# Savitribai Phule Pune University, Pune

## Faculty of Commerce and Management

### Bachelor of Business Administration in Computer Application

**(BBA-CA)**

**Revised Curriculum (2024Pattern as per NEP-2020)**

**w. e. f. Academic Year: 2025-2026**

| Semester III | | | | | |
|---|---|---|---|---|---|
| **Course Type** | **Course** | **Paper Title** | **Hours / Week** | **Credits** | |
| | | | | **Theory** | **Practical** |
| Major Mandatory (08) | Major Mandatory 7 | Data Structure | 4 | 4 | |
| | Major Mandatory 8 | PHP | 4 | 4 | |
| Minor | Minor 2 (Practical) | Computer Laboratory based on DS, PHP | 8 | | 4 |
| Open Elective(OE) | Open Elective 5 | Introduction to Cyber Security | 2 | 2 | |
| Vocational Skill Development Course (VSC) | Vocational Skill Development Course (VSC) (Practical) | Web development tools | 4 | | 2 |
| Ability Enhancement Course (AEC) | Ability Enhancement Course (AEC) | Modern Indian Languages 1: Marathi/Hindi/Sanskrit | 2 | 2 | |
| Field Projects(FP) | Project | Project based on Web Applications | 4 | | 2 |
| Co-Curricular Courses (CC) | Co-Curricular Courses (CC) | NSS/NCC/Yoga Education/Health and Wellness/Fine Arts-I | @ Dept | 2 | |
| | | **Sub Total** | - | **14** | **8** |
| | | **Total** | | **22** | |

| Semester III | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/Week** |
| III | | Major Mandatory | Data Structure | 4 | 4 |

| **Course Objectives** | |
|---|---|
| **1** | To introduce the fundamental concepts and classifications of data structures. |
| **2** | To develop an understanding of linear and non-linear data structures such as arrays, linked lists, stacks, queues, trees, and graphs. |
| **3** | To enable students to analyze the time and space complexity of algorithms using asymptotic notations. |
| **4** | To develop the ability to implement various sorting and searching algorithms. |
| **5** | To apply data structure concepts to solve real-world problems through structured programming. |

| **Course Outcomes**<br>**On successful completion of the course, the student will be able to:** | |
|---|---|
| **1** | Explain and differentiate between various data structures and their real-life applications. |
| **2** | Analyze and evaluate the efficiency of different algorithms using Big O and other notations. |
| **3** | Implement linear data structures like arrays, stacks, and queues using static and dynamic memory allocation. |
| **4** | Design and implement linked lists and perform various operations on them. |
| **5** | Apply tree and graph structures for problem-solving and implement traversal and search algorithms. |

| **Unit** | **Title and Contents** | **No. of Lecture Hours** |
|---|---|---|
| **1** | **<u>Introduction to Data Structures</u>**<br>1.1 Array, types of array and its representation<br>1.2 Self referential structure<br>1.3 Pointer and dynamic memory allocation<br>1.4 Data types, Data Objects and Abstract Data Type(ADT)<br>1.5 Data structure and types of data structure<br>1.6 Algorithm Analysis: Space complexity, time complexity, Asymptotic Notations(Big O, Omega Ω) | **06** |

| | | |
|---|---|---|
| **2** | **<u>Linear Data Structure</u>**<br>2.1 Introduction to Linear Data Structure<br>Definition, Characteristics, Types of Linear Data Structure<br>2.2 Sorting algorithms with time complexity<br>Bubble sort, Insertion sort, Merge sort, Quick Sort, Selection Sort<br>2.3 Searching techniques<br>Linear Search, Binary search | **10** |
| **3** | **<u>Linked List</u>**<br>3.1 Introduction to Linked List<br>- Definition, Advantages and Disadvantages<br>3.2 Implementation of Linked List<br>- Static and Dynamic Representation,<br>- Node Structure<br>3.3 Types of Linked List<br>3.3.1 Singly Linked list<br>Operations - Create, Printing, Insertion(Begin, Middle, End),<br>Deleting(Begin, Middle, End), Reverse, Searching<br>3.3.2 Doubly Linked list<br>Operations - Create, Printing, Insertion(Begin, Middle, End),<br>Deleting(Begin, Middle, End)<br>3.3.3 Circularly Singly Linked list<br>Operations - Create, Printing<br>3.3.4 Circularly Doubly Linked list<br>Operations - Create, Printing | **12** |
| **4** | Stack and Queue<br>4.1 Introduction<br>- Concept and characteristics (LIFO)<br>Real-world examples: browser history, undo operations<br>4.2 Stack Implementations<br>- Static representation using arrays<br>Dynamic representation using linked lists<br>4.3 Stack Operations<br>- Push, Pop, Peek, isEmpty, isFull<br>4.4 Applications of Stacks<br>4.5 Conversion of Infix, prefix, postfix , Evaluation of postfix and prefix<br>4.6 Introduction to Queue<br>- Advantages and Disadvantages of Queue<br>- Application Queue<br>4.7 Representation - Static & Dynamic<br>- Queue using LinkedList<br>4.8 Primitive Operations on Queue (Insert, Delete, Display)<br>4.9 Circular queue(insert, delete ,display) | **20** |

| | | |
|---|---|---|
| **5** | Tree and Graph<br>5.1 Tree Concept & Terminologies<br>5.2 Binary tree, Binary search tree<br>5.3 Operations on BT and BST – create, Insert, delete<br>5.4 Tree Traversals (preorder, inorder, postorder)<br>5.5 Height balanced tree- AVL trees- Rotations, AVL tree examples.<br>5.6 Introduction of Graph<br>5.7 Representation of Graph- Adjacency Matrix, Adjacency List<br>5.8 Graph Traversals- BFS and DFS<br>5.9 Degree of Graph<br>5.10 Spanning Tree | **12** |

**Reference Books**

| Sr. No. | Title of the Book | Author/s | Publication | Place |
|---|---|---|---|---|
| 1 | Data Structure Using 'C' | Shrivastava | BPB Publication | |
| **2** | Data Structure Using 'C' | Yashwant Kanetkar | BPB Publication | |
| **3** | Data Structures Using C | Horowitz, Sahani, and Freed | | |
| **4** | Data Structure Through C | G.S. Baluja | | |
| **5** | Fundamentals of Data Structures in C | Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed | University Press | |
| **6** | Data Structures Using C | Reema Thareja | Oxford University Press | |
| **7** | Data Structures: A Pseudocode Approach with C | Richard F. Gilberg, Behrouz A. Forouzan | Cengage Learning | |

Other Learning Material
E- Resource:
Website: **https://visualgo.net/en/sorting**

| Semester III | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/Week** |
| III | | Major Mandatory | PHP | 4 | 4 |

| **Course Objectives** | |
|---|---|
| **1** | Understand how server-side programming works on the web. |
| **2** | Using PHP built-in functions and creating custom functions |
| **3** | Understanding POST and GET in form submission. |
| **4** | How to receive and process form submission data. |
| **5** | Read and process data in a MySQL database. |

| **Course Outcome** | |
|---|---|
| **1** | Understand the basics of server-side scripting using PHP. |
| **2** | Develop dynamic web pages using PHP. |
| **3** | Work with PHP functions, arrays, and strings effectively. |
| **4** | Implement file handling and session management. |
| **5** | Connect and interact with databases using PHP and MySQL. |

| **Unit** | **Title and Contents** | **No. of Lecture Hours** |
|---|---|---|
| **1** | PHP Basics & Control structure and loops<br>1.1 Setting up a development environment<br>1.2 Variables, numbers and strings<br>1.3 Calculations with PHP<br>1.4 Conditional Statements<br>1.5 Loops for Repetitive tasks<br>1.6 Using Arrays<br>1.7 Combing Loops and Arrays | **15** |
| **2** | Functions, Objects and Errors<br>2.1 PHP's Built-in functions<br>2.2 Creating Custom functions<br>2.3 Passing Values by Reference<br>2.4 Understanding Objects<br>2.5 Differences between POST and GET<br>2.6 Preserving User Input<br>2.7 Working with Forms<br>2.8 Building a Form<br>2.9 Processing a Form's Data<br>2.10 Types of Errors ,Error reporting | **15** |

| | | |
|---|---|---|
| **3** | More with Forms<br>3.1 Dealing with checkboxes and radiobuttons<br>3.2 Retrieving values from lists<br>3.3 Validating and restricting data<br>3.4 Sending Email<br>3.5 Storing and Protecting Data<br>3.6 Setting and Reading Cookies<br>3.7 Protecting Online Files<br>3.8 Understanding Session Variables<br>3.9 Sticky Forms<br>3.10 Self processing | **15** |
| **4** | MySQL Database Overview<br>4.1 phpMyAdmin Overview<br>4.2 Using a MySQL Database<br>4.3 Executing queries from PHP<br>4.4 Prepared statements and parameter binding for security<br>4.5 Reading and writing data | **15** |

***Reference Material***
**Reference Books**

| Sr. No. | Title of the Book | Author/s | Publication | Place |
|---|---|---|---|---|
| 1 | Php: A Beginner's Guide | VikramVaswani | 1st EditionMcGraw-Hill Osborne Media; 1 edition | |
| **2** | Murach's PHP and MySQL (2nd Edition) | Joel Murach and Ray Harris | | |
| **3** | PHP: The Complete Reference Paperback – 1 Jul 2017 | Steven Holzner | McGraw Hill Education | |
| **4** | PHP AND MYSQL WEB DEVELOPMENT-5TH EDN | Luke Welling and Laura Thomson | Pearson Education-5th Edition | |
| **5** | Beginning PHP 5, Apache MYSQL , Web Development | Naramore Elizabeth | Wiley-dreamtech India Pvt. Ltd. | |

Other Learning Material
E- Resource:

1. https://www.w3school.ccom/php/
2. https://www.tutorialspoint.com/php/index.htm
3. e-PGPathshala
4. https://www.geeksforgeeks.org/php/php-tutorial/

| Semester No. | Course Code | Type of Course | Course Title | Credits | Hours/Week |
|---|---|---|---|---|---|
| III | | Minor | Computer Laboratory based on DS, PHP(Practical) | 4 | 8 |

**Lab Book:**

The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

**Assessment**

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices

## Data Structure Lab Course Contents

**Assignment 1 Arrays**

1. Dynamic Memory allocation
2. Pointer to structure

**Assignment 2 Sorting and Searching**

1. Implementation of Selection Sort, Insertion Sort, Quick Sort
2. Implementation of Linear Search
3. Implementation of Binary Search

**Assignment 3 Linked List**

1. Implementation of Singly Linked List (create ,display,Insert ,delete)
2. Implementation of Doubly Linked List (create , display, Insert ,delete )
3. Implementation of Circular Linked List(create,display)

**Assignment 4 Stack and Queues**

1. Implementation of Stack (LIFO),push, pop, display
2. Implementation of Dynamic Stack
3. Implementation of Queues(FIFO),insert,delete,display
4. Implementation of Dynamic Queue

**Assignment 5 Tree and Graphs**

1. Implementation of BT and BST – create, Insert, delete
2. Implementation of tree traversal, preorder, postorder, inorder
3. Implementation of adjacency matrix
4. Implementation graph traversal BFS and DFS

# PHP Lab Course Contents

**Assignment 1 : PHP Basics & Control structure and loops**

1.Programs on arithmetic calculation
2.Area Calculation
3.Total and percentage of marks
4. Programs on if, switch case , while and for loop
5. Operations on indexed array
6. Operations on associative array
7. String handling programs ,Counting Vowels,Occurrence of each vowel, palindrome
8. Using text box (string replacement) by making use of built in functions.
9. Using Form design, arithmetic calculations between two numbers.
10. Bill calculation program using explode function .
11.Program on string manipulation ( Compare string ,split string) .
12.Various array handling functions .
13 Sort , Merge ,filter elements from array .

**Assignment 2 :- Functions , Objects and errors**

1.Area, volume calculation using function
2.Swap two numbers, maximum out of three numbers using function
3.Form designing concept : Calculate bill
4.Program on string manipulation ( Compare string ,split string)
5.Various array handling functions Sort , Merge ,filter elements from array .
6. Concept of class and interface calculation of area and volume of cylinder.

**Assignment 3 :- More with forms**

1. Accept user name and password
2. Email validation
3. Program based on base class and derived class.
4. Write a PHP script to keep track of number of times the web page has been accessed.

**Assignment 4 :- MySQL Database review (Sample programs)**

1. Emp-Dept are related with one-many relationship. Create a RDB for the above and solve following Using above database.Write a PHP script which will print a salary statement for specified emp_no with his details.
2. Consider the following entities and their relationships Doctor (doc_no, doc_name, address, city, area) Hospital (hosp_no, hosp_name, hosp_city) Doctor and Hospital are related with many-many relationship. Create a RDB in 3 NF for the above and solve following Using above database, write a PHP script which accepts hospital name and print information about doctors visiting / working in that hospital in tabular format.
3. Executing queries from PHP.

| Semester III | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/Week** |
| III | | OE (Open Elective) | Introduction to Cyber Security | 2 | 2 |

**Note: This course is taken from OE basket of Faculty of Science and Technology – BoS in Computer Science. This course is mandatory for SYBBA-CA Semester III students**

| Course Objectives | |
|---|---|
| 1 | Understand basic concepts and terms in cyber security. |
| 2 | Learn about privacy and related legal protections. |
| 3 | Grasp fundamental encryption principles. |
| 4 | Understand basics of Cyber laws and Indian IT Act. |

| Course Outcome | |
|---|---|
| CO1 | Define and explain essential cybersecurity concepts, threats, and preventive strategies. |
| CO2 | Interpret privacy principles and identify relevant laws and regulations protecting digital data. |
| CO3 | Apply basic encryption methods to secure data and understand their role in cybersecurity. |
| CO4 | Good understanding of cyberlaws, cybercrime and punishments in Indian Scenario. |

| Unit | Title and Contents | No. of Lecture Hours |
|---|---|---|
| 1 | **Chapter 1: Introduction to Cyber Crime and Cyber Security**<br>1.1 Introduction<br>1.2 Cybercrime:Definition and significance of cybersecurity, Evolution and historical context of cybersecurity<br>1.3 Cybercrime and Information Security<br>1.4 Who are Cybercriminals?<br>1.5 Hackers and Types of Hackers<br>1.6 Types of Cybercrimes:<br>E-Mail Spoofing, Spamming, Cyber defamation, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web Jacking, Newsgroup, Spam/Crimes Emanating from Usenet Newsgroup, Industrial Spying/Industrial Espionage, Hacking, Online Frauds, Computer Sabotage, Email Bombing/Mail Bombs, Computer Network Intrusions, Password Sniffing, Credit Card Frauds, Identity Theft | 15 |

| | | |
|---|---|---|
| | 1.7 Vulnerability, Threats, and Harmful Acts<br>1.8 CIA Triad | |
| **2** | **Chapter 2:- Cybercrime Tools, Techniques and Cyber Laws**<br>2.1 Introduction<br>2.2 Proxy Servers and Anonymizers<br>2.3 Phishing<br>2.4 Password Cracking<br>2.5 Keyloggers and Spyware<br>2.6 Virus and Worms<br>2.7 Trojan Horses and Backdoors<br>2.8 Steganography<br>2.9 DoS and DDoS Attacks<br>2.10 SQL Injection<br>2.11 Introduction: Cyber Laws<br>2.12 Cybercrime and the Legal Landscape around the World<br>2.13 Why Do We Need Cyberlaws: The Indian Context<br>2.14 The Indian IT Act<br>2.14.1 Challenges to Indian Law and Cybercrime Scenario in India<br>2.14.2 Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act<br>2.15 Cybercrime and Punishment<br>2.16 Cyberlaw, Technology and Students: Indian Scenario | **15** |

***Reference Material***

**Reference Books**

| Sr. No. | Title of the Book | Author/s | Publication | Place |
|---|---|---|---|---|
| **1** | Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives | Nina Godbole, Sunit Belapure | Wiley | April 2011 India Publications Released. |
| **2** | Principles of Information Security. 3rd Edition, 2011. | Michael E Whitman, Herbert J Mattord | Cengage Learning | 20 Channel Center Street, Boston, MA 02210 USA |
| **3** | Computer Security: Principles and Practice, 3rd edition | William Stallings and Lawrie Brown | Pearson | Boston, Massachusetts, USA |
| **4** | Cyber Security Essentials | James Graham Richard Howard Ryan Olson | Auerbach Publications | United States of America |

Other Learning Material

E- Resource:

1) Swayam – Cyber Security Course (by NPTEL/IIT Madras) https://nptel.ac.in/courses/106106248
2) Swayam – Cyber laws https://onlinecourses.swayam2.ac.in/cec25_cs04/preview

| Semester III | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/Week** |
| **III** | | **VSC (Practical)** | **Web development tools** | **2** | **4** |

| **Course Objectives** | |
|---|---|
| 1 | To Understand the Fundamentals of WordPress |
| 2 | To Create and Manage Website Content through WordPress |
| 3 | To make students learn about how to set up and configure a WordPress Website |

| **Course Outcome**<br>At the end of the course, students will be able to | |
|---|---|
| 1 | Explain the purpose, features, and evolution of WordPress |
| 2 | Create, format, and manage content using posts, pages, categories, and tags in WordPress. |
| 3 | Publish and manage a responsive, user-friendly, and content-rich website suitable for business, blogging, or personal use |

| Unit | Title and Contents | No. of Lecture Hours |
|---|---|---|
| 1 | **Introduction to WordPress**<br>What is WordPress? Overview of WordPress and its features<br>Brief history and evolution of WordPress<br>Benefits of using WordPress for website development<br>**Setting up a WordPress Website**<br>Choosing a domain and hosting: Selecting a domain name and web hosting service<br>Installing WordPress<br>**WordPress Dashboard**<br>Introduction and Overview of the WordPress dashboard and its fe<br>Creating and editing posts in WordPress<br>Creating and editing pages in WordPress<br>**Themes and Customization**<br>Choosing a WordPress theme for a website<br>Customizing WordPress themes using the theme editor<br>Creating child themes in WordPress | 15 |
| 2 | **Content Management Through WordPress**<br>**Plugins and Extensions**<br>Introduction of WordPress plugins and their uses<br>Installing plugins in WordPress<br>Overview of popular WordPress plugins, such as | 15 |

| | | |
|---|---|---|
| | Yoast SEO and WooCommerce<br>**Content Creation and Management**<br>Creating high-quality content in WordPress<br>Optimizing content for search engines using keywords and meta tags<br>Managing content in WordPress, including Media Library and publishing posts<br>**Security and Maintenance**<br>Best practices for securing a WordPress website<br>Updating WordPress core, themes, and plugins<br>Backing up WordPress websites using plugins and manual methods | |

***Reference Material***

**Reference Books**

| Sr. No. | Title of the Book | Author/s | Publication | Place |
|---|---|---|---|---|
| 1 | Professional WordPress Design and Development | Hal Stern, David Damstra, and Brad Williams | Wiley Publishing, Inc | Canada |
| 2 | WordPress® ALL-IN-ONE FOR DUMmIES | Lisa Sabin-Wilson, Cory Miller, Kevin Palmer, Andrea Rennick, and Michael Torbert | Wiley Publishing, Inc | Hoboken |
| 3 | WordPress: The Missing Manual | Matthew MacDonald | O'Reilly | Sebastopol |
| 4 | Building Web Apps with WordPress | Brian Messenlehner, Jason Coleman | O'Reilly Media | Sebastopol, |
| 5 | WordPress Theme Development Beginner's Guide | Tessa Blakeley Silver | Packt Publishing | Birmingham |

Other Learning Material

E- Resource:

1. https://wordpress.com/
2. https://infyspringboard.onwingspan.com
3. https://www.wpbeginner.com/

| Semester III | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/ Week** |
| **3** | | **Ability Enhancement Course (AEC)** | **Modern Indian Languages 1 : Marathi/Hindi/Sanskrit** | **2** | **2** |

**The details syllabus of each of the languages will be shared by respective board of studies.**

| Semester III | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/Week** |
| III | | Field Projects (FP) | Project based on Web Applications | 2 | 4 |

| **Course Objectives** | |
|---|---|
| **1.** | Learn core web technologies and client-server basics. |
| **2.** | Build web applications using front-end Tools. |
| **3.** | Develop teamwork and problem-solving skills through real-world projects. |

| **Course Outcome** | |
|---|---|
| **CO1** | Develop responsive web pages using Web Applications. |
| **CO2** | Build web applications with front-end Validations. |
| **CO3** | Use of APIs for dynamic content handling. |
| **CO4** | Collaborate on and deploy real-world web projects. |

**Project Guidelines**

- The team should consist of a maximum of 2 students.
- Students can choose any project topic, with no restriction on technology or domain.
- Students must independently handle all stages: problem identification, research, design, implementation testing and reporting.
- Minimum 2 project presentations must be conducted by the guide to monitor progress.
- The final report should follow academic standards with clear sections: abstract, background, aim, design and implementation, testing, conclusion, references.
- Tables and figures must be numbered and referenced in the report.
- Final presentation and demonstration will be evaluated by the project guide and one external examiner appointed by the University.

**Formatting Specifications**

- **Paper Size**: A4
- **Font**: Times New Roman, 12 pt
- **Line Spacing**: Single
- **Margins**: 1 inch (top, bottom, left, right)
- Spiral Bounded Project Documentation

**Recommended Documentation Contents**

- **Title Page**: Include project title, team members, guide's name, institution and University Name.
- **Certificate**: Signed by the internal guide and Head of the Department/Co-ordinator.
- **Acknowledgements**: Recognize contributions from individuals and institutions.
- **Table of Contents**: List chapters with page numbers.

- **List of Figures and Tables**: If applicable.

**Chapters**

1. **Abstract**: A concise summary of the project.
2. **Introduction**:
    - Background of the Project
    - Problem Statement
    - Objectives and Goals
    - Scope and Limitations
3. **System Analysis**:
    - Existing Systems and their Limitations
    - Project Perspective and Features
    - Requirement Analysis (Functional, Performance, Security)
4. **System Design**:
    - Design Constraints
    - Flow Chart
    - User Interfaces (Design Screen)
5. **Implementation Details**:
    - Software and Hardware Specifications
    - Screenshots of Working System and Reports
6. **Testing**:
    - Input, Expected Output, Actual Output
    - Screens with Validations (Eg; Numeric, Character, Mail Id, etc;)
    - Error/ Success Message Window
7. **Conclusion and Recommendations**
8. **Future Scope**
9. **Bibliography and References**
10. **Abbreviations**

# Savitribai Phule Pune University, Pune

## Faculty of Commerce and Management

## Bachelor of Business Administration – Computer Application (BBA-CA)

### Revised Curriculum (2024 Pattern as per NEP-2020)

**w.e.f. Academic Year: 2025-2026**

| SYBBA - CA Semester IV | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Course Type | Course | Course Code | Paper Title | Credits | | Hours / Week | Marks | |
| | | | | Theory | Practical | | Int. | Ext. |
| Major Mandatory | Major Mandatory 9 | MJ-251-OOPC | Object Oriented Programming using C++ | 4 | - | 4 | 30 | 70 |
| | Major Mandatory 10 | MJ-252-PHP | Advance PHP | 4 | - | 4 | 30 | 70 |
| Minor | Minor (Practical) | MNP-251-LAB | Computer Laboratory based on CPP, Adv PHP | - | 4 | 4 | 30 | 70 |
| Open Elective (OE) | Open Elective 5 | | To be selected from the OE basket of Faculty of S&T, Faculty of Humanities and Faculty of Interdisciplinary Studies | 2 | - | 2 | 15 | 35 |
| Vocational Skill Development Course (VSC) | Vocational Skill Development Course (VSC) | VSC-251-CN | Computer Network | 2 | - | 2 | 15 | 35 |
| Ability Enhancement Course (AEC) | Ability Enhancement Course (AEC) | | Modern Indian Languages 2– Marathi/Hindi/Sanskrit | 2 | - | 2 | 15 | 35 |
| Community Engagement and Service | Project | CEP-251-SA | Community Engagement through Social Awareness | - | 2 | 4 | 50 | - |
| Co-Curricular Courses (CC) | Co-Curricular Courses (CC) | | NSS/NCC/Yoga Education/Health and Wellness/Fine Arts-I | 2 | - | 2 | 50 | - |
| | | | **Sub-Total** | **16** | **6** | | **235** | **315** |
| | | | **Total** | **22** | | | **550** | |

| Semester IV | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Lecture Hours/Week** |
| IV | MJ-251-OOPC | Major Mandatory | Object Oriented Programming using C++ | 04 | 04 |

| **Course Objectives** | |
|---|---|
| 1 | To acquire an understanding of basic object-oriented concepts and the issues involved in effective class design. |
| 2 | To enable students for writing programs using C++ features |
| 3 | To provide understanding of inheritance and polymorphism, virtual functions, pointers to objects, and dynamic binding. |
| 4 | Train students in file handling and templates, covering file operations, error handling, class/function templates, and exception handling in C++. |

| **Course Outcome:** After completing the course students will be able to | |
|---|---|
| 1 | Explain the fundamental concepts, features, and advantages of Object-Oriented Programming and describe the structure, features, and basic I/O operations of C++. |
| 2 | Write simple C++ programs using appropriate data types, variables, operators, manipulators, and functions |
| 3 | Apply different types of inheritance, operator overloading, function overloading, and runtime polymorphism to create flexible and extensible C++ programs. |
| 4 | create, open, read, write, and close files using C++ standard library functions and implement function templates to create reusable, type-independent code. |

| **Unit** | **Title and Contents** | **No. of Lecture Hours** |
|---|---|---|
| **1** | **Introduction to C++**<br>1.1 Basic concepts, features, advantages and applications of OOP<br>1.2 Introduction, applications and features of C++<br>1.3 Input and Output operator in C++<br>1.4 Simple C++ program<br>1.5 Data type and Keywords<br>1.6 Declaration of variables, dynamic initialization of variables, reference variable<br>1.7 Operators:<br>1.7.1 Scope resolution operator<br>1.7.2 Memory management operators<br>1.8 Manipulators | 12 |

| | | |
|---|---|---|
| | 1.9 Functions:<br>1.9.1 Function prototyping, call by reference and return by reference<br>1.9.2 Inline functions<br>1.10 Default arguments | |
| **2** | **Classes and Objects**<br>2.1 Structure and class, Class, Object<br>2.2 Access specifiers, defining data member<br>2.3 Defining member functions inside and outside class definition.<br>2.4 Simple C++ program using class<br>2.5 Memory allocation for objects<br>2.6 Static data members and static member functions<br>2.7 Array of objects, objects as a function argument<br>2.8 Friend function and Friend class<br>2.9 Constructors and Destructors<br>2.9.1 Constructors<br>2.9.2 Types of constructor: Default, Parameterized, Copy<br>2.9.3 Multiple constructors in a class<br>2.9.4 Constructors with default argument<br>2.9.5 Dynamic initialization of constructor<br>2.9.6 Destructor | **16** |

| | | |
|---|---|---|
| **3** | **Inheritance, Polymorphism & Console Input-Output Handling in C++**<br>**3.1 Introduction to inheritance**<br>3.1.1.Defining Base class and Derived class<br>3.1.2 Types of Inheritance<br>3.1.3 Virtual Base Class<br>3.1.4 Abstract class<br>3..1.5 Constructors in derived class<br>**3.2 Polymorphism**<br>3.2.1 Compile Time Polymorphism<br>3.2.2 Introduction, rules for overloading operators<br>3.2.3 Function overloading<br>3.2.4. Operator Overloading unary and binary<br>3.2.5 Operator Overloading using friend function<br>3.2.6 Overloading insertion and extraction operators<br>3.2.7. String manipulation using operator overloading<br>3.2.8 Runtime Polymorphism<br>3.2.9 this Pointer, pointers to objects, pointer to derived | **20** |

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|---|---|---|
| | classes<br>3.2.10 Virtual functions and pure virtual functions | |

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| **4** | **Working with Files & Templates**<br>4.1 Stream Classes for File operations<br>4.2 File operations - Opening, Closing and updating<br>4.3 File updating with random access.<br>4.4 Error handling during File operations<br>4.5 T Introduction to Template<br>4.6 Class Template and class template with multiple parameters<br>4.7 Function Template and function template with multiple parameter<br>4.8 Exception Handling Introduction | **12** |

***Reference Material***

**Reference Books**

| Sr.No | Title of the Book | Author/s | Publication |
|---|---|---|---|
| 1 | Object Oriented programming with C++ | E Balagurusamy | McGraw-Hill Education |
| **2** | Object Oriented Programming with C++ | Robert Lafore | Galgotia Publications |
| **3** | The Complete Reference C++ | Herbert Schildt | Tata-McGraw Hill |
| **4** | Programming in C++ | Ashok Kamthane | Pearson Education |
| **5** | C++ for Beginners | Herbert Schildt (Simplified Edition) | Tata-McGraw Hill |

**Other Learning Material E- Resource:**

1. YouTube Playlists - Code With Harry – C++ Full Course
2. Neso Academy – C++ OOP Tutorials
   https://www.youtube.com/playlist?list=PLLy_2iUCG87CQHHuz4x2ZR4U9WmG3P-l0
3. Apna College – C++ Placement Course (Beginner Friendly)
   https://www.youtube.com/watch?v=tv0JZlvfI-0
4. Jenny's Lectures – File Handling & OOP Concepts
   https://www.youtube.com/watch?v=s3d0-9c8e5c
5. e-PGPathshala

| Semester IV | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Lecture Hours/Week** |
| **IV** | **MJ-252-PHP** | **Theory** | **Advance PHP** | **4** | **4** |

| **Course Objectives** | |
|---|---|
| **1** | To know & understand concepts of internet programming**.** |
| **2** | Understand namespaces, traits, generators, late static binding, and advanced OOP concepts. |
| **3** | Work with MVC architecture, routing systems, templating engines, and modern PHP frameworks (e.g., Laravel). |

| **Course Outcome:** After completing the course students will be able to | |
|---|---|
| **1** | Apply advanced PHP language features—including namespaces, traits, exceptions, and OOP principles—to build modular and reusable applications. |
| **2** | Develop secure, database-driven web applications using PDO, prepared statements, transactions, and ORM tools. |
| **3** | Use MVC architecture and modern PHP frameworks (e.g., Laravel ) to create scalable and maintainable projects. |

| **Unit** | **Title and Contents** | **No.of Lecture Hours** |
|---|---|---|
| **1** | **Introduction to Object Oriented Programming in PHP**<br>1.1 Classes<br>1.2 Objects<br>1.3 Introspection<br>1.4 Serialization<br>1.5 Inheritance<br>1.6 Interfaces<br>1.7 Encapsulation<br>1.8 Web Techniques<br>1.8.1 Server information<br>1.8.2 Processing forms<br>1.8.3 Sticky forms | **20** |

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|---|---|---|
| **2** | **XML & Ajax with PHP**<br>2.1 Introduction XML<br>2.2 XML document Structure<br>2.3 PHP and XML<br>2.4 XML parser<br>2.5 The document object model<br>2.6 The simple XML extension<br>2.7 Changing a value with simple XML<br>2.8 Ajax with PHP<br>2.8.1 Understanding java scripts for AJAX<br>2.8.2 AJAX web application model<br>2.8.3 AJAX –PHP framework<br>2.8.4 Performing AJAX validation<br>2.8.5 Handling XML data using php and AJAX | **20** |

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|---|---|---|
| **3** | **Introduction to Web Services**<br>3.1 Definition of web services<br>3.2 Basic operational model of web services, tools and technologies enabling web services<br>3.3 Benefits and challenges of using web services.<br>3.4 Web services Architecture and its characteristics<br>3.5 Core building blocks of web services | **10** |

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|---|---|---|
| **4** | **PHP Framework**<br>4.1 Introduction to Laravel ?<br>4.2 Advantages of Laravel<br>4.3 features of Laravel<br>4.3 Introduction of MVC Pattern<br>4.4 Installation of Laravel<br>4.5 Laravel PHP Framework Sample program | **10** |

***Reference Material***

**Reference Books**

| Sr. No. | Title of the Book | Author/s | Publication |
|---|---|---|---|
| 1 | Php: A Beginner's Guide 1st Edition | McGraw-Hill Osborn | |
| **2** | PHP: The Complete Reference Paperback | Steven Holzner | |
| **3** | Murach's PHP and MySQL (2nd Edition) | Joel Murach and Ray Harris | |

| Semester IV | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/ Week** |
| **IV** | **MNP-251-LAB** | **Minor** | **Computer Laboratory based on CPP, Adv. PHP** | **4** | 8 |

**Detail Lab book will be shared soon.**

| Semester IV | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Lecture Hours/Week** |
| IV | VSC-251-CN | VSC | Computer Network | 2 | 2 |

| **Course Objectives** | |
|---|---|
| **1** | To gain knowledge about Computer Networks concepts. |
| **2** | To know about working of networking models, addresses and connectivity devices. |
| **3** | To acquire information about network security and cryptography. |

| **Course Outcomes: On successful completion of the course, the student will be able to:** | |
|---|---|
| **1** | Student will have knowledge of networking devices, types of addresses |
| **2** | Student will understand types of network and its uses |
| **3** | Student will gain knowledge on cryptography and its types and understand security mechanism |

| **Unit** | **Title and Contents** | **No of Lecture (Hours)** |
|---|---|---|
| **1** | Introduction to Computer Network<br>1.1 Basics of Computer Network<br>1.1.1 Definition<br>1.1.2 Goals<br>1.1.3 Applications,<br>1.1.4 Network Hardware –Broadcast, Point to Point<br>1.1.5 Components of Data Communication<br>1.2 Network Topologies<br>1.2.1Mesh<br>1.2.2 Star,<br>1.2.3 Bus,<br>1.2.4 Ring<br>1.3 Types of Networks<br>1.3.1 LAN,MAN,WAN,<br>1.3.2 Internetwork,<br>1.3.3 Wireless Network<br>1.4 Modes of Communication | **15** |

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|---|---|---|
| | 1.4.1 Simplex,<br>1.4.2 Half Duplex,<br>1.4.3 Full Duplex<br>1.5. Server Based LANs & Peer-to-Peer LANs<br>1.6. Protocols and Standards<br>1.7. Network Software<br>1.7.1 Protocol Hierarchies, Layers, Peers, Interfaces<br>1.7.2 Design Issues of the Layers<br>1.7.3 Connection Oriented and Connectionless Service<br>1.8 Network Connectivity Devices<br>1.8.1 Active and Passive Hubs<br>1.8.2 Repeaters<br>1.8.3 Bridges- Types of Bridges<br>1.8.4 Switches<br>1.8.5 Router<br>1.8.6 Gateways | |
| **2** | Network Models<br>2.1 OSI Reference Model : Functions of each Layer<br>2.2 TCP/IP Reference Model, Comparison of OSI and TCP/IP<br>2.3 TCP/IP Protocol Suite<br>2.4 Addressing<br>2.4.1 Physical Addresses<br>2.4.2 Logical Addresses<br>2.4.3 Port Addresses,<br>2.4.4 Specific Addresses<br>2.5 IP Addressing<br>2.5.1 Classfull Addressing<br>2.5.2 Classless Addressing<br>2.6 Introduction to Network<br>2.6.1 Security Need for Security,<br>2.6.2 Security Services Message- -Confidentiality, Integrity, Authentication, Non repudiation<br>2.6.3 Types of Attack<br>2.6.4 Cryptography, Plain Text, Cipher Text, Encryption, Decryption<br>2.6.5 Symmetric Key and Asymmetric Key Cryptography | **15** |

***Reference Material***

**Reference Books**

| Sr. No. | Title of the Book | Author/s | Publication | Place |
|---|---|---|---|---|
| 1 | Computer Networks | Andrew Tanenbaum | Pearson Education.[4th Edition] | |
| 2 | Data Communication and Networking | Behrouz Forouzan | TATA McGraw Hill. .[4th Edition] | |
| 3 | Computer Networking: A Top-Down Approach | James F. Kurose & Keith W. Ross | 7th Edition, Pearson. | |
| 4 | Data and Computer Communications | William Stallings | 10th Edition, Pearson. | |

**Other Learning Material E- Resource:**

1. https://www.tutorialspoint.com/computer_networking
2. https://www.geeksforgeeks.org/computer-network-tutorials/

| Semester IV | | | | | |
|---|---|---|---|---|---|
| **Semester No.** | **Course Code** | **Type of Course** | **Course Title** | **Credits** | **Hours/ Week** |
| **IV** | **CEP-251-CA** | **Community Engagement Program** | **Community Engagement Program through Social Awareness** | **2** | 4 |

**This will be of 60 Hrs. Duration and to be conducted on field in collaboration with any NGO. Detail guidelines will be shared soon.**