SARDAR PATEL UNIVERSITY, BALAGHAT

School of Computer Application
Syllabus (under NEP with Option 2)

Course: Master of Computer Applications (MCA)   Semester: II

Branch: Computer Science and Application   w.e.f. Academic Session: 2025-26

Subject: Data Structure and Algorithm (MCA201)

Course Objectives
- To introduce fundamental data structures and their operations.
- To develop basic algorithmic thinking and problem-solving skills.
- To understand how data is organized and processed in computer programs.
- To implement simple algorithms using a programming language.
- To explore basic tree and graph structures used in computing.

Course Outcomes
After completing this course, students will be able to:
- Understand and use basic data structures like arrays, stacks, queues, trees, and graphs.
- Write simple algorithms for searching, sorting, and traversal.
- Analyze the efficiency of basic algorithms using Big-O notation.
- Apply recursion to solve simple problems.
- Use data structures to solve real-world problems in programming.

UNIT-I: Introduction to Data Structures and Algorithms
What is a data structure? Types of data structures: linear and non-linear. Introduction to algorithms. Basic algorithm analysis: time and space complexity. Introduction to Big-O notation.
Focus: Building foundational understanding of how data is stored and processed.

UNIT-II: Arrays, Strings, and Linked Lists
Arrays: definition, operations (insertion, deletion, traversal). Strings and basic string operations. Introduction to linked lists: singly and doubly linked lists. Basic operations on linked lists.
Focus: Handling sequential and dynamic data.

UNIT-III: Stacks and Queues
Stack (LIFO): operations and applications (e.g., expression evaluation). Queue (FIFO): simple and circular queues. Implementation using arrays and linked lists. Real-life applications of stacks and queues.
Focus: Structured data flow and memory usage.

UNIT-IV: Trees and Graphs
Introduction to trees: binary trees, tree terminology. Tree traversal: inorder, preorder, postorder. Introduction to graphs: types and representations (adjacency matrix/list). Basic graph traversal: BFS and DFS.
Focus: Understanding hierarchical and networked data structures.

UNIT-V: Searching, Sorting, and Recursion
Searching: linear and binary search. Sorting: bubble, selection, insertion. Introduction to recursion. Simple recursive problems (factorial, Fibonacci).
Focus: Efficient data access and recursive logic.

Text Books

1. **Data Structures Using C** by Reema Thareja.
   Oxford University Press, Beginner-friendly with clear examples and diagrams.
2. **Fundamentals of Data Structures in C** by Ellis Horowitz and Sartaj Sahni.
   Universities Press, Covers basic concepts with practical implementations.

Reference Books

1. **Data Structures and Algorithms Made Easy** by Narasimha Karumanchi.
   CareerMonk Publications, Simple language and problem-solving approach.
2. **Let Us C** by Yashavant Kanetkar.
   BPB Publications, Useful for understanding C programming used in data structures.
3. **Schaum's Outline of Data Structures with C++** by John R. Hubbard
   McGraw-Hill Education, Great for practice problems and revision.

Subject: Artificial Intelligence (MCA202)

Course Objectives

- To introduce the fundamental concepts and techniques of Artificial Intelligence.
- To understand intelligent agents, search strategies, and knowledge representation.
- To explore problem-solving, reasoning, and learning methods.
- To apply AI techniques in real-world domains such as natural language processing and robotics.
- To develop basic AI applications using suitable programming tools.

Course Outcomes

Upon successful completion, students will be able to:

- Explain the principles and history of AI and its applications.
- Design intelligent agents and apply search algorithms to solve problems.
- Represent knowledge using logic and inference techniques.
- Implement basic machine learning algorithms and reasoning models.
- Apply AI concepts to domains like NLP, expert systems, and robotics.

UNIT-I: Introduction to Artificial Intelligence

Definition and history of AI. Applications of AI in various fields. Intelligent agents and environments. Types of agents: simple reflex, goal-based, utility-based. PEAS representation.

Focus: Understanding what AI is and how it interacts with the world.

UNIT-II: Problem Solving and Search Techniques

Problem formulation. Uninformed search: BFS, DFS, depth-limited, iterative deepening. Informed search: Greedy, A*, heuristic functions. Constraint satisfaction problems. Game playing: Minimax and Alpha-Beta pruning.

Focus: Learning how AI solves problems through search and decision-making.

UNIT-III: Knowledge Representation and Reasoning

Propositional and predicate logic. Inference rules and resolution. Forward and backward chaining. Semantic networks and frames. Ontologies and knowledge-based systems.

Focus: Representing and reasoning about knowledge in intelligent systems.

UNIT-IV: Machine Learning and Expert Systems

Introduction to machine learning. Supervised and unsupervised learning. Decision trees, k-NN, Naive Bayes. Basics of neural networks. Expert systems: architecture and applications.

Focus: Exploring how machines learn and make expert-level decisions.

UNIT-V: Advanced Topics and Applications

Natural Language Processing (NLP): syntax, semantics, parsing. **Robotics:** perception, planning, and control. AI in vision and speech recognition. Ethical issues in AI. Introduction to AI programming tools (e.g., Python, TensorFlow).

Focus: Applying AI in real-world domains and understanding its impact.

Text Books

1. **Artificial Intelligence: A Modern Approach** by Stuart Russell and Peter Norvig.
   Publisher: Pearson Education, Widely regarded as the definitive AI textbook.
2. **Artificial Intelligence** by Kevin Knight and Elaine Rich.
   Publisher: McGraw-Hill Education, Covers foundational concepts with clarity.

Reference Books

1. **Introduction to Artificial Intelligence** by Wolfgang Ertel.
   Publisher: Springer, Beginner-friendly with practical examples.
2. **Artificial Intelligence** by Dan W. Patterson.
   Publisher: Pearson Education, Focuses on expert systems and knowledge representation.
3. **Python Machine Learning** by Sebastian Raschka and Vahid Mirjalili.
   Publisher: Packt Publishing, Great for hands-on implementation of AI algorithms.

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Subject: Advance Programming in C++ (MCA203P)

Course Objectives
- To introduce the principles of object-oriented programming (OOP).
- To teach C++ syntax and structure for implementing OOP concepts.
- To develop skills in designing and building modular programs.
- To explore advanced OOP features like inheritance and polymorphism.
- To apply file handling and exception management in C++ applications.

Course Outcomes
By the end of this course, students will be able to:
- CO1: Understand and apply object-oriented concepts such as classes, objects, and encapsulation.
- CO2: Implement inheritance and polymorphism in C++ programs.
- CO3: Use constructors, destructors, and operator overloading effectively.
- CO4: Handle files and exceptions in C++.
- CO5: Design and develop modular, reusable, and maintainable C++ applications.

UNIT-I: Introduction to Object-Oriented Programming and C++
Basics of C++ syntax and structure. Difference between procedural and object-oriented programming. Concepts of OOP: class, object, abstraction, encapsulation. Writing simple C++ programs using classes and objects. Access specifiers: public, private, protected.

UNIT-II: Constructors, Destructors, and Operator Overloading
Constructors: default, parameterized, copy. Destructor and its role in memory cleanup. Constructor overloading. Operator overloading: unary and binary operators. Friend functions and friend classes.

UNIT-III: Inheritance and Polymorphism
Types of inheritance: single, multiple, multilevel, hierarchical, hybrid. Base and derived classes. Function overriding. Virtual functions and runtime polymorphism. Abstract classes and interfaces.

UNIT-IV: File Handling and Exception Management
File streams: ifstream, ofstream, fstream. Opening, reading, writing, and closing files. Working with text and binary files. Exception handling using try, catch, throw. Creating and using custom exception classes.

UNIT-V: Advanced OOP Concepts and Applications
Static members and functions. Templates: function and class templates. Introduction to Standard Template Library (STL). Case study: building a simple object-oriented application. Best practices in object-oriented design.

Text Book

- E. Balagurusamy, Object-Oriented Programming with C++, McGraw Hill Education.

Reference Books

- Bjarne Stroustrup, The C++ Programming Language, 4th Edition, Addison-Wesley.
- Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo, C++ Primer, 5th Edition, Addison-Wesley.
- Robert Lafore, Object-Oriented Programming in C++, Sams Publishing.

Practical List

Classes and Objects

1. Program to create a class with data members and member functions.
2. Program to demonstrate constructor and destructor.
3. Program to implement constructor overloading.
4. Program to show use of static data members and static member functions.
5. Program to demonstrate friend function accessing private members.

Inheritance and Polymorphism

6. Program to implement single inheritance.
7. Program to implement multiple inheritance.
8. Program to implement multilevel inheritance.
9. Program to demonstrate function overriding.
10. Program to implement runtime polymorphism using virtual functions.

Operator Overloading

11. Program to overload unary operator (++).
12. Program to overload binary operator (+) for complex numbers.
13. Program to overload relational operator (==) for comparing objects.

File Handling and Exception Handling

14. Program to read and write text files using ifstream and ofstream.
15. Program to read and write binary files.
16. Program to demonstrate try-catch block for exception handling.
17. Program to create and use custom exception class.

Templates and Advanced Concepts

18. Program to implement function template for swapping values.
19. Program to implement class template for a simple stack.
20. Program to demonstrate use of STL vector and basic operations.

SARDAR PATEL UNIVERSITY, BALAGHAT

School of Computer Application
Syllabus (under NEP with Option 2)

Course: Master of Computer Applications (MCA)   **Semester: II**

Branch: Computer Science and Application   **w.e.f. Academic Session: 2025-26**

Subject: Web Technology MCA204P)

Course Objectives

- To introduce the fundamentals of web development and the structure of web applications.
- To teach HTML for creating structured web content.
- To apply CSS for styling and layout of web pages.
- To develop interactive web pages using JavaScript.
- To build responsive and user-friendly web interfaces.

Course Outcomes

After completing this course, students will be able to:

- CO1: Design and structure web pages using HTML.
- CO2: Style and layout web pages using CSS.
- CO3: Add interactivity and dynamic behavior using JavaScript.
- CO4: Develop responsive and accessible web applications.
- CO5: Integrate HTML, CSS, and JavaScript to build complete front-end web projects.

UNIT-I: Introduction to Web Development & HTML

Basics of the Internet and Web. Web browsers and servers. Introduction to HTML5. HTML tags: headings, paragraphs, lists, tables, forms. Semantic elements: <header>, <footer>, <article>, <section>. Embedding images, audio, video, and links.

UNIT-II: Cascading Style Sheets (CSS)

Introduction to CSS: inline, internal, external. Selectors, properties, and values. Box model: margin, border, padding, content. Positioning and layout: static, relative, absolute, fixed. Flexbox and Grid layout. Responsive design with media queries.

UNIT-III: JavaScript Basics

Introduction to JavaScript and its role in web development. Variables, data types, and operators. Control structures: if-else, switch, loops. Functions and scope. Arrays and objects. DOM (Document Object Model) manipulation.

UNIT-IV: Advanced JavaScript and Events

Event handling: onclick, onmouseover, onsubmit, etc,. Form validation using JavaScript. Timers: setTimeout and setInterval. Introduction to ES6 features: let/const, arrow functions, template literals. JSON basics and parsing.

UNIT-V: Web Page Integration and Mini Project

Integrating HTML, CSS, and JavaScript. Creating interactive forms and UI components. Introduction to developer tools and debugging. Best practices in web design and accessibility. Mini project: Build a responsive, interactive website.

Text Book

- Achyut Godbole and Atul Kahate, *Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET*, McGraw Hill Education.

Reference Books

- Jon Duckett, *HTML and CSS: Design and Build Websites*, Wiley.
- Jon Duckett, *JavaScript and JQuery: Interactive Front-End Web Development*, Wiley.
- Thomas A. Powell, *HTML & CSS: The Complete Reference*, McGraw Hill.
- David Flanagan, *JavaScript: The Definitive Guide*, O'Reilly Media.

Practical List

HTML

1. Create a personal profile page using HTML.
2. Design a registration form with input fields and labels.
3. Create a table to display student marks.
4. Embed an image gallery using HTML.
5. Create a webpage using semantic HTML5 tags.

CSS

6. Style a webpage using internal and external CSS.
7. Create a navigation bar using CSS.
8. Design a responsive layout using Flexbox.
9. Apply CSS Grid to create a photo gallery.
10. Use media queries to make a page mobile-friendly.

JavaScript Basics

11. Write a program to display an alert message on button click.
12. Create a calculator using JavaScript.
13. Validate a registration form (e.g., email, password).
14. Change the background color of a page dynamically.
15. Display current date and time on a webpage.

JavaScript DOM & Events

16. Create a to-do list with add/remove functionality.
17. Build an image slider using JavaScript.
18. Implement a countdown timer.
19. Create a dynamic table with add/delete row options.
20. Develop a mini project: Responsive portfolio or product showcase website.

Course: Master of Computer Applications (MCA)   Semester: II

Branch: Computer Science and Application   w.e.f. Academic Session: 2025-26

Subject: Environmental Studies (MCA205)

Course Objectives
- To create awareness about environmental issues and the importance of sustainable development.
- To understand the structure and function of ecosystems and biodiversity.
- To explore natural resources and their conservation.
- To examine environmental pollution, its impact, and control measures.
- To understand environmental policies, laws, and the role of individuals in environmental protection.

Course Outcomes
After completing this course, students will be able to:
- CO1: Explain the structure and function of ecosystems and the importance of biodiversity.
- CO2: Identify various natural resources and suggest sustainable practices for their use.
- CO3: Analyze causes and effects of environmental pollution and propose control measures.
- CO4: Understand environmental legislation and policies for environmental protection.
- CO5: Demonstrate awareness of environmental ethics and sustainable development practices.

UNIT-I: Introduction to Environmental Studies and Natural Resources
- Definition, scope, and importance of environmental studies
- Components of the environment: atmosphere, hydrosphere, lithosphere, biosphere
- Renewable and non-renewable resources
    - Forest resources: uses, overexploitation, deforestation
    - Water resources: use and conflicts, floods, droughts
    - Mineral and energy resources: types, uses, and conservation
- Role of individuals in conservation of natural resources

UNIT-II: Ecosystems and Biodiversity
- Concept of an ecosystem: structure and function
- Energy flow in ecosystems, food chains, food webs, and ecological pyramids
- Types of ecosystems: forest, grassland, desert, aquatic (ponds, lakes, oceans)
- Biodiversity: definition, levels (genetic, species, ecosystem)
- Biodiversity hotspots, threats to biodiversity, conservation methods (in-situ and ex-situ)

UNIT-III: Environmental Pollution
- Types of pollution: air, water, soil, noise, thermal, radioactive
- Causes, effects, and control measures of each type
- Solid waste management: causes, effects, and control
- Role of individuals in pollution prevention
- Case studies on pollution disasters (e.g., Bhopal gas tragedy, Minamata disease)

UNIT-IV: Social Issues and the Environment
- Sustainable development: concept and practices
- Urban problems related to energy and water conservation
- Climate change, global warming, ozone layer depletion, acid rain
- Environmental ethics: issues and possible solutions
- Environmental movements: Chipko, Narmada Bachao Andolan
- Disaster management: floods, earthquakes, cyclones, landslides

UNIT-V: Environmental Legislation and Human Population
- Environmental Protection Act, Air and Water Acts, Wildlife Protection Act, Forest Conservation Act
- Role of central and state pollution control boards
- Population growth and its impact on the environment
- Human health and environment: sanitation, hygiene, and diseases
- Role of information technology in environmental management

Text Book
- Erach Bharucha, *Textbook of Environmental Studies for Undergraduate Courses*, University Grants Commission (UGC), Orient BlackSwan.

Reference Books
- Anubha Kaushik and C.P. Kaushik, *Perspectives in Environmental Studies*, New Age International Publishers.
- Rajagopalan, *Environmental Studies: From Crisis to Cure*, Oxford University Press.
- Benny Joseph, *Environmental Studies*, Tata McGraw Hill Education.
- Cunningham, W.P. and Cunningham, M.A., *Principles of Environmental Science: Inquiry and Applications*, Tata McGraw Hill.

SARDAR PATEL UNIVERSITY, BALAGHAT
School of Computer Application
Syllabus (under NEP with Option 2)
Course: Master of Computer Applications (MCA)   Semester: II
Branch: Computer Science and Application   w.e.f. Academic Session: 2025-26

Subject: Fundamentals of Soft Skills (MCA206)

Course Objectives
- To introduce the concept and importance of soft skills in personal and professional life.
- To develop effective communication, presentation, and interpersonal skills.
- To enhance emotional intelligence, teamwork, and leadership abilities.
- To prepare students for interviews, group discussions, and workplace etiquette.
- To build confidence, adaptability, and a positive attitude for career growth.

Course Outcomes
After completing this course, students will be able to:
- CO1: Demonstrate effective verbal and non-verbal communication skills.
- CO2: Apply interpersonal and teamwork skills in academic and professional settings.
- CO3: Exhibit emotional intelligence and leadership qualities.
- CO4: Prepare and present themselves confidently in interviews and group discussions.
- CO5: Practice professional etiquette and adapt to diverse work environments.

UNIT-I: Introduction to Soft Skills and Communication
- Definition and importance of soft skills
- Difference between hard skills and soft skills
- Verbal communication: clarity, tone, fluency
- Non-verbal communication: body language, gestures, eye contact
- Listening skills and barriers to effective communication

UNIT-II: Presentation and Public Speaking Skills
- Elements of effective presentations
- Planning and structuring a presentation
- Use of visual aids and storytelling
- Public speaking: overcoming stage fear, voice modulation
- Practice sessions: delivering short speeches and presentations

UNIT-III: Interpersonal Skills and Emotional Intelligence
- Building rapport and empathy
- Conflict resolution and negotiation
- Emotional intelligence: self-awareness, self-regulation, motivation
- Managing stress and maintaining a positive attitude
- Case studies and role plays

UNIT-IV: Teamwork and Leadership
- Importance of teamwork in organizations
- Roles and responsibilities in a team
- Leadership styles and qualities
- Decision-making and problem-solving
- Group activities and team-building exercises

UNIT-V: Professional Skills and Career Readiness

- Resume writing and cover letters
- Interview skills: preparation, common questions, mock interviews
- Group discussion techniques
- Workplace etiquette: email writing, meeting behavior, time management
- Adaptability and lifelong learning

Text Book

- K. Alex, *Soft Skills: Know Yourself and Know the World*, S. Chand Publishing.

Reference Books

- Barun K. Mitra, *Personality Development and Soft Skills*, Oxford University Press.
- Goleman, Daniel, *Emotional Intelligence*, Bantam Books.
- Wallace and Masters, *Personal Development for Life and Work*, Cengage Learning.
- Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, Oxford University Press.