	3	0	1	4	3	0	2	20	50	10	20	100
PC-1@ 3 credits	Office Automation Tools	25MCS105	0	0	3	3	0	0	6	-	-	20	50	70
Any one of the following														
DEC-1 @ 4 credits	Computer Architecture and Organization	25MCS106	4	0	0	4	4	0	0	30	70	-	-	100
	Design and Analysis of Algorithms	25MCS107	4	0	0	4	4	0	0	30	70	-	-	100
SEMESTER-II														
CC-5 @ 4 credits	Operating Systems	25MCS201	3	0	1	4	3	0	2	20	50	10	20	100
CC-6 @ 4 credits	Object Oriented Programming using C++	25MCS202	3	0	1	4	3	0	2	20	50	10	20	100
CC-7 @ 4 credits	Computer Networking	25MCS203	4	0	0	4	4	0	0	30	70	-	-	100
CC-8 @ 4 credits	Artificial Intelligence	25MCS204	4	0	0	4	4	0	0	30	70	-	-	100
PC-2@ 3 credits	Programming in MATLAB	25MCS205	0	0	3	3	0	0	6	-	-	20	50	70
Any one of the following														
DEC-2 @ 4 credits	Data Mining	25MCS206	4	0	0	4	4	0	0	30	70	-	-	100
	Linux Administration	25MCS207	4	0	0	4	4	0	0	30	70	-	-	100
IKS/OEC @2 credits	Indian Knowledge System in Computer Science	25MCS208	2	0	0	2	2	0	0	15	35	-	-	50
SEMESTER-III (for option I and II)														
CC-9 @ 4 credits	Python Programming	25MCS301	3	0	1	4	3	0	2	20	50	10	20	100
CC-10 @ 4 credits	Software Engineering	25MCS302	4	0	0	4	4	0	0	30	70	-	-	100
CC-11 @ 4 credits	Computer Graphics	25MCS303	3	0	1	4	3	0	2	20	50	10	20	100

Semester-I

Name of the Course (CC1) 4 credits	MATHEMATICAL FOUNDATIONS OF COMPUTING	Course Code	25MCS101
Maximum Marks	Theory: 30(Internal)+70(External)=100	Time of Examination	3 Hours

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each Section. All questions will carry equal marks.

Course Learning Outcomes (CLO):
After completion of course, students would be able to understand:

- The basic notions of discrete and continuous probability.
- The methods of statistical inference and the role that sampling distributions play in those methods.
- Correct and meaningful statistical analyses of simple to moderate complexity.

Section – I

Sets: Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications. Relations and F**unctions:** Properties of Relations, Equivalence Relation, Partial Order Relation, Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.

Section – II

Propositional Logic: Proposition logic, basic logic, Logical Connectives, truth tables, tautologies, contradiction, Logical implication, Logical equivalence, Normal forms, Theory of Inference and deduction. **Predicate Calculus:** Predicates and quantifiers. Mathematical Induction.
Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint and Inverse of a matrix. Determinants: Definition, Minors, Cofactors, Properties of Determinants, Applications of determinants in finding area of triangle, solving a system of linear equations.

Section – III

Graph: Definition, walks, paths, trails, connected graph, regular and bipartite graph, cycles and circuits. Tree and rooted tree, Spanning tree, Eccentricity of a vertex radius and diameter of a graph, Central graphs. Centre(s) of a tree. Hamiltonian and Eulerian graph, planar graphs

Section – IV

Probability and Distribution: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

References:

1. C.L.Liu: *Elements of Discrete Mathematics, McGraw Hill.*
2. Lipschutz, Seymour: *Discrete Mathematics, Schaum's Series.*
3. John Vince: Foundation Mathematics for Computer Science, Springer.
4. Trembley, J.P & R. Manohar: *Discrete Mathematical Structure with Application to Computer Science, TMH.*
5. Kenneth H. Rosen: *Discrete Mathematics and its applications, TMH.*

Semester-I

Name of the Course (CC2) 3 credits	DATA STRUCTURE USING C	Course Code	25MCS102
Maximum Marks	Theory: 20(Internal)+50(External)=70	Time of Examination	3 Hours

Note:
Examiner will set seven questions and the candidates will be required to attempt four questions in all. Question number one will be compulsory containing four short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each Section. All questions will carry equal marks.

Course Learning Outcomes (CLO):

- For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
- For a given Search problem (Linear Search and Binary Search) student will able to implement it.
- For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
- Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
- Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

Section – I

Programming in C: Introduction to C, Data type, constants and variable; Structure of a C program, Operators and Expressions, Control statements: Sequencing, Alteration and Iteration; Arrays: Representation of single and multidimensional arrays; String and pointers, Functions, Recursion.
Data Structures: Definition and its types, Abstract Data Types, Review of strings: String representation and manipulation, Static and dynamic memory storage,

Section – II

Arrays, matrices, sparse matrices, multi-dimensional arrays, operations on arrays. Linked Lists, List Types (singly, doubly, singly circular, header, doubly circular), Operations on Lists – create, insert, delete, search, Applications of linked list.
Stacks: Definition, Array implementation of stacks, Linked implementation of stacks, Applications of Stacks: Infix, Postfix and prefix expression, conversions and evaluation of expressions.
Queues: Definition, Array implementation of queues, linked implementation of queues, Circular queues, Priority queues, Double-ended queues

Section - III

Searching and Sorting: Linear search, Binary search, Insertion sort, selection sort, Bubble sort, Merge sort, Quick Sort, Heap Sort; Hashing, Hash table, Hash functions,
Trees: Binary Trees and their properties, Linked and static Representation of binary trees, Complete Binary Tree, Threaded Binary tree, Different tree traversal algorithms, Binary Search Tree (create, delete, search, insert, display) and its complexity analysis, AVL Trees.
Graphs: Definition, Array and linked representation of graphs, Graph Traversal (BFS and DFS), Adjacency matrix and adjacency lists, path matrix, Shortest Path Algorithm.

References:

1. Fundamentals of Data Structures: *Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.*
2. Schaum's outline series: *Data Structure, TMH.*
3. Tenenbaum, Langsam, Augenstein: *Data Structures using C, Pearson Education.*
4. E. Horowitz and S. Sahani:*Fundamentals of Data Structures, GalgotiaBooksourcePvt. Ltd.*
5. Bala Guruswamy: *Data Structures Using C, TMH.*

Semester-I

Name of the Course (CC3) 3 credits	DATABASE MANAGEMENT SYSTEM	Course Code	25MCS103
Maximum Marks	Theory: 20(Internal)+50(External)=70	Time of Examination	03 Hours

Note:
Examiner will set seven questions and the candidates will be required to attempt four questions in all. Question number one will be compulsory containing four short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each Section. All questions will carry equal marks.

Course Learning Outcomes (CLO):
After completion of course, students would be able to understand:

- For a given query write relational algebra expressions for that query and optimize the developed expressions.
- For a given specification of the requirement design the databases using E-R method and normalization.
- For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
- Implement the isolation property, including locking, time stamping based on concurrency control and serializability of scheduling.

Section-I

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).
Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.
Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Section-II

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.
Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.
Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Section-III

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.
Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

References:

1. Database System Concepts: *6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.*
2. Principles of Database and Knowledge – Base Systems: Vol 1 by J. D. Ullman, Computer Science Press.
3. Fundamentals of Database Systems: 5th Edition by R. Elmasri and S. Navathe, Pearson Education.
4. Foundations of Databases: Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

Semester-I

Name of the Course (CC4) 3 credits	FUNDAMENTALS OF WEB DESIGNING	Course Code	25MCS104
Maximum Marks	Theory: 20(Internal)+50(External)=70	Time of Examination	3 Hours

Note:
Examiner will set seven questions and the candidates will be required to attempt four questions in all. Question number one will be compulsory containing four short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each Section. All questions will carry equal marks.

Course Learning Outcomes (CLO):
After completion of course, students would be able to understand:

- The client side and server side scripts used in programming
- The basic concept of designing websites
- Database connectivity with the web pages

Section – I

Introduction to Web programming – Introduction to SGML features – HTML, XHTML, DHTML, HTML Vs XML. Overview of HTML - basic formatting tags - heading, paragraph, underline break, bold, italic, underline, superscript, subscript, font and image. Attributes - align, color, bgcolor, font face, border, size. Navigation Links using anchor tag - internal, external, mail and image links. Lists - ordered, unordered and definition, Table tag, HTML Form controls - form, text, password, text area, button, checkbox, radio button, select box, hidden controls.

Section – II

Cascading Style Sheets: Introduction, Inline, Internal, External CSS, Linking CSS to Web Page. **Client–Side Programming**: Introduction to JavaScript, Basic Syntax, Variables and Data types, Statements, Operators, Literals, Functions, Objects, Arrays.
XML: Relation between XML and HTML, Goals of XML, Structure and Syntax of XML, Well Formed XML, DTD and its Structure, tree structures in data organization, Searching with XPath.

Section – III

Apache Web Server: Introduction, architecture, features, Apache's Role in the Internet, LAMP, WAMP, XAMPP.
Server side programming – PHP – Designing dynamic web pages using PHP - Defining PHP variables – variable types – operators – control flow constructs in PHP – passing form data between pages - Establishing connection with MySQL database – managing database

References:

1. Dick Oliver: Tech Yourself HTML 4 in 24 Hours, Techmedia.
2. Satish Jain: "O" – Level Information Technology.
3. AchyutGodbole, “Web Technologies”, Tata McGraw Hill, India.
4. Craig Zacker: 10 minutes Guide to HTML Style Sheets, PHI.
5. V.K. Jain: "O" – Level Information Technology, BPB Publications.

Semester-I

Name of the Course (PC1) 3 credits	OFFICE AUTOMATION TOOLS	Course Code	25MCS105
Maximum Marks	Practical: 20(Internal)+50(External)=70		

Course Learning Outcomes (CLO):

- Understand concept of Word Processor and use its features.
- To use the advanced features of Ms-Word to make day to day usage easier.
- To work comfortably with Ms-Excel Environment. To create work sheets and user advanced feature of Excel.
- To create make presentations and inserting multimedia in them.

Section: I

Introduction to MS Office & MS Word: MS-Word: Features of MS-Word, MS-Word Window components, working with formatted text, Shortcut keys, formatting documents: Selecting text, Copying &moving data, formatting characters, changing cases, Paragraph formatting, Indents, Drop Caps, using format painter, Page formatting, Bullets & numbering, Tabs, Forming tables. Finding & replacing text.

Overview MS Word Advanced features: Header & footer, Macro, Tables, Mail merging, Printing documents, Tables: Insert tables, Charts

Section: 2

MS-Excel: Excel Features, Spreadsheets, cell, cell referencing, workbooks, creating, saving & edit workbook, Renaming sheet, spell check, Adding and deleting rows and columns, Sorting, Filtering, Advance Filter, Conditional Formatting, Charts, Pivot Table and Chart, conditional formatting, tables

Section: 3

MS-Power Point: Features of Power Point, Uses, components of power point window, designing slides, slide layouts, customizing slides through slide master, changing colour scheme, changing background and shading, adding header and footer, Inserting picture, shapes, charts, audio, video into slide. Adding transition and animations, Working in slide sorter view(deleting, duplicating, rearranging slides), slide show

References:

1. Fundamentals of Computer – V. Rajaraman, Prentice Hall of India.
2. Introduction to Computers–Peter Norton McGraw-Hill.

Semester-I

Name of the Course (DEC-1) 4 credits	COMPUTER ARCHITECTURE AND ORGANIZATION	Course Code	25MCS106
Maximum Marks	Theory: 30(Internal)+70(External)=100	Time of Examination	3 Hours

Note: Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each Section. All questions will carry equal marks.

Course Learning Outcomes (CLO):

- Study of the basic structure and operation of a digital computer system.
- Analysis of the design of arithmetic & logic unit and understanding of the fixed point and floating point arithmetic operations.
- Implementation of control unit techniques and the concept of Pipelining
- Understanding the hierarchical memory system, cache memories and virtual memory

Section: I

Boolean Algebra and Logic Gates: Basic definition, Axiomatic Definition, Basic theorem and Properties of Boolean algebra, Minterms and Maxterms, Logic Operations, Digital logic gates, IC digital logic families

Simplification of Boolean functions: Different types map method, product of sum simplification, NAND or NOR implementation, Don't care condition, Tabulation method, Adder, subtractor, Decoder, Encoder, Code Conversion, Universal Gate.

Section:2

Sequential Logic: Flip-flops, Triggering of Flip-flops, Analysis of clocked sequential circuits, State reduction and Assignment, Flip-flop excitation, Design of counters, Design with state equations

Overview Of Register Transfer And Microoperations: Register Transfer Language, Register transfer, Bus and Memory transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit

Section: 3

Basic Computer Organization and Design: Instruction codes, Computer registers, Computer instructions, Timing and Control, Instruction cycle, Memory-Reference Instructions, Input-output and interrupt, Design Basic computer, Design of Accumulator Unit

Programming The Basic Computer: Introduction, Machine Language, Assembly Language, the Assembler, Program loops, Programming Arithmetic and logic operations, Subroutines, I-O Programming

Section: 4

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, Data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC).

Pipeline Processing: Pipeline and Vector Processing, Parallel processing, Pipelining, Arithmetic Pipeline, Instruction pipeline and Arrays Processors.

References:

1. Computer System Architecture: By M. Morris Mano.
2. Structured Computer Organization: By Tanenbaum.
3. Computer Organization: By Stallings.
4. Computer Architecture and Organization: By Hayes.
5. Microprocessor Architecture, Programming, and Applications with the 8085 - Ramesh S. Gaonkar Pub: Penram International.

Semester-I

Name of the Course (DEC-2) 4 credits	DESIGN AND ANALYSIS OF ALGORITHMS	Course Code	25MCS107
Maximum Marks	Theory: 30(Internal)+70(External)=100	Time of Examination	3 Hours

Note: Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing seven short answer type questions from all sections. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each Section. All questions will carry equal marks.

Course Learning Outcomes (CLO):

- To learn the basic concept of the asymptotic performance of algorithms.
- To understand the write rigorous correctness proofs for algorithms.
- Demonstrate familiarity with major algorithms and data structures and apply them to solve problems.

Section: I

Introduction to analysis of algorithms: Analysis of algorithms, asymptotic notation-Big- O, Omega and Theta notations, recurrence relations, solving recurrences, Abstract data types, Linear Data Structures and their sequential storage representation: stacks, queues, priority queues, and their applications.

Section:2

Divide and Conquer: General method, Binary Search, Exponentiation problem, Merge Sort, Quick Sort, Selection Sort, Strassen‘s Matrix Multiplication algorithms and analysis of algorithms for these problems. Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning trees, Single source shortest path and analysis of these algorithms

Section: 3

Dynamic Programming: General method, 0/1 Knapsack problem, Optimal BST, All Pairs shortest path, Traveling Salesman Problem, longest common subsequence (LCS). Back Tracking: General method, 8 queen‘s problem, graph coloring, Hamiltonian cycles and analysis of these problems.

Section: 4

NP-Hard and NP-Complete Problems: P, NP, NP-Hard & NP Complete Classes, Reductions: Vertex cover, Simple Max-Cut, Hamiltonian Circuit, Traveling salesman problem, kernel, 3- dimensional matching, and other NP-Complete Problems, Satisfiability and variations, Cook's theorem, examples of NP-Hard problems.

References:

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., Introduction to Algorithms, MIT Press, 2010.
2. Goodrich, M.T., Tamassia, R. and Mount, D.M., Data Structures and Algorithms in C++, John Wiley & Sons, 2016.
3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., Data Structures using C and C++, Prentice Hall, 2015.
4. Lipschutz, S., Schaum's Outline of Theory and Problems of Data Structures, McGraw-Hill, 2014

Semester-I

Name of the Course (1 credit)	PRACTICAL (BASED ON 25MCS102)	Course Code	25MCS102P
Maximum Marks	Practical: 10(Internal)+20(External)=30		

Course Outcomes: By the end of the course the students will be able to:

CO1: Able to develop basic programs of in C language and Use various problem solving techniques.
CO2: Programming in C by using functions, structures and union.
CO3: Able to use various searching and sorting algorithms using arrays in C
CO4: Able to implement Stack, Queue, Linked List, Trees, Graphs
CO5: Able to solve various problems using C language on small scale.

List of Practical:

1. Write a C program to implement recursive and non-recursive Linear search and Binary search
2. Write a C program to implement Searching and Sorting
3. Write a C program to implement Linked List.
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list. b) Delete an element from list c) Search for a key element in list d) count number of nodes in list
5. Write C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT
6. Write C programs to implement the deque (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations: a) Insert an element into a binary search tree. b) Delete an element from a binary search tree. c) Search for a key element in a binary search tree.
8. Write C programs for implementing the following sorting methods: Merge sort b) Heap sort
9. Write C programs that use recursive functions to traverse the given binary tree in a) Preorder b) inorder and c) postorder.
10. Write a C program to perform the following operations a) Insertion into a B-tree b) Deletion from a B-tree
11. Write a C program to perform the following operations a) Insertion into an AVL-tree b) Deletion from an AVL-tree
12. Program for Queue and Circular Queue Task
14. Program for Single Link List to insert a node at any point and display all nodes Task
15. Program for Single Link List to delete a node at any point and display all nodes

Semester-I

Name of the Course (1 credit)	PRACTICAL (BASED ON 25MCS103)	Course Code	25MCS103P
Maximum Marks	Practical: 10(Internal)+20(External)=30		

Course Learning Outcomes (CLO):

CO1: Knowledge of Basic fundamentals of database management and implementation of MYSQL Queries.
CO2: Basic understanding of DDL, DML statements
CO3: Basic operations and queries on data

List of Practical:

1. To study DBMS, RDBMS.
2. To study Data Definition Language Statements.
3. To study Data Manipulation Statements.
4. Study of SELECT command with different clauses.
5. Study of SINGLE ROW functions (character, numeric, Data functions).\
6. Study of GROUP functions (avg, count, max, min, Sum).
7. Study of various type of SETOPERATORS (Union, Intersect, Minus).
8. Study of various types of Integrity Constraints.
9. Study of Various types of JOINS.
10. To study Views and Indices.

Semester-I

Name of the Course (1 credit)	PRACTICAL (BASED ON 25MCS104)	Course Code	25MCS104P
Maximum Marks	Practical: 10(Internal)+20(External)=30		

Course Outcomes: By the end of the course the students will be able to:

CO1: Designing the web page using HTML, DHTML, JavaScript, CSS, PHP

CO2: Writing the client side and server side scripts

List of Practical:

1. Create a simple HTML page with title, heading, and paragraph, formatting tags, hyperlinks, list items and image elements.
2. Create a simple HTML page having image elements with the use of map.
3. Create a simple HTML page having a complex table.
4. Create a simple HTML page having multiple Frames.
5. Embed Video in a HTML page.
6. Create a simple HTML page that uses Inline CSS
7. Create a simple HTML page that uses Document level CSS
8. Create a simple HTML page that uses External level CSS
9. Create a HTML page that uses all CSS properties Contents Tasks List Description
10. Write a simple JavaScript to print text on to the HTML document.
11. Write a simple script in head portion of HTML document.
12. Write a simple script in body portion of the HTML document.
13. Write an external script and link it to the HTML document.
14. Write a PHP script to get the PHP version and configuration information
15. Write a PHP script to display any multi-line string
16. Write a PHP script to place a variable to a title and as hyperlink of the Web page
17. Create a simple HTML form and accept the user name and display the name through PHP echo statement.