SYLLABUS OF

Bachelor of Computer Application

PROGRAM

BCA Third Semester

Department of Computer Science & IT

Mangaldai College (Autonomous)

Semester-III		
Course Code	**Course**	**T+P (Credit)**
Code: BCA-DSC-3014	**Data Structures & Algorithms**	**3+1=4**
Code: BCA-DSC-3024	**Database Management System**	**3+1=4**
Code: BCA-DSC-3034	**Mathematics II**	**4**
Code: BCA-SEC-3013	**Advanced Web Development**	**2+1=3**
	MDC-3	**3**
	VAC-3	**2**
		20

Course Information

Course Title	:	Data Structures & Algorithms
Course Code	:	*BCA-DSC-3014*
Programme	:	Bachelor of Computer Application
Semester / Year	:	3rd Semester
Credits	:	3+1
Contact Hours	:	Theory: 45 hrs. (45 classes) Practical: 30 hrs. (15 classes)
Marks	:	**Theory: 75** **Practical: 25** Internal: 30 Internal: 10 ESE : 45 ESE : 15
Course Objectives	:	✓ To understand fundamental concepts of data types, abstract data types, and data structures. To study the importance and applications of data structures in problem solving. ✓ To learn array representation techniques and address calculation methods. To perform insertion, deletion, and large number operations using arrays. ✓ To understand linked list structures and their variants. To implement basic operations such as insertion, deletion, and traversal. ✓ To understand tree data structures and binary search trees. To perform traversal operations and heap-based processing. ✓ To analyze searching and sorting techniques along with algorithm complexity. To compare algorithms using time and space complexity measures.
Course Outcomes (COs)	:	**CO1:** Explain fundamental data structures concepts and classify data types. **CO2:** Implement arrays and linked lists with basic operations. **CO3:** Apply stacks and queues to solve expression and scheduling problems **CO4:** Construct and traverse trees and perform searching and sorting. Analyze algorithms using time and space complexity notations.
Recommended Books & References	:	Weiss, Mark Allen. "**Data Structures and Algorithm Analysis in C**". 3rd ed., Pearson, 2012 Sedgewick, Robert. "**Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms**". 3rd ed., Addison-Wesley Professional, 2002. Goodrich, Michael T., and Roberto Tamassia. "**Data Structures and Algorithms in C**". 2nd ed., Wiley, 2011.

Course Content / Units

A. Theory		Class	Marks
Unit 1:	**Data Structures Overview and Arrays** Concepts of data types, abstract data types, and data structures. Importance and applications of data structures. One-dimensional and two-dimensional arrays, array representation, address calculation, and basic operations such as traversal, insertion, deletion, and searching.	**8**	**8**
Unit 2:	**Linked Lists** Structures and pointers, self-referential structures, and introduction to linked lists. Singly linked lists, doubly linked lists, and circular linked lists. Operations on linked lists including creation, traversal, insertion, deletion, searching, merging, and splitting.	**8**	**8**
Unit 3:	**Stacks and Queues** Concepts of stacks and queues. Representation using arrays and linked lists. Stack operations (push and pop) and queue operations (enqueue and dequeue). Circular queues, priority queues, conversion of infix expressions to postfix expressions, and evaluation of postfix expressions.	**7**	**7**
Unit 4:	**Trees** Introduction to trees and binary trees. Basic tree terminologies, representation of binary trees, and tree traversal methods including preorder, inorder, and postorder. Binary search trees and their operations such as creation, insertion, deletion, and searching. Introduction to heaps.	**7**	**7**
Unit 5:	**Searching and Sorting** Linear search, binary search, and basic hashing techniques. Sorting algorithms including bubble sort, selection sort, insertion sort, merge sort, and quick sort. Concepts of stable sorting and in-place sorting.	**10**	**10**
Unit 6:	**Analysis of Algorithm and Complexity** Introduction to algorithm analysis. Time and space complexity, best-case, average-case, and worst-case analysis. Asymptotic notations including Big-O, Omega (Ω), and Theta (θ). Complexity analysis of searching and sorting algorithms.	**5**	**5**

B. Practical / Lab	Class	Marks
List of Practical's	**30**	**15**

Practical / Lab (30 Classes, 15 Marks)

1. Array creation, initialization, and retrieval of elements.
2. Array operations: traversal, insertion, deletion, and processing of elements.
3. Finding positions of specific elements (e.g., even numbers) in an array.
4. Creation and traversal of a singly linked list.
5. Counting nodes in a linked list.
6. Insertion of nodes at the beginning, end, and specified position in a linked list.
7. Deletion of nodes from the beginning, end, and specified position in a linked list.

8. Searching for an element in a linked list.
9. Splitting and merging linked lists.
10. Implementation of stack operations and evaluation of postfix expressions.
11. Implementation of queue operations.
12. Linear search and binary search on arrays.
13. Creation and traversal of Binary Search Trees (BST).
14. Searching and insertion operations in BST.
15. Implementation of sorting algorithms: Bubble Sort, Selection Sort, and Insertion Sort.

***NB**: Presentation and assignment copy submission at the end of the course completion*

Course Information		
Course Title	:	Database Management System
Course Code	:	*BCA-DSC-3024*
Programme	:	Bachelor of Computer Applications (BCA)
Semester / Year	:	BCA 3rd Semester
Credits	:	3+1
Contact Hours	:	Theory: 45 hrs. (45 classes) Practical 30 hrs. (15 classes)
Marks	:	**Theory: 75** Internal: 30 ESE : 45 **Practical: 25** Internal: 10 ESE : 15
Course Objectives	:	✓ To understand the basic concepts of data, information, and Database Management Systems. ✓ To explain the limitations of traditional file systems. To understand the need and advantages of using DBMS. ✓ To study DBMS architecture and data independence. To understand schemas, instances, and data models. ✓ To learn different types of database systems. To understand centralized, distributed, and client/server databases. ✓ To design Entity–Relationship diagrams using entities, attributes, and relationships. To convert ER models into relational tables. ✓ To understand the relational model and relational algebra operations. To learn SQL commands and database constraints. To understand transaction management and concurrency control.
Course Outcomes (COs)	:	**CO1** Understand basic database and DBMS concepts. Explain DBMS architecture and data models **CO2** Design ER diagrams and convert them into tables. Apply relational algebra operations. **CO3** Analyze functional dependencies and normalization. Write SQL queries and manage transactions.
Recommended Books & References	:	Dr. Satinder Bal Gupta and Aditya Mittal, ***Introduction to Database Management System*** **, University Science Press** A. Silberschatz, H.F. Korth, S. Sudarshan, ***Database System Concepts*****, McGraw Hill** R. Elmasri, S.B. Navathe, ***Fundamentals of Database Systems*****, Pearson Education** Dr. Rajive Chopra, ***Database Management System (DBMS): A Practical Approach*****,** S. Chand Publication

Course Content / Units

A. Theory		Class	Marks
Unit 1:	**Introduction to Database Management Systems** Basic Definition and Concepts. Definition of Database Management System (DBMS), Primary Functions of DBMS, Traditional File approach, Traditional file approach versus database management system approach, Disadvantages of Traditional File System, Need of a DBMS, Components of a DBMS, Advantages of DBMS, Disadvantages of Database Systems, Various uses of database System Applications, Database Users, *Database Administrator* (*DBA*), Responsibilities of DBA.	**5**	**5**
Unit 2:	**Database Management System Architecture** Schemas and Data Independence (Physical and Logical). Three-level DBMS architecture and its advantages. Data models: concept, characteristics, and types. Relational data model. Types of database systems: single-user, multiuser, centralized, distributed, and client-server systems.	**5**	**5**
Unit 3:	**E-R Modeling** Basic Concepts: *Entity*, *Attributes*, *Entity Sets*, *Domain*. Types of attributes: *Simple and Composite Attributes*, *Single Valued and Multi-valued Attributes*, *Derived Attributes and Stored Attributes*. Types Of Entity Sets. Concept of Relationship and Relationship sets, Types of Relationship: One-to-One, One-to-Many, Many-to-One and Many-to Many, Mapping constraints. Definition of Key, Types of Keys.Symbols used in E-R diagrams, Conversion of an ER and Diagram in to Relational Tables	**5**	**5**
Unit 4:	**Relational Model and Relational Algebra** Relational database concepts: relation, tuple, attribute, domain, degree, and cardinality. Integrity constraints including domain and key constraints. Advantages and disadvantages of the relational model. Relational algebra and its operations. Aggregate functions: AVG, MAX, MIN, SUM, and COUNT.	**5**	**5**
Unit 5:	**Functional Dependency and Normalization** Functional dependencies, Armstrong's axioms, attribute closure, anomalies in relational databases, and normalization (1NF, 2NF, 3NF, BCNF).	**5**	**5**
Unit 6:	**Transaction and Concurrency Control** Definition of Transaction, ACID Properties of transaction, Transaction States, Definition of Concurrency Control, Need of Concurrency Control, The Lost Update Problem, The Uncommitted Dependency Problem, The Inconsistent Analysis Problem, Serializability: View Serializability and Conflict Serializability	**5**	**5**
Unit 7:	**SQL Queries** SQL fundamentals, data types, DDL, DML, DCL and TCL commands, query formulation, constraints, and aggregate functions.	**15**	**15**

B. **Practical / Lab**	**Class**	**Marks**
List of Practical's	**30**	**15**

Practical / Laboratory Work to be Performed

a) Implementation of SQL DDL statements in MySQL DBMS: CREATE DATABASE, CREATE TABLE, ALTER TABLE, RENAME, DROP DATABASE/TABLE

b) Use of SQL DML statements in MySQL DBMS: INSERT, SELECT, UPDATE, DELETE SQL commands

c) Implementing following constraints in MySQL DBMS: PRIMARY KEY, FOREIGN KEY, NOT NULL, UNIQUE and DEFAULT

d) Handling following SQL clauses in MySQL DBMS: WHERE, GROUP BY, ORDER BY, HAVING, IN, BETWEEN, LIKE

e) Working with following aggregate functions in MySQL DBMS: COUNT, AVG, MAX, MIN and SUM

f) Working with transaction processing command in MySQL DBMS: START TRANSACTION, COMMIT and ROLLBACK Statements, SET auto commit

***NB**: Presentation and assignment copy submission at the end of the course completion*

Course Information

Course Title	:	Mathematics II
Course Code	:	*BCA-DSC-3034*
Programme	:	Bachelor of Computer Applications (BCA)
Semester / Year	:	BCA 3rd Semester
Credits	:	4
Contact Hours	:	Theory: 60 hrs. (60 classes)
Marks	:	**Theory: 100** Internal: 40 ESE : 60
Course Objectives	:	✓ To develop an understanding of limits, continuity, and differentiation. To apply calculus concepts for solving problems involving maxima and minima. ✓ To introduce basic concepts of graph theory and graph representations. To study graph properties and traversal algorithms such as BFS and DFS. ✓ To understand fundamental counting techniques in combinatorics. To apply permutation and combination principles to solve counting problems. ✓ To learn the basics of mathematical logic and logical reasoning. To analyze logical expressions using truth tables, normal forms, and inference.
Course Outcomes (COs)	:	**CO1:** Understand and apply limits, continuity, and differentiation techniques. Apply graph traversal algorithms such as BFS and DFS. **CO2:** Use derivatives to solve problems involving maxima and minima. Explain basic concepts of graph theory and graph representations. **CO3:** Solve counting problems using combinatorics principles. Analyze logical statements using propositional and predicate logic.
Recommended Books & References	:	**Discrete Mathematics structures with applications to Computer Science**, J. P. Tremblay and R. Manohar, Mc-Graw Hill. **Discrete Mathematics**, N. Ch.SN Iyengar, K.A. Venkatesh, V. M. Chandrasekaran, P. S. Arunachalam, Vikash Publishing House Pvt Ltd.

Course Content / Units			
A. Theory		**Class**	**Marks**
Unit 1:	**Calculus** Intuitive idea of limits and continuity. Limits of polynomials and rational functions. Derivatives, algebra of derivatives of a function, derivatives of polynomials and trigonometric functions. Rolle's theorem, Lagrange's Mean Value Theorem and Taylor's theorem. Meaning of the sign of derivative, indeterminate forms, maxima and minima (single variable only).	**15**	**15**
Unit 2:	**Graph theory** Basic definition of graph, vertices and edges, directed, undirected and weighted graphs. Types of graphs including simple, complete and bipartite graphs. Representation of graphs in computers using adjacency matrix and adjacency list. Degree of vertices including indegree and outdegree. Walks, paths, cycles and acyclic graphs. Connected and disconnected graphs. Trees, basic properties of trees and forests. Graph traversal algorithms – Breadth First Search and Depth First Search.	**15**	**15**
Unit 3:	**Numerical Methods** Errors and approximations, Bisection method, Newton-Raphson method, basic interpolation, numerical differentiation, numerical integration, applications in scientific computing.	**15**	**15**
Unit 4:	**Fundamentals of Statistics and Discrete Probability** Types of data, attributes and variables; construction of frequency and cumulative frequency distributions. Graphical representation of frequency distribution: histogram, frequency polygon, frequency curve and cumulative frequency curves (ogive curves). Diagrammatic representation: simple bar, subdivided bar and pie diagrams. Measures of central tendency – mean, median and mode. Measures of variation – range, interquartile range, standard deviation and variance. Sample space, events, random variables, basic probability, conditional probability and Bayes' theorem.	**15**	**15**

Course Information

Course Title	:	Advanced Web Development
Course Code	:	BCA-SEC-3013
Programme	:	Bachelor of Computer Applications (BCA)
Semester / Year	:	BCA 3rd Semester
Credits	:	2+1
Contact Hours	:	Theory: 30 hrs. (30 classes) Practical: 30 hrs. (15 classes)
Marks	:	**Theory: 50** **Practical: 25** Internal: 20 Internal: 10 ESE : 30 ESE : 15
Course Objectives	:	✓ To enhance skills in advanced HTML5, semantic elements, forms, and multimedia integration. To improve web accessibility, SEO, and document structuring. ✓ To develop advanced CSS skills including layouts, typography, flexbox, grid, and responsive design. To introduce CSS preprocessors and frameworks like Sass, Bootstrap, and Tailwind. ✓ To strengthen JavaScript programming skills including DOM manipulation, events, arrays, and asynchronous programming. To apply AJAX and jQuery for dynamic and interactive web pages. ✓ To learn server-side scripting with PHP and database interactions using MySQL. To implement user authentication, session management, and secure web applications. ✓ To understand advanced web programming concepts including web hosting, APIs, JavaScript frameworks, version control, and web security. To gain knowledge of modern deployment practices, monitoring, and analytics.
Course Outcomes (COs)	:	**CO1:** Develop web pages using advanced HTML5 features, semantic elements, and multimedia integration. **CO2:** Apply advanced CSS techniques, responsive layouts, and CSS frameworks for modern web design. **CO3:** Implement dynamic and interactive web pages using JavaScript, DOM manipulation, and AJAX. **CO4:** Build server-side web applications using PHP and MySQL, including authentication and session management. Understand web hosting, APIs, JavaScript frameworks, version control, and web security concepts.
Recommended Books & References	:	**V. Rajaraman** – *Fundamentals of Computers* **P. K. Sinha & Priti Sinha** – *Computer Fundamentals*

Course Content / Units

A. Theory		Class	Marks
Unit 1:	**Advanced HTML** Review of basic HTML tags and their usage. Working with forms validation using HTML5 attributes. HTML5 Semantic Elements-header, nav, section, article, aside, footer. Applying proper semantic markup for improved SEO. Multimedia integration. Embedding images with different attributes. Adding video and audio. Meta information and Document Structure-metadata, viewport settings.	**7**	**7**
Unit 2:	**Advanced Design with CSS** Review of CSS CSS Selectors. Specificity and the cascade. Psudo-classes and pseudo-elements.CSS Box sizing. Gradient and Transparent backgrounds. CSS Typography - Line height and letter spacing. Web-safe fonts. CSS Layout. Display property inline, block, inline-block. none. Positioning static, relative, absolute, fixed. Floats and clear property. Box alignment flexbox and grid layout. Responsive Web Design Media queries and breakpoints. Fluid layouts. Brief concept of CSS preprocessors Sass, Less. Brief concept of CSS frameworks - Bootstrap, Tailwind.	**5**	**5**
Unit 3:	**Advanced JavaScript** Review of JavaScript concepts. Functions in JavaScript. Lexical Environment. Arrays and Array manipulation in JavaScript. JavaScript Events and Event Handling - Event propagation and event delegation. Implementing interactivity with user actions. Introduction to JavaScript APIs. Callback functions and event loop. Promise chain. Asynchronous function with async/wait. DOM manipulation and event handling with jQuery. Overview of AJAX. Brief concept of XMLHttpRequest object.	**5**	**5**
Unit 4:	**Server-Side Scripting using PHP** Review of PHP as a server-side scripting language. Handling forms and user input with PHP. Interacting with databases and performing CRUD operations using PHP and MySQL. User authentication using PHP. Implementing user registration and login functionality. Session management and Token based authentication. Overview of Cookies and their use in Web applications. Working with cookies in PHP setting, reading, deleting. Concept of Cross-site scripting (XSS).	**5**	**5**
Unit 5:	**Advanced Web Programming** Advanced Concepts of Web Programming Overview of web hosting shared hosting, VPS, dedicated hosting, cloud hosting. Overview of Server-Side Includes (SSI). Brief concepts of Web APIs and data integration. Concept of JavaScript frameworks React.js and Node.js. Version Control Systems. Brief overview of Continuous Integration and Deployment. Overview of Web security and SSL/TLS. Web analytics and monitoring.	**8**	**8**

B. Practical / Lab	Class	Marks
List of Practical's	**30**	**15**

1. Create a semantic HTML structure for a blog post, including headings, paragraphs, images, and nested elements.
2. Develop an HTML5 video player with custom controls, including play, pause, volume control, and full-screen functionality.
3. Create a responsive HTML layout using CSS Grid or Flexbox that adapts to different screen sizes and orientations.
4. Develop a responsive navigation menu that collapses into a hamburger menu for mobile devices, utilizing media queries and CSS transitions.
5. Implement a CSS animation or transition to create a smooth fade-in effect for an element on page load.
6. Design a CSS grid layout that displays a multi-column card-based UI, where each card has a consistent height but variable width. Each card should display an image, title, and description.
7. Develop a CSS-only tooltip that appears when hovering over an element, with customizable
8. styles and positioning. 8) Design a CSS drop-down menu with multiple levels of nested submenus, allowing users to navigate through the menu hierarchy.

***NB**: Presentation and assignment copy submission at the end of the course completion*