



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY | COURSE NAME     | TEACHING & EVALUATION SCHEME |                         |               |                      |                         |                      | L | T | P | CREDITS |
|-------------|----------|-----------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |          |                 | Marks                        | THEORY                  |               |                      | PRACTICAL               |                      |   |   |   |         |
|             |          |                 |                              | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BCCA204     | Major -3 | Data Structures | Max                          | 60                      | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |
|             |          |                 | Min                          | 24                      | 16            |                      |                         |                      |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### COURSE OBJECTIVES:

The student will have ability to:

1. To understand the students with the applications of Standard data structure in real world problems.
2. To provide knowledge of creation of new data structures.
3. To familiarize the students with the analysis and design a particular problem.

### COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

### COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Demonstrate familiarity with major algorithms and data structures.
- CO2** Analyse performance of algorithms.
- CO3** Choose the appropriate data structure and algorithm design method for a specified application..
- CO4** Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs.
- CO5** Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

### TEACHING PEDAGOGY:

- T1** Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2** ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

### ASSESSMENT TOOLS:

- ATL1** Quiz
- ATL2** Activity Based Learning

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY | COURSE NAME     | TEACHING & EVALUATION SCHEME |                         |               |                      |                         |                      | L | T | P | CREDITS |
|-------------|----------|-----------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |          |                 | Marks                        | THEORY                  |               |                      | PRACTICAL               |                      |   |   |   |         |
|             |          |                 |                              | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BCCA204     | Major -3 | Data Structures | Max                          | 60                      | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |
|             |          |                 | Min                          | 24                      | 16            |                      |                         |                      |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

|      |                            |
|------|----------------------------|
| ATL3 | Midterm Exams              |
| ATL4 | Flip Class                 |
| ATL5 | Seminar Presentation       |
| ATL6 | Assignments                |
| ATL7 | Poster                     |
| ATL8 | Oral Viva-voce examination |

### PREREQUISITES:

Basic Computer Knowledge

### SYLLABUS:

| Module | Descriptors/Topics                                                                                                                                                                                                                                                                                                                                                                                        | Hours | Assessment Tools |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------|
| I      | The Concept of Data Structure, Abstract Data Type, Concept of List and Array, Introduction to Stack, Stack as an Abstract Data Type, Primitive Operations on Stack, Stack's Applications - polish notations Infix, Postfix, Prefix and Recursion. Introduction to Queues, Primitive operations on Queues, Queue as an Abstract Data Type, Circular Queue, Dequeue, Priority Queue, Applications of Queue. | 9     | ATL3<br>ATL6     |
| II     | Linked List - Introduction to Linked List, Memory Representations of Linked List, comparison; Operations on Linked List, Linked Representation of Stack and Queue, Header Nodes. Types of Linked List : Doubly Linked List, Circular Linked List, Application of Linked List, Self Referential Structures.                                                                                                | 9     | ATL3<br>ATL6     |
| III    | Trees: Definition, Basic Terminology of Trees, Tree Representations as Array and Linked. Binary Trees, Binary Tree Operations. Traversal of Binary Trees – In order, Preorder & Post order, Complete Binary Tree, almost complete binary tree; Application of Binary Tree.                                                                                                                                | 9     | ATL3<br>ATL6     |
| IV     | Complexity: concept and notations. Searching: Sequential, Binary and their comparison. Sorting - External and Internal Sorting, Insertion Sort, Selection                                                                                                                                                                                                                                                 | 9     | ATL3             |

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY | COURSE NAME     | TEACHING & EVALUATION SCHEME |                         |               |                      |                         |                      | L | T | P | CREDITS |
|-------------|----------|-----------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |          |                 | Marks                        | THEORY                  |               |                      | PRACTICAL               |                      |   |   |   |         |
|             |          |                 |                              | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BCCA204     | Major -3 | Data Structures | Max                          | 60                      | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |
|             |          |                 | Min                          | 24                      | 16            |                      |                         |                      |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

|             |                                                                                                                                                                                                         |    |              |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------|
|             | Sort, Quick Sort, Bubble Sort, Heap Sort, Comparison of Sorting Methods. Hashing;                                                                                                                       |    | ATL6         |
| V           | Graphs - Introduction to Graphs, Basic Terminology, Directed, Undirected and Weighted graph, Representation of Graphs, Graph Traversals - Depth First and Breadth First Search. Applications of Graphs. | 9  | ATL3<br>ATL6 |
| Total Hours |                                                                                                                                                                                                         | 45 |              |

### SUGGESTED READINGS:

#### Textbooks

1. Kruse R.L. Data Structures and Program Design in C; PHI
2. Aho, "Data Structure & Algorithms".
3. Trembly and SORRENSON, "Introduction to Data Structure with Applications".
4. Tennenbaum A.M. & others, "Data Structures using C & C++"; PHI
5. Horowitz & Sawhney, "Fundamentals of Data Structures", Galgotia Publishers.

#### Suggested e- resources (Websites/e- books)

1. Yashwant Kanetkar, "Understanding Pointers in C", BPB.
2. Lpschuists, "Data Structure", (Schaum 's Outline Series, McGraw Hill publication)
3. Ellis Horowitz and Sartaj Sawhney, "Fundamentals of Computer Algorithm"

#### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY | COURSE NAME     | TEACHING & EVALUATION SCHEME |                         |               |                      |                         |                      | L | T | P | CREDITS |
|-------------|----------|-----------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |          |                 | Marks                        | THEORY                  |               |                      | PRACTICAL               |                      |   |   |   |         |
|             |          |                 |                              | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BCCA204     | Major -3 | Data Structures | Max                          | 60                      | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |
|             |          |                 | Min                          | 24                      | 16            |                      |                         |                      |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course Outcomes | Correlation with POs |      |      |      |      |      |      |      |      |       |       |       | Correlation with PSOs |       |       |
|-----------------|----------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|
|                 | PO 1                 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 |
| CO1             | 3                    | 2    | 2    | 1    |      |      |      |      |      |       | 1     |       |                       |       |       |
| CO2             | 3                    | 2    | 3    | 2    |      |      |      |      |      |       | 1     |       |                       |       |       |
| CO3             | 3                    | 2    | 3    | 2    |      |      | 1    |      |      |       | 1     | -     |                       |       |       |
| CO4             | 3                    | 2    | 2    | 1    |      |      |      |      |      |       | 1     | -     |                       |       |       |
| CO5             | 3                    | 2    | 3    | 2    |      |      |      |      |      |       | 1     | -     |                       |       |       |

#### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY | COURSE NAME                         | TEACHING & EVALUATION SCHEME |                         |               |                      |                         |                      | L | T | P | CREDITS |
|-------------|----------|-------------------------------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |          |                                     | Marks                        | THEORY                  |               |                      | PRACTICAL               |                      |   |   |   |         |
|             |          |                                     |                              | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BCCA205     | Major -2 | Object oriented Methodology and C++ | Max                          | 60                      | 20            | 20                   | 0                       | 0                    | 3 | 1 | 0 | 4       |
|             |          |                                     | Min                          | 24                      | 16            |                      |                         |                      |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### COURSE OBJECTIVES:

The student will have ability to:

1. To familiarize the students with programming and to encourage them to develop their logic.
2. To make students well versed with C++ language to solve problems efficiently.
3. Using simple and well-drawn illustrations develop their programming skills using modular programming.

### COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

### COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1 Develop algorithms for problems.
- CO2 To understand the object oriented paradigm.
- CO3 Apply the programming concepts to solve the given problems.
- CO4 Write the programs using modular programming.
- CO5 Understand and write programs using various data structures very efficiently.

### TEACHING PEDAGOGY:

- T1 Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
- T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

### ASSESSMENT TOOLS:

- ATL1 Quiz
- ATL2 Activity Based Learning
- ATL3 Midterm Exams
- ATL4 Flip Class

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY    | COURSE NAME                            | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|-------------|----------------------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |             |                                        | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |             |                                        |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA205     | Major<br>-2 | Object oriented<br>Methodology and C++ | Max                          | 60                            | 20               | 20                      | 0                             | 0                       | 3 | 1 | 0 | 4       |
|             |             |                                        | Min                          | 24                            | 16               |                         |                               |                         |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

|      |                            |
|------|----------------------------|
| ATL5 | Seminar Presentation       |
| ATL6 | Assignments                |
| ATL7 | Poster                     |
| ATL8 | Oral Viva-voce examination |

### PREREQUISITES:

Basic Computer Knowledge

### SYLLABUS:

| Module | Descriptors/Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Hours | Assessment Tools |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------|
| I      | <b>Object Oriented Paradigm:</b> Need, Features, comparison with other programming paradigm, various programming styles; Basic concepts: C++ basics, C++ character set, C++ Tokens (Identifiers, Keywords, Constants), operators, precedence and associativity, expressions, type conversion and type casting, Structure of a C++ Program (include files, main function), cout, cin, loops and decisions. Use of I/O Operators (<< and >>), Cascading of I/O Operators, Inline Functions, Reference Variables, Call by Reference, Function Overloading. | 9     | ATL3<br>ATL6     |
| II     | Concept of a class, Data Members and Member Functions, visibility modes, scope resolution operator (::); Objects: accessing members through object, object and classes, object arrays, passing objects as function arguments, Friend Function; Constructor and Destructor functions: Default Constructor, Overloaded Constructors, Copy Constructor, Constructor with default arguments, Dynamic Constructors.                                                                                                                                          | 9     | ATL3<br>ATL6     |
| III    | Operator overloading; Inheritance: Concepts of Base Class and Derived Class; Private, Public and Protected derivation of classes, accessibility of base class members by objects of derived class, access mechanism in classes, ambiguity resolution in inheritance, virtual base classes, constructors in                                                                                                                                                                                                                                              | 9     | ATL3<br>ATL6     |

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY    | COURSE NAME                            | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|-------------|----------------------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |             |                                        | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |             |                                        |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA205     | Major<br>-2 | Object oriented<br>Methodology and C++ | Max                          | 60                            | 20               | 20                      | 0                             | 0                       | 3 | 1 | 0 | 4       |
|             |             |                                        | Min                          | 24                            | 16               |                         |                               |                         |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

|    |                                                                                                                                                                                                                                                                                                                                                                                     |           |              |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|
|    | derived classes, member/nested classes.                                                                                                                                                                                                                                                                                                                                             |           |              |
| IV | <b>Pointers:</b> Declaration and Initialization of Pointers; Dynamic memory allocation, new, delete operators; Pointers and Arrays: Array of Pointers, Pointer to an Array, Pointer to Objects, Array of Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Early and Late Binding, Runtime Polymorphism, Pure Virtual Functions, Abstract Classes. | 9         | ATL3<br>ATL6 |
| V  | C++ I/O system, Use of defined manipulators, formatted I/O, creating inserters and extractors, file I/O basics, Data File Handling: creating disk files and file manipulations using seekg(), seekp(), tellg() and tellp() functions, ifstream, ofstream, file stream classes; Exception Handling: Try, Catch and Throw                                                             | 9         | ATL3<br>ATL6 |
|    | <b>Total Hours</b>                                                                                                                                                                                                                                                                                                                                                                  | <b>45</b> |              |

### SUGGESTED READINGS:

#### Textbooks

1. Robert Lafore, "Object-Oriented Programming in C++", 4e, SAMS.
2. Ricahrd C. Lee, William M. Tepfenhart "UML & C++: A Practical Guide To Object Oriented Development", 2e, Pearson.
3. Herbert Schildt, "C++ the complete reference", 4e, 2003.

#### Suggested e- resources (Websites/e- books)

1. E Balagurusamy, "Object Oriented Programming with C++", 6e, McGraw Hill Education.
2. G.Booch, "Object Oriented Analysis And Design With Applications", 3e, Pearson.
3. K.R. Venugopal, RajkumarBuyya, "Mastering C++", 2e, McGraw Hill Education.

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY    | COURSE NAME                            | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|-------------|----------------------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |             |                                        | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |             |                                        |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA205     | Major<br>-2 | Object oriented<br>Methodology and C++ | Max                          | 60                            | 20               | 20                      | 0                             | 0                       | 3 | 1 | 0 | 4       |
|             |             |                                        | Min                          | 24                            | 16               |                         |                               |                         |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course Outcomes | Correlation with POs |      |      |      |      |      |      |      |      |       |       |       | Correlation with PSOs |       |       |
|-----------------|----------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|
|                 | PO 1                 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1                 | PSO 2 | PSO 3 |
| CO1             | 3                    | 2    | 3    | 2    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |
| CO2             | 3                    | 3    | 2    | 3    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |
| CO3             | 3                    | 3    | 3    | 2    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |
| CO4             | 2                    | 3    | 2    | 3    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |
| CO5             | 3                    | 3    | 3    | 2    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |

#### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY               | COURSE NAME            | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|------------------------|------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |                        |                        | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |                        |                        |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA206     | Practical<br>(Major-2) | Programming Lab in C++ | Max                          | 0                             | 0                | 0                       | 30                            | 20                      | 0 | 0 | 4 | 2       |
|             |                        |                        | Min                          |                               |                  |                         | 13.5                          | 9                       |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### COURSE OBJECTIVES:

The student will have ability to:

1. To familiarize the students with programming and to encourage them to develop their logic.
2. To make students well versed with C++ language to solve problems efficiently.
3. Using simple and well-drawn illustrations develop their programming skills using modular programming.

### COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

### COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Develop algorithms for problems.
- CO2** To understand the object oriented paradigm.
- CO3** Apply the programming concepts to solve the given problems.
- CO4** Write the programs using modular programming.
- CO5** Understand and write programs using various data structures very efficiently.

#### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY               | COURSE NAME            | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|------------------------|------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |                        |                        | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |                        |                        |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA206     | Practical<br>(Major-2) | Programming Lab in C++ | Max                          | 0                             | 0                | 0                       | 30                            | 20                      | 0 | 0 | 4 | 2       |
|             |                        |                        | Min                          |                               |                  |                         | 13.5                          | 9                       |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### LIST OF PRACTICAL

|    | Title                                                                                                                                                                                                                                               | CO Mapping |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1. | Define a friend function. Explain the relation of friend function with respect to Public, Private and Protected data members of the class.                                                                                                          | CO4        |
| 2. | Write a C++ program that uses a function to check whether a given number is divisible by another number or not. Give proper comments whether the denominator number is a prime number or not.                                                       | CO4        |
| 3. | Write a program in C++ a. To generate the number pyramid                                                                                                                                                                                            | CO4        |
| 4. | Create two function max and min to find the largest and smallest numbers respectively                                                                                                                                                               | CO4        |
| 5. | Write a function in C++ that take one string argument and return a reversed string.                                                                                                                                                                 | CO4        |
| 6. | Write a C++ program using structure to store information of 10 employee (id_no, empname, empadd, sal) and display information of an employee depending upon the employee no given.                                                                  | CO4        |
| 7. | Create a class contains name & telephone number as two of it's fields. Write a C++ Program                                                                                                                                                          | CO4        |
| 8. | Using an object to do the following.<br>(a) to add a record (b) to search of telephone number for a given name. (c) to determine the name of telephone number is known .(d) Updating the data file, whenever there is a change in telephone number. | CO4        |
| 9. | Member function: (1)to assign initial values (2) to increment only people total in case ticket is not sold out. (3) to increment people total as well as amount total in case ticket is not sold out (4) to display the two totals (5) to           | CO5        |

#### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY               | COURSE NAME            | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|------------------------|------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |                        |                        | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |                        |                        |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA206     | Practical<br>(Major-2) | Programming Lab in C++ | Max                          | 0                             | 0                | 0                       | 30                            | 20                      | 0 | 0 | 4 | 2       |
|             |                        |                        | Min                          |                               |                  |                         | 13.5                          | 9                       |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

|     |                                                                                                                                                                                                                                                                                                                                                              |     |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|     | display the number of tickets sold out.                                                                                                                                                                                                                                                                                                                      |     |
| 10. | Create a class Bank account of 20 customers with the following data members depositor no, (a) initialize the data member (b) deposit money (c) Display the customer information (d) withdraw money after checking the balance (min bal for saving account is 500 and for current 1000) (e) search the depositor details according to name or number or both. | CO5 |
| 11. | Write a program to interchange the private values of two classes by using a friend function swap().                                                                                                                                                                                                                                                          | CO5 |
| 12. | Write C++ code to create a class date. Using this class, calculate the age of a person as on the current date.                                                                                                                                                                                                                                               | CO5 |
| 13. | Define a class string use overloaded == operator to compare two string.                                                                                                                                                                                                                                                                                      | CO5 |
| 14. | Find the largest value of two objects using > operator.                                                                                                                                                                                                                                                                                                      | CO5 |
| 15. | Write a C++ program to print the number between 1 to 100 and 100 to 1 using operator overloading.                                                                                                                                                                                                                                                            | CO5 |

### COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course Outcome s | Correlation with POs |      |      |      |      |      |      |      |      |       |       |       | Correlation with PSOs |       |       |
|------------------|----------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-----------------------|-------|-------|
|                  | PO 1                 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1                 | PSO 2 | PSO 3 |
| CO1              | 3                    | 2    | 3    | 2    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |
| CO2              | 3                    | 3    | 2    | 3    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |
| CO3              | 3                    | 3    | 3    | 2    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |
| CO4              | 2                    | 3    | 2    | 3    | -    | -    | -    | -    | -    | -     | 1     | -     |                       |       |       |

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY            | COURSE NAME            | TEACHING & EVALUATION SCHEME |                         |               |                      |                         |                      | L | T | P | CREDITS |
|-------------|---------------------|------------------------|------------------------------|-------------------------|---------------|----------------------|-------------------------|----------------------|---|---|---|---------|
|             |                     |                        | Marks                        | THEORY                  |               |                      | PRACTICAL               |                      |   |   |   |         |
|             |                     |                        |                              | END SEM University Exam | Two Term Exam | Teachers Assessment* | END SEM University Exam | Teachers Assessment* |   |   |   |         |
| BCCA206     | Practical (Major-2) | Programming Lab in C++ | Max                          | 0                       | 0             | 0                    | 30                      | 20                   | 0 | 0 | 4 | 2       |
|             |                     |                        | Min                          |                         |               |                      | 13.5                    | 9                    |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

|     |   |   |   |   |   |   |   |   |   |   |   |   |  |  |  |
|-----|---|---|---|---|---|---|---|---|---|---|---|---|--|--|--|
| CO5 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 1 | - |  |  |  |
|-----|---|---|---|---|---|---|---|---|---|---|---|---|--|--|--|

### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY               | COURSE NAME                     | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|------------------------|---------------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |                        |                                 | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |                        |                                 |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA207     | Practical<br>(Major-3) | Data Structure lab in C/<br>C++ | Max                          | 0                             | 0                | 0                       | 30                            | 20                      | 0 | 0 | 4 | 2       |
|             |                        |                                 | Min                          |                               |                  |                         |                               |                         |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

### COURSE OBJECTIVES:

The student will have ability to:

1. To understand the students with the applications of Standard data structure in real world problems.
2. To provide knowledge of creation of new data structures.
3. To familiarize the students with the analysis and design a particular problem.

### COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)** and **SDG 9 (Industry, Innovation and Infrastructure)**.

### COURSE OUTCOMES:

After completion of the course, the student will be able to:

- CO1** Demonstrate familiarity with major algorithms and data structures.
- CO2** Analyse performance of algorithms.
- CO3** Choose the appropriate data structure and algorithm design method for a specified application..
- CO4** Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs.
- CO5** Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

### LIST OF PRACTICAL

| Title | CO |
|-------|----|
|-------|----|

#### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

#### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY               | COURSE NAME                     | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|------------------------|---------------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |                        |                                 | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |                        |                                 |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA207     | Practical<br>(Major-3) | Data Structure lab in C/<br>C++ | Max                          | 0                             | 0                | 0                       | 30                            | 20                      | 0 | 0 | 4 | 2       |
|             |                        |                                 | Min                          |                               |                  |                         |                               |                         |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

|     |                                                                                                            | Mapping |
|-----|------------------------------------------------------------------------------------------------------------|---------|
| 1.  | Write a program to create a two dimensional array and perform add, subtract and multiplication operations. | CO4     |
| 2.  | Write a program to create a two dimensional array using dynamic memory allocation                          | CO4     |
| 3.  | Write a program to implement stack.                                                                        | CO4     |
| 4.  | Write a program to convert infix expression into postfix expression.                                       | CO4     |
| 5.  | Write a program to check balanced parentheses for a given infix expression.                                | CO4     |
| 6.  | Write a program to evaluate postfix expression.                                                            | CO4     |
| 7.  | Write a program to implement queue.                                                                        | CO4     |
| 8.  | Write a program to implement circular queue.                                                               | CO4     |
| 9.  | Write a program to implement link list with insert, delete, search, view, and delete function.             | CO5     |
| 10. | Write a program to implement ordered link list.                                                            | CO5     |
| 11. | Write a program to add two polynomials.                                                                    | CO5     |
| 12. | Write a program to create doubly link list.                                                                | CO5     |
| 13. | Write a program to implement tree with insert, delete and search function.                                 | CO5     |
| 14. | Write a program for in order, post order and preorder traversal of tree.                                   | CO5     |
| 15. | . Write a program for binary search and sequential search using recursion.                                 | CO5     |
| 16. | Write a program for bubble sort and sequential search.                                                     |         |
| 17. | Write a program for insertion sort and quick sort.                                                         |         |

### COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

| Course | Correlation with POs | Correlation with |
|--------|----------------------|------------------|
|--------|----------------------|------------------|

**Chairperson**  
Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Chairperson**  
Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Controller of Examinations**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

**Registrar**  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Computer Application

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Sc. (Data Science)

SEMESTER-II (2026-29)

| COURSE CODE | CATEGORY               | COURSE NAME                     | TEACHING & EVALUATION SCHEME |                               |                  |                         |                               |                         | L | T | P | CREDITS |
|-------------|------------------------|---------------------------------|------------------------------|-------------------------------|------------------|-------------------------|-------------------------------|-------------------------|---|---|---|---------|
|             |                        |                                 | Marks                        | THEORY                        |                  |                         | PRACTICAL                     |                         |   |   |   |         |
|             |                        |                                 |                              | END SEM<br>University<br>Exam | Two Term<br>Exam | Teachers<br>Assessment* | END SEM<br>University<br>Exam | Teachers<br>Assessment* |   |   |   |         |
| BCCA207     | Practical<br>(Major-3) | Data Structure lab in C/<br>C++ | Max                          | 0                             | 0                | 0                       | 30                            | 20                      | 0 | 0 | 4 | 2       |
|             |                        |                                 | Min                          |                               |                  |                         |                               |                         |   |   |   |         |

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; \*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

| Outcome s |      |      |      |      |      |      |      |      |      |       |       |       | PSOs  |       |       |
|-----------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
|           | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
| CO1       | 3    | 2    | 2    | 1    |      |      |      |      |      |       | 1     |       |       |       |       |
| CO2       | 3    | 2    | 3    | 2    |      |      |      |      |      |       | 1     |       |       |       |       |
| CO3       | 3    | 2    | 3    | 2    |      |      | 1    |      |      |       | 1     | -     |       |       |       |
| CO4       | 3    | 2    | 2    | 1    |      |      |      |      |      |       | 1     | -     |       |       |       |
| CO5       | 3    | 2    | 3    | 2    |      |      |      |      |      |       | 1     | -     |       |       |       |

### Chairperson

Board of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

### Chairperson

Faculty of Studies  
Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

### Controller of Examinations

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore

### Registrar

Shri Vaishnav Vidyapeeth  
Vishwavidyalaya, Indore