Sant Gadge Baba Amravati University, Amravati
FACULTY: Science and Technology

Teaching and Learning Scheme: for the Degree of Bachelor of Computer Application (BCA) with the Major: Data Science

(Three Years- Six Semesters Bachelor's Degree Programme)
(Four Years- Eight Semesters Bachelor's Degree Programme (Honors)
(Four Years- Eight Semesters Bachelor's Degree Programme (Honors with Research)

Preamble

The new curriculum of the four-year undergraduate program under NEP, for Computer Application aims to develop the core competence in computing and problem solving amongst its graduates. Informally, "Learning to learn" has been the motto of the department since its inception. The curriculum thus focuses on building theoretical foundations in Computer Science to enable its pupils to think critically when challenged with totally different and new problems. It imbibes the following **Student-Centric** features of NEP2020:

Flexibility to Exit:

In order to support early exits, the curriculum aims to develop employability skills early. This has been done so that the outcomes of the 4 yr degree is not compromised as we believe that all but a few students will go for the full 4-year degree. As programming is at the heart of computing it is proposed to have two programming courses early so that the students can develop good programming skills in the first year. At the same time students are familiarized with the hardware of computers early on.

Employability:

Industry demand in the IT sector has changed considerably in the past few years. With the humongous amount of data coming from all the domains like medical data, social networking data, astronomical data, education, etc., automating information extraction and analysis of data is the only way forward to leverage the available data for the future. The curriculum aims to equip the students with tools and techniques of Artificial Intelligence, Machine Learning and a pathway on Data Science if the student so desires. Having said this, there is no replacement for the foundational courses like programming, data structures and algorithms. With two courses on programming and three courses on data structures and algorithms together, a strong foundation will be laid down for problem solving.

Research:

With the option to obtain specialization in an area of their choice, the curriculum prepares the students to take up research projects in their final year.

Program Outcomes:

Knowledge outcomes: After completing BCA Program students will be able to:

PO1: To develop problem solving abilities using a computer.;

PO2: To prepare necessary knowledge base for research and development in Computer Science.

Skill outcomes: After completing BCA Program students will be able to:

PO3: To build the necessary skill set and analytical abilities for developing computer-based solutions.

PO4: To train students in professional skills related to Software Industry.

Generic outcomes: Students will

PO5: Augment the recent developments in the field of IT and relevant fields of Research and Development.

PO6: Enhance the scientific temper among the students so that to develop a research culture and Implementation the policies to tackle the burning issues at global and local level.

Program Specific Outcomes

PSO1: Students get knowledge and training of technical subjects so that they will be technical professional by learning C programming, Relational Database Management, Data Structure, Software Engineering,

Graphics, Java, PHP, Networking, Theoretical Computer Science, System programming, Object Oriented Software Engineering.

PSO2: Students understand the concepts of software application and projects.

PSO3: Students understand the computer subjects with demonstration of all programming and theoretical concepts with the use of ICT.

PSO4: Development of in-house applications in terms of projects

PSO5: Students will build up programming, analytical and logical thinking abilities.

PS06: Aware them to publish their work in reputed journals

PS07: To make them employable according to current demand of IT Industry and responsible citizen.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	101202/ 102202	**Programming with C++**	2	30	2 Hrs	30

Course Objectives:	1.To provide students with understanding of code organization and functional hierarchical decomposition with using data types. 2. Programming is about writing the instructions which a computer follows to enable it to store knowledge, process knowledge, and communicate knowledge with the outside world.
Course Outcomes:	On competition of the following syllabus the students will be able to - 1. Understand the Programming concepts. 2. Understand Object Oriented Programming. 3. Write Algorithms for the task/problem. 4. Able to design flowcharts of the problem. 5. Able to write Simple C++ Programs.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	Software Evolution, Programming Paradigm Evolution - Imperative Programming, Declarative Programming, OOP Paradigm: Basic Concepts, Features, Advantages, Applications of OOP, Structured Vs OOP, Trending OOP Languages.	8 Hrs	8 Marks	The students have a problem understanding the concept of arrays, dealing with the syntax of the language, designing the organization of the program and understanding the concept of flow control such as looping and branching or function calls. 1. To help solve this problem we have divided the various concepts and used different examples in day to day life. 2. The Necessity Of Teaching Reform: The final goal of programming teaching is making the students mastering the ability of coding and debugging. 3. Chalk and Board method. 4. Power point presentation with
Unit II	**OOP Concepts**: Data Abstraction and Encapsulation: Classes and Objects Introduction, Defining a Class, Function Prototype, Inline Function, Default Argument, Function Overloading, Constructors, Types of Constructors: Default, Parameterized and Copy Constructor, Access Specifiers, Memory Allocation for Objects, Objects as Function Arguments, Returning Objects From Functions.	7 Hrs	7 Marks	
Unit III	**Inheritance:** Definition, Types of Inheritance: Single, Multiple, Hierarchical, Multilevel, Hybrid, Visibility Modes, Constructor and Destructor, Calling Sequence, Type Casting, Upcasting and Downcasting.	8 Hrs	8 Marks	
Unit IV	**Polymorphism:** Compile Time, Run Time, Virtual Base Classes, Virtual Functions, Pure Virtual Functions,	7 Hrs	7 Marks	

	Early Binding and Late Binding. Function Overriding, Operator Overloading, Overloading Unary and Binary Operator, Rules for Overloading.			animation. 5. Use of online software to explain the coding and debugging.
References:	**Text books:** 1. Object oriented programming with C++: E.Balagurusamy 2. The C++ programming language: Bjarne Stroustrup **Reference Books:** 1. The Object-Oriented Thought Process, 5th Edition by Matt Weisfeld 2. An Introduction to Object-Oriented Programming: Timothy Budd 3. Programming principles and Practice using C++: Bjarne Stroustrup **Weblink to Equivalent MOOC on SWAYAM if relevant:** 1. https://onlinecourses.nptel.ac.in/noc20_cs59/preview 2. https://onlinecourses.nptel.ac.in/noc19_cs48/preview 3. https://www.classcentral.com/course/swayam-programming-in-c-6704 **Weblink to Equivalent Virtual Lab if relevant:** • https://www.programiz.com/c-programming/online-compiler/ • https://www.onlinegdb.com/online_c_compiler • https://www.tutorialspoint.com/compile_c_online.php			

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	101203/ 102203	**Laboratory on Programming with C++**	2	60	4Hrs	50

Course Objectives:	1. Understand the concept of C++ programming 2. Know the importance of Looping Statement. 3. To implement decision making structure 4. To develop proficiency in Objects
Course Outcomes:	On competition of the following syllabus the students will be able to - 1. To design simple C Program. 2. To design program for implementing looping structure. 3. Ability to use function. 4. Skill in structuring code with function.

Contents	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
1. Write a program in C++ to demonstrate Class and Object. 2. Write a program in C++ to demonstrate constructor and destructor. 3. Write a program in C++ to demonstrate Inline function. 4. Write a program in C++ to demonstrate the use of friend function. 5. Write a program in C++ for default argument. 6. Write a program in C++ for unary operator overloading. 7. Write a program in C++ for Binary operator overloading. 8. Write a program in C++ for function overloading. 9. Write a program in C++ for virtual base class. 10. Write a program in C++ to implement single Inheritance. 11. Write a program in C++ to implement multiple Inheritance. 12. Write a program in C++ to implement multilevel Inheritance. 13. Write a program in C++ to implement hybrid Inheritance. 14. Write a program in C++ to implement hierarchical Inheritance. 15. Write a program in C++ for constructor overloading. 16. Write a program in C++ to implement parametrized constructor 17. Write a program in C++ to implement copy constructor 18. Write a program in C++ to implement abstract base classes 19. Write a program in C++ to implement ‘this’ pointer 20. Write a program in C++ for implement array of object			

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	101402/ 102402	**Data Structure**	2	30	2 Hrs	30

Course Objectives:	1.To provide students with understanding of code organization and functional hierarchical decomposition with using data types. 2. Programming is about writing the instructions which a computer follows to enable it to store knowledge, process knowledge, and communicate knowledge with the outside world.
Course Outcomes:	On competition of the following syllabus the students will be able to - 1. Describe how arrays, linked structures, stacks, queues, and trees are represented in memory and design and implementation with the help of algorithms. 2. Design common applications for arrays, linked structures, stacks, queues and trees. 3. Preparing programs that use arrays, linked structures, stacks, queues, trees. 4. Demonstrate different methods for traversing trees. 5. Compare alternative implementations of data structures with respect to performance. 6. Describe the concept of recursion, give examples of its use, describe how it can be implemented using a stack. 7. Analyzing the computational efficiency of the principal algorithms for sorting and searching.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Introduction of Data structure:** Introduction, Definition, Types of data Structure, Data Structure Operations, Algorithms: Algorithmic notations, Control Structures, Complexity, time-space tradeoffs. **Arrays:** Introduction, Representation of linear array in memory, Multidimensional Arrays, operations on linear array: Traversing, Insert, Delete	8 Hrs	8 Marks	The students have a problem understanding the concept of arrays, dealing with the syntax of the language, designing the organization of the program and understanding the concept of flow control such as looping and branching or function calls. 1. To help solve this problem we have divided the various concepts and used different examples in day to day life. 2. The Necessity Of Teaching Reform: The final goal of programming teaching is making the students mastering the ability of coding and debugging.
Unit II	**Stack:** Introduction of stack, Representation of Stack: Using arrays and Linked Lists, Operations on stack: push, pop, Stack applications, Infix to Postfix conversion of expression, Expression evaluation, Recursion. **Queues:** Introduction, Insert and Delete operations, Queue implementation using array, Types – Priority Queue, Circular queue, Dequeue, Queue applications**.**	7 Hrs	7 Marks	
Unit III	**Linked list:** Introduction, Memory representation of linked list, free storage list, operations on linked list: traversing, searching, insertion and deletion, Header linked list, Two-Way	8 Hrs	8 Marks	

	list, Stacks and Queues as Linked Lists.			3. Chalk and Board method. 4. Power point presentation with animation. 5. Use of online software to explain the coding and debugging.
Unit IV	**Trees:** Introduction and Tree terminologies, Types of Binary tree, Representation of Trees: Using arrays and Linked Lists, Types of Traversal: Preorder, Inorder, Postorder, Applications of Binary trees, Binary Search Tree (BST): Introduction and definition, Expression tree.	7 Hrs	7 Marks	
References:	**Text books:** 1) Data Structures by Seymour Lipschutz. Schaum's Series 2) Data Structure by Trembley and Sorenson. 3) Data Structure by Horowitz & Sahani. **Reference Books:** 1) Fundamentals of Computer Algorithm : Horowitz & Sahani 2) Data structures and Algorithms in C++ : B.R. Weiss Pearsons. 3) Introduction to Data Structure in C: Kamthane (Pearson) 4) Introduction to Data Structure : Bhagat Singh, Naps **Weblink to Equivalent MOOC on SWAYAM if relevant:** • https://onlinecourses.swayam2.ac.in/cec19_cs04/preview • https://nptel.ac.in/courses/106102064 • https://www.classcentral.com/course/swayam-data-structures-13983 • https://www.classcentral.com/course/swayam-data-structure-using-c-programming-204238 • https://www.coursera.org/learn/data-structures **Weblink to Equivalent Virtual Lab if relevant:** • https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html • https://cse01-iiith.vlabs.ac.in/ • https://www.cemca.org/ckfinder/userfiles/files/Virtual%20Labs%20for%20Data%20Structures%20An%20Algodynamics%20Approach.pdf • https://www.cemca.org/virtual-labs-data-structures **Any pertinent media (recorded lectures, YouTube, etc.) if relevant:** • https://www.youtube.com/watch?v=Db9ZYbJONHc&list=PLVlQHNRLflP_OxF1QJoGBwH_TnZszHR_j • https://www.youtube.com/watch?v=8hly31xKli0 • https://www.youtube.com/watch?v=AT14lCXuMKI&list=PLdo5W4Nhv31bbKJzrsKfMpo_grxuLl8LU • https://www.youtube.com/watch?v=xLetJpcjHS0&list=PLBlnK6fEyqRj9lld8sWIUNwlKfdUoPd1Y • https://www.youtube.com/watch?v=fPDQVUIxCas			

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	101403/ 102403	**Laboratory on Data Structure using C++**	2	60	4Hrs	50

Course Objectives:	1. Understand the concept of Data Structure using C++ programming 2. Know the importance of Data Structure. 3. To implement various Data Structure practically using C++ programming 4. To develop proficiency in Data Structure
Course Outcomes:	On competition of the following syllabus the students will be able to - 1. Be able to design and analyze the time and space efficiency of the data structure. 2. Be capable to identity the appropriate data structure for given problem. 3. Have practical knowledge on the applications of data structures 4. Ability to implement linear and non-linear data structure operations using C programs 5. Ability to solve problems implementing appropriate data structures 6. Ability to implement sorting and searching algorithms using relevant data structures

Contents	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
1. Design Program to find sum of N number 2. Design Program to find factorial of N 3. Design Program to find greatest amongst three given number 4. Implementation of traversing technique in array 5. Implementation of insertion technique in array 6. Implementation of deletion technique in array 7. Implementation of PUSH and POP operations on stack. 8. Implementation of insertion and deletion technique in queue 9. Implementation of List data structure using i) array ii) singly linked list. 10. Implementation of recursive technique for finding factorial of an integer. 11. Implement stack using i) array ii) singly linked list 12. Implement Queue using i) array ii) singly linked list 13. Implementation of data insertion in Binary Search trees. 14. Implementation of data deletion in Binary Search trees. 15. Implementation of search in Binary Search trees. 16. Implementation of Linear search 17. Implementation of Binary Search using arrays.			

Weblink to Equivalent Virtual Lab if relevant:

- https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://cse01-iiith.vlabs.ac.in/
- https://www.cemca.org/ckfinder/userfiles/files/Virtual%20Labs%20for%20Data%20Structures%20An%20Algodynamics%20Approach.pdf

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	101601/ 102601	**Laboratory on E-Commerce**	2	60	4Hrs	50

Course Objectives:	1. To provide students with understanding of E-Commerce. 2. Importance of E-Commerce in the current business. 3. How to process E-Commerce and communicate knowledge with the outside world.			
Course Outcomes:	On competition of the following syllabus the students will be able to 1. Understand the complexity of e-Commerce and its many facts. 2. Explore how e-business and e-commerce fit together. 3. Apply the Knowledge to perform E-Commerce transactions. 4. Identify the impact of e-commerce. 5. Recognize the benefits and limitations of e-commerce			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
	List of Practical: 1. Visit E-Commerce Website 2. B2B e commerce. Give an example for this. 3. Define B2C e commerce. Give an example for this. 4. Define C2B e commerce. Give an example for this. 5. Define C2C e commerce. Give an example for this. 6. Give any 2 applications of e commerce. 7. Perform digital marketing, Edit Basket of purchase. 8. Visit the e-Commerce site register yourself as client. 9. Visit the e-Commerce site register yourself as client and change the address of client. 10. Illustrate the B2B, B2C with example.			1. Demonstration of execution of purchasing goods. 2. On line Visit to websites. 3. Demonstration of how to register and use e-Commerce website.
References:	**Weblink to Equivalent MOOC on SWAYAM if relevant:** • https://www.bigcommerce.com/articles/ecommerce/best-ecommerce-website-design/ • https://www.coursera.org/learn/ecommerce-academy • https://www.coursera.org/learn/foundations-of-digital-marketing-and-e-commerce.			

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	101602/ 102602	**Laboratory on Web Publishing**	2	60	4Hrs	50

Course Objectives:	1. Understand the concept of Webpage/site 2. Know the importance of web publishing. 3. Explain the functions of web publishing. 4. Define the scope and benefits and limitations of web publishing.
Course Outcomes:	On competition of the following syllabus the students will be able to - 1. To design simple web page. 2. To design web page with login id. 3. To create web page/site. 4. To publish the website.

Contents		**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
	List of Practical: 1. Create a web page of your name using various heading tags. 2. Design a web page according to the format given below using heading tag with your name displayed on the top. Creating a web-page using <p> tag 3. Design a web page describing yourself using single and multiline comments. Also use tag. 4. Create a html file for displaying a webpage with below mentioned tags. a. Bold b. Italics c. Underline d. Alignment e. Paragraph 5. Create a html file for displaying a webpage with below mentioned tags: a. Text color b. Headings c. HR d. Background color e. Line break 6. Design a web page of your CV with headings as objective, educational qualification, achievements, strengths, hobbies and personal details. a. Insert a horizontal line after every above-mentioned heading			1. Demonstration of execution of tags. 2. On line Visit to websites. 3. Demonstration of how to register and publish the web site.

	b. Set any light color as page background. c. Bold and underline every heading 4. Use heading tag to specify the heading d. Use pre tag for Educational Qualification. 7. Create a html page which shows the following list apply the following parts: a. Put horizontal line after newspaper and magazine. b. Apply heading tag for newspaper and magazine. c. Apply a background color 8. Create a webpage to show the use of lists with type. 9. Design a web page to display the names of Beverages, Dishes and Desserts using unordered lists: 10. Design a web page to display the different courses available in your institute. Show the use of different types of ordered lists.			
	Weblink to Equivalent MOOC on SWAYAM if relevant: • **http://tinyurl.com/mtjx8pnw** • https://www.youtube.com/watch?v=qiR-7fL-I2A • http://tinyurl.com/y84uddwa			