



Vishwavidyalaya Karyasoudha  
Crawford Hall, Mysuru- 570 005

No.AC2(S)/35/2025-26

Dated: 09-06-2026

**Notification**

**Sub:-** Syllabus and Scheme of Examinations of Computer Application (UG) Programme (V & VI Semester) from the Academic year 2026-27.

- Ref:-** 1. Decision of Board of Studies in Computer Science (UG) meeting held on 16-03-2026, 17-03-2026 & 20-03-2026.  
2. Decision of the Faculty of Science & Technology meeting held on 22-04-2026.  
3. Decision of the Academic Council meeting held on 01-06-2026.

\*\*\*\*\*

The Board of Studies in Computer Science (UG) which met on 16-03-2026, 17-03-2026 & 20-03-2026 has resolved to recommend and approved the V & VI Semester Syllabus and Scheme of Examinations of Computer Application (UG) programme with effect from the Academic year 2026-27.

The Faculty of Science & Technology and Academic Council at their meetings held on 22-04-2026 and 01-06-2026 respectively have also approved the above mentioned Syllabus and Scheme of Examinations, accordingly it is hereby notified.

The Syllabus and Scheme of Examinations content may be download from the University Website [www.uni-mysore.ac.in](http://www.uni-mysore.ac.in).

  
Registrar

Registrar  
University of Mysore  
Mysore

**To;**

1. All the Principals of affiliated Colleges of University of Mysore, Mysuru.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS in Computer Science, Manasagangothri, Mysuru
4. The Dean, Faculty of Science & Technology, DOS in Botany, MGM.
5. The Director, PMEB, University of Mysore, Mysuru
6. The Director, College Development Council, Manasagangothri, Mysuru
7. The Director, ICD, MGM-Request to publish this Notification in University website.
8. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
9. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
10. Office Copy.

# **Annexure D**

## **BCA**

### **I to IV Semesters**

### **Modified Syllabus (SEP) 2026-27**

### **University of Mysore**

## Curriculum

**Program: BCA**

**Subject: Computer Applications**

| Semester | Course No. | Theory/<br>Practical | Credits | L-T-P | No. of<br>Hours | Paper Title                                    | Marks |     |
|----------|------------|----------------------|---------|-------|-----------------|------------------------------------------------|-------|-----|
|          |            |                      |         |       |                 |                                                | SEE   | CIE |
| I        | CAM11T     | Theory               | 03      | 3-0-0 | 03              | Digital Computer Organization                  | 80    | 20  |
|          | CAM11P     | Practical            | 02      | 0-0-2 | 04              | Office Automation and HTML                     | 40    | 10  |
|          | CAM12T     | Theory               | 03      | 3-0-0 | 03              | Problem Solving using C++                      | 80    | 20  |
|          | CAM12P     | Practical            | 02      | 0-0-2 | 04              | C++ Programming                                | 40    | 10  |
|          | CAM13T     | Theory               | 03      | 3-0-0 | 03              | Mathematical and Statistical Computing         | 80    | 20  |
|          | CAM13P     | Practical            | 02      | 0-0-2 | 04              | Mathematical and Statistical Computing using R | 40    | 10  |
| II       | CAM21T     | Theory               | 03      | 3-0-0 | 03              | Data Structures                                | 80    | 20  |
|          | CAM21P     | Practical            | 02      | 0-0-2 | 04              | Data Structures using C++                      | 40    | 10  |
|          | CAM22T     | Theory               | 03      | 3-0-0 | 03              | Object Oriented Programming with Java          | 80    | 20  |
|          | CAM22P     | Practical            | 02      | 0-0-2 | 04              | Programming with Java                          | 40    | 10  |
|          | CAM23T     | Theory               | 03      | 3-0-0 | 03              | Operating Systems                              | 80    | 20  |
|          | CAM23P     | Practical            | 02      | 0-0-2 | 04              | Shell Programming                              | 40    | 10  |

| Semester | Course No. | Theory/<br>Practical   | Credits | L-T-P | No. of<br>Hours | Paper Title                                                                         | Marks |     |
|----------|------------|------------------------|---------|-------|-----------------|-------------------------------------------------------------------------------------|-------|-----|
|          |            |                        |         |       |                 |                                                                                     | SEE   | CIE |
| III      | CAM31T     | Theory                 | 03      | 3-0-0 | 03              | C#.NET Programming                                                                  | 80    | 20  |
|          | CAM31P     | Practical              | 02      | 0-0-2 | 04              | C#.NET Programming Lab                                                              | 40    | 10  |
|          | CAM32T     | Theory                 | 03      | 3-0-0 | 03              | Data base Management System                                                         | 80    | 20  |
|          | CAM32P     | Practical              | 02      | 0-0-2 | 04              | DBMS Lab                                                                            | 40    | 10  |
|          | CAM33T     | Theory                 | 03      | 3-0-0 | 03              | Web Technologies                                                                    | 80    | 20  |
|          | CAM33P     | Practical              | 02      | 0-0-2 | 04              | Web Technologies Lab                                                                | 40    | 10  |
|          | CAE31X     | Theory<br>(Elective 1) | 02      | 2-0-0 | 02              | 1. Cyber Security<br>2. Software Engineering<br>3. System Software                  | 40    | 10  |
|          | CAE32X     | Theory<br>(Elective 2) | 02      | 2-0-0 | 02              | 1. Cloud Computing<br>2. Digital Image Processing<br>2. E-Commerce and E-Governance | 40    | 10  |

| Semester | Course No.  | Theory/<br>Practical                        | Credits | L-T-P | No. of<br>Hours | Paper Title                                                                     | Marks |     |
|----------|-------------|---------------------------------------------|---------|-------|-----------------|---------------------------------------------------------------------------------|-------|-----|
|          |             |                                             |         |       |                 |                                                                                 | SEE   | CIE |
| IV       | CAM41T      | <b>Theory</b>                               | 03      | 3-0-0 | 03              | Computer Networks                                                               | 80    | 20  |
|          | CAM41P      | <b>Practical</b>                            | 02      | 0-0-2 | 04              | Networking Lab                                                                  | 40    | 10  |
|          | CAM42T      | <b>Theory</b>                               | 03      | 3-0-0 | 03              | Python Programming                                                              | 80    | 20  |
|          | CAM42P      | <b>Practical</b>                            | 02      | 0-0-2 | 04              | Python Programming Lab                                                          | 40    | 10  |
|          | CAM43T      | <b>Theory</b>                               | 03      | 3-0-0 | 03              | PHP & MySQL                                                                     | 80    | 20  |
|          | CAM43P      | <b>Practical</b>                            | 02      | 0-0-2 | 04              | PHP & MySQL Lab                                                                 | 40    | 10  |
|          | CAE41X      | <b>Theory<br/>(Elective1)</b>               | 02      | 2-0-0 | 02              | 1. Fundamentals of Data Science<br>2. Internet of things<br>3. Software Testing | 40    | 10  |
|          | CACP41<br>P | <b>Practical<br/>(Compulsory<br/>Paper)</b> | 02      | 0-0-2 | 04              | Digital Marketing Lab                                                           | 40    | 10  |

## Semester: I

|                                   |                                                    |
|-----------------------------------|----------------------------------------------------|
| <b>Course Code:</b> CAM11T        | <b>Course Title:</b> Digital Computer Organization |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                              |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20              |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                           |

### Course Learning Outcomes (CLOs):

On successful completion of this course, students will be able to:

- CLO 1:** Understand the digital computer system including classification of computers, anatomy of computer, input/output devices and memory organization of computer.
- CLO 2:** Illustrate the types of Software, Computer languages and Translator programs.
- CLO 3:** Apply Boolean algebra to simplify logical expressions and solve problems using Karnaugh maps and other minimization techniques.
- CLO 4:** Design and analyze combinational and sequential logic circuits, including adders, subtractors, flip-flops, encoders, decoders, multiplexers, and counters.
- CLO 5:** Perform conversions between decimal, binary, octal, and hexadecimal number systems and carry out arithmetic operations in binary.

### Course Pedagogy

1. Explain core concepts such as data representation, register transfer, ALU operations, and memory organization.
2. Use diagrams, block representations, and timing charts to explain CPU organization and data flow.
3. Numerical problems on number systems, binary arithmetic, and instruction execution.
4. Demonstrate working of logic circuits, registers, and memory hierarchy using software tools or hardware kits.

### Course Contents

| Unit-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Fundamentals of Computers:</b> Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computer, Types of Computers, Basic Organization of a Digital Computer. <b>Input / Output Organization:</b> Peripheral Devices, Input – Output Interface. <b>Memory Organization:</b> Computers Memory System Overview- Characteristics and Types of Memory System. <b>Types Of Software:</b> System Software, Application Software and Utility Software; <b>Computer Languages:</b> Machine Level, Assembly Level & High-Level Languages, <b>Language Translators:</b> Assembler, Interpreter and Compiler. | 11<br>Hours |

| <b>Unit-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Number Systems:</b> Introduction, Decimal, Binary, Octal and Hexadecimal. Inter-Conversions, Addition, Subtraction, Multiplication and Division in Binary Number System. 1's and 2's Complement Method in Binary Number System. Subtraction Using 1's and 2's Compliment, Weighted Number System, Binary Coded Decimal (BCD), Addition of BCD Numbers. Non-Weighted Number System, Applications, Excess-3, Gray Code Conversions, Gray and Binary Codes. | 11<br>Hours |
| <b>Unit-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |
| <b>Boolean Algebra:</b> Basic Laws, Demorgan's Theorem, Duality Theorem, Sum of Product Method and Products of Sum Method. Karnaugh Map (Upto 4 Variables, Don't Care Condition). <b>Fundamentals Of Gates:</b> Basic Gates, Derived Gates and Universal Gates (Design).                                                                                                                                                                                    | 11<br>Hours |
| <b>Unit-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               |             |
| <b>Combinational And Sequential Logic Circuits:</b> Half Adder, Full Adder, Half - Subtractor and Full-Subtractor. <b>Flip-Flops:</b> SR, JK, Master-Slave JK, T Flip-Flops, Decoders - 3 To 8 Lines, Encoders- Octal To Binary. <b>Multiplexer:</b> 4 To 1 Line, Counters-3 Bits Binary Ripple Counter, 3 Shift Registers- Serial-In-Parallel-Out, Parallel-In-Serial-Out.                                                                                 | 11<br>Hours |

#### **Learning Resources:**

1. Computer Fundamentals, V Rajaraman.
2. Computer System Architecture (3rd edition) Morris Mano PHI.
3. Computer Organization – by V.Carl Hamacher, Z.G.Vranesic, and S.G.Zaky, 3rd Edition. McGraw Hill,
4. Computer Organization & Design, (3rd Edition) by – D.A.Patterson & J.L.Hennessy – Morgan Kaufmann Publishers (Elseviers)

## Semester: I

|                                   |                                                 |
|-----------------------------------|-------------------------------------------------|
| <b>Course Code:</b> CAM11P        | <b>Course Title:</b> Office Automation and HTML |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                           |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10           |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                        |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

**CLO 1:** Confidently work on Office Automation software such as word processor, spreadsheet and power point.

**CLO 2:** Understand the Web Programming basics and create simple web pages using HTML.

### Course Pedagogy

1. Introduction to office automation tools (Word, Excel, PowerPoint) and HTML basics.
2. Demonstration-Based Learning.
3. Hands-on Practice.

### Laboratory Program List

#### Part A:

1. Using Word processor with suitable examples, write the steps and execute the following with respect to table handling
  - i. Creating a table (At least 4 Columns and 6 Rows).
  - ii. Entering appropriate data into the table.
  - iii. Sort the table.
  - iv. Apply the formulas on table numeric values.
2. Using Word processor write the steps and execute for creating “Mail Merge” document for “FORMLETTERS”.
3. Using spread sheet, with suitable example, write steps and create worksheet called “Employee” and calculate the following using formulas
  - i. Enter Employee Code, Name and Basic Salary.
  - ii. Calculate DA (20% of Basic Salary).
  - iii. Calculate HRA (10% of Basic Salary).
  - iv. Calculate CCA (8.5% of Basic Salary).
  - v. Calculate Total Salary (Basic Salary + DA + HRA + CCA)
  - vi. Calculate Deductions (10% of Total Salary).
  - vii. Calculate Net Salary (Total Salary – Deductions).

4. Using spread sheet draw X-Y Line Chart and Bar Charts based on the following worksheet data and write the steps  
ITEM MONTHLY SALES  
(in Thousands)  
Cotton 2,750  
Wool 3,100  
Yarn 2,975  
Jute 2,100  
Fiber 3,010
5. Using spread sheet write the steps and execute the following:  
Roll, No, StudName, Marks1, Marks2, Mark3, Total, Percentage, Result
  - i. Create appropriate records
  - ii. Calculate total and marks using formula.
  - iii. Update result column using IF function.  
(Result: Distinction, First Class, Second Class, Pass, Fail).
6. Using Power Point with suitable examples write steps and execute the following:
  - i. Create presentation slides with Titles, Sub Titles and Charts choosing different slide layouts.
  - ii. Use Design templates for background.
  - iii. Format the slide design.
7. Using PowerPoint, Create the presentation for
  - i. “Components of PC” using organization chart.
  - ii. Use different views such as slide view, slide sorter view and slide show view.
8. Using PowerPoint, Create the presentation to demonstrate
  - i. Insert Images, Shapes.
  - ii. Charts for tabulated data
9. Using PowerPoint, Create the presentation to demonstrate Transitions, animations and Slide show.

**Part B:**

1. Design a page having suitable background colour and text colour with title “My First Web Page” using all the attributes of the Font tag.
2. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style
3. Write a HTML program for the demonstration of Lists.

- a. Unordered List
  - b. Ordered List
4. Write a HTML program for demonstrating Hyperlinks.
  - a. Navigation from one page to another.
  - b. Navigation within the page.
5. Write a HTML program for time-table using tables.
6. Write a HTML program to develop a static Registration Form.
7. Write a HTML program to develop a static Login Page.
8. Write a HTML code to create a web page with pink color background and display moving message in red color.
9. Write a HTML program to develop a static Web Page for Shopping Cart.
10. Write a HTML program to develop simple calculator.

**Evaluation Scheme for Lab Examination [Marks: 40]**

| Assessment Criteria |                                | Marks     |
|---------------------|--------------------------------|-----------|
| Writing             | One Program from Part A        | 15        |
|                     | One Program from Part B        | 15        |
| Execution           | Any one of the written Program | 5         |
| Viva Voce           |                                | 5         |
| <b>Total</b>        |                                | <b>40</b> |

## Semester: I

|                                   |                                                |
|-----------------------------------|------------------------------------------------|
| <b>Course Code:</b> CAM12T        | <b>Course Title:</b> Problem Solving using C++ |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                          |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20          |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                       |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

- CLO 1:** Understand the fundamental concepts and benefits of Object-Oriented Programming (OOP) and how it differs from Procedure-Oriented Programming paradigms.
- CLO 2:** Interpret and apply C++ syntax and structure, including input-output statements, keywords, identifiers, constants, variables, data types, operators, expressions and file handling to create basic programs and solve problems.
- CLO 3:** Describe the control structures, functions, and different parameter passing methods and write programs to solve problems.
- CLO 4:** Demonstrate the concepts of classes and objects, access specifiers, constructors, destructors, and OOP features like polymorphism, inheritance with the help of programs.

### Course Pedagogy

1. Interactive Lectures on fundamental concepts.
2. Demonstration-Based Learning to illustrate C++ syntax, program structure, and debugging techniques.
3. Problem-Solving Approach.

### Course Contents

| <b>Unit-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Introduction to Programming:</b> Program development life cycle, Introduction to Procedure Oriented Programming and Object-Oriented Programming (OOP) paradigms, basic concepts of OOP, benefits and applications of OOP. <b>Introduction to C++:</b> Overview of C++, Structure of C++ Program, Input-Output statements, Keywords, Identifiers, Constants, Variables, Data types, Operators, Types of operators, Expressions, Precedence of Operators, Type Conversion, Storage classes. | 11<br>Hours |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Unit-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |
| <b>Control statements:</b> Selection And Iteration Statements, Loop Control Statements.<br><b>Modular Programming:</b> Functions and Its Types, Recursion, Functions with Default Arguments, Inline Functions, Function Overloading, Call by Value and Reference, Math Library Functions.                                                                                                                                                                                                                           | 11 Hours |
| <b>Unit-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |
| <b>Derived Data Types:</b> Arrays, Array Types, Strings, String Manipulation Functions, Pointers, Pointer Arithmetic.<br><b>Managing Console, I/O Operations:</b> C++ Stream, C++ Stream Classes, Unformatted I/O Operations, Formatted Console I/O Operations, Managing Output with Manipulators.<br><b>User Defined Data Type:</b> Class Definition, Instance Variables, Member Methods, Accessing Members, Access specifiers, this pointer, Friend Function, Constructors, Types of Constructors and Destructor. | 11 Hours |
| <b>Unit-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |          |
| <b>Polymorphism:</b> Operator Overloading, Rules for Operator Overloading, Overloading Unary and Binary Operators.<br><b>Inheritance:</b> Inheritance, Types of Inheritance, Virtual Functions and Abstract Classes.<br><b>File Handling:</b> Introduction To Files and File Handling, File Opening Modes, Classes For File Stream Operations, File I/O Operations (Opening, Reading, Writing, Append and Closing).                                                                                                 | 11 Hours |

#### Learning Resources:

1. Object-Oriented Programming with C++, By M. T. Somashekara, D. S. Guru, H. S. Nagendraswamy, K. S. Manjunatha, PHI Learning Pvt. Ltd.
2. Object-Oriented Programming with C++, By E Balaguruswamy, Tata McGraw-Hill Publicationm Company Ltd.
3. The C++ Programming Language, By Stroustrup, Bjarne, Addison Wesley.
4. How To Solve It by Computer - R G Dromey, Prentice-Hall International.

## Semester: I

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b> CAM12P        | <b>Course Title:</b> C++ Programming  |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                 |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03              |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

- CLO 1:** Demonstrate fundamental C++ programming concepts by writing programs for simple problems.
- CLO 2:** Utilize features of C++, such as recursion, function overloading, and friend functions, to enhance the functionality and efficiency of programs.
- CLO 3:** Design and construct classes and objects in C++ to model real-world entities, demonstrate inheritance, operator overloading, constructors, and file handling operations.

### Course Pedagogy

1. Hands on experiments to design, compile, and execute programs during lab sessions.
2. Step-by-step Demonstration of program execution.
3. Design and implement algorithms/flowcharts.

### Laboratory Program List

#### Part -A

1. Program to swap 2 numbers with and without using temporary variable.
2. Program to convert the Fahrenheit to Celsius and vice-versa.
3. Program to compute to add and multiply two complex numbers.
4. Program to demonstrate functions of simple calculator.
5. Program to display multiplication table of a given number.
6. Program to check whether a number is a palindrome or not.
7. Program to generate Fibonacci series.
8. Program to compute sum of principle diagonal, lower diagonal and upper diagonal elements of a matrix.
9. Program to reverse a given string without using built-in function.
10. Program to demonstrate the usage of any five Math.h library functions.

#### Part-B

1. Program to demonstrate call by value and call by reference.
2. Program to generate factorial of a given number using recursion.
3. Program to create a Class for representing student details with appropriate member

functions to accept and display the details.

4. Program to demonstrate function overloading.
5. Program to demonstrate friend function.
6. Program for single inheritance.
7. Program to demonstrate multilevel inheritance.
8. Program to demonstrate operator overloading.
9. Program to demonstrate the usage of default and parameterized constructors.
10. Program to read and display the contents of a text file.

**Evaluation Scheme for Lab Examination [Marks: 40]**

| Assessment Criteria |                                | Marks |
|---------------------|--------------------------------|-------|
| Writing             | One Program from Part A        | 15    |
|                     | One Program from Part B        | 15    |
| Execution           | Any one of the written Program | 5     |
| Viva Voce           |                                | 5     |
| Total               |                                | 40    |

## Semester: I

|                                   |                                                             |
|-----------------------------------|-------------------------------------------------------------|
| <b>Course Code:</b> CAM13T        | <b>Course Title:</b> Mathematical and Statistical Computing |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                                       |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20                       |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                                    |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

- CLO 1:** Construct, evaluate, and apply logical statements and truth tables, understand the principles of set theory, perform various set operations, and effectively use Venn diagrams for solving complex problems.
- CLO 2:** Understand Cartesian products, relations, and their properties, including equivalence relations and partitions. They will also gain skills in function composition, inverse functions, and representing relations through matrices and directed graphs.
- CLO 3:** Organize and interpret data using statistical methods, calculate measures of central tendency and dispersion, analyze correlation between variables, and perform linear regression analysis.

### Course Pedagogy

1. Explain mathematical and statistical concepts such as matrices, numerical methods, probability, and statistical analysis.
2. Use real-world examples to connect theory with applications.
3. Step-by-step solution of numerical and statistical problems.
4. Focus on algorithmic methods for solving mathematical problems.
5. Encourage stepwise computation and interpretation of results.

### Course Contents

|                                                                                                                                                                                                                                                                                                                                              |             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-1:</b><br><b>Mathematical Logic Introduction:</b> Statements Connectives - Negation, Conjunction, Disjunction- Statement Formulas and Truth Tables- Conditional and Bi Conditional Statements- Tautology, Contradiction. <b>Set Theory:</b> Sets And Subsets, Set Operations and The Laws of Set Theory, Counting and Venn Diagrams. | 11<br>Hours |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|

|                                                                                                                                                                                                                                                                                                                                                                                                            |             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-2:</b><br><b>Cartesian Products and Relations,</b> Properties of Relations. <b>Computer Recognition:</b> Relation Matrices and Directed Graphs, Equivalence Relations and Partitions.<br><b>Functions:</b> One-to-One, Onto Functions, Function Composition and Inverse Functions.                                                                                                                 | 11<br>Hours |
| <b>Unit-3:</b><br><b>Statistical methods:</b> Introduction, Definitions, Classifications, Frequency Distribution, Mean - Arithmetic Mean for Grouped and Ungrouped Data. <b>Median:</b> Meaning, Calculations of Median for Ungrouped. <b>Mode:</b> Meaning, Calculations of Mode for Discrete Series and Continuous Series.                                                                               | 11<br>Hours |
| <b>Unit-4:</b><br><b>Standard Deviation:</b> Meaning, Standard Deviation for Actual Mean Method, Assumed Mean Method and Step Deviation Method Using Discrete Series And Continuous Series.<br><b>Coefficient of Variation:</b> Meaning and Problems. <b>Correlation:</b> Meaning, Types, Rank Correlations and Problems. <b>Simple Linear Regression:</b> Meaning, Properties of Regression Coefficients. | 11<br>Hours |

#### Learning Resources:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education, 2004.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 6th Edition, McGraw Hill, 2007.
3. Jayant Ganguly, "A Treatise on Discrete Mathematical Structures", Sanguine Pearson, 2010.
4. D.S. Malik and M.K. Sen, "Discrete Mathematical Structures: Theory and Applications", Thomson, 2004.
5. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier, 2005, Reprint 2008.
6. Fundamentals of Mathematical Statistics by Gupta and Kapoor (Sultan Chand).
7. Mathematical Statistics by John Freund (Prentice Hall India Pvt. Ltd.)

## Semester: I

|                                   |                                                                     |
|-----------------------------------|---------------------------------------------------------------------|
| <b>Course Code:</b> CAM13P        | <b>Course Title:</b> Mathematical and Statistical Computing using R |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                                               |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10                               |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                                            |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

- CLO 1:** Develop practical skills in implementing set operations and function operations using R programming.
- CLO 2:** Implement logic gates using R and perform comprehensive statistical analysis including calculations of central tendency and conduct linear regression analysis.
- CLO 3:** Compute Cartesian products and analyze relations for properties such as reflexivity, symmetry, and transitivity through R scripts.

### Course Pedagogy

1. Introduction to mathematical and statistical concepts along with R fundamentals.
2. Explanation of concepts such as vectors, matrices, probability distributions, and statistical measures using R.
3. Students practice coding in R during lab sessions.
4. Implementation of statistical techniques and numerical methods.

### Laboratory Program List

#### Part A

1. Write a R Program to implement operations of Set (Union, Intersection, Difference, Subset).
2. Write a R program to implement inverse function.
3. Write a R Program to implement one-to-one function.
4. Write a R Program to implement Cartesian Product of Two sets.
5. Write a R Program to check whether the given relation is Reflexive.
6. Write a R Program to check whether the given relation is Transitive.
7. Write a R Program to implement logic gates (NOT, AND, OR, XOR).
8. Write a R Program to check whether the given relation is Symmetric.

#### Part B

1. Write a R Program to Calculate central tendency (mean, median, mode).
2. Write a R Program to Calculate standard deviation and variance for discrete & continuous series.
3. Write a R Program to Calculate coefficient of variance for discrete & continuous series.

4. Write a R Program to Calculate simple Linear Algebra Operations.
5. Write a R Program to Calculate arithmetic mean for grouped and ungrouped data.
6. Write a R Program to Calculate cumulative sums, and products, minima, maxima.
7. Write a R Program to Calculate frequency distribution for discrete & continuous series.
8. Write a R Program to Calculate Simple Linear Regression.

**Evaluation Scheme for Lab Examination [Marks: 40]**

| <b>Assessment Criteria</b> |                                | <b>Marks</b> |
|----------------------------|--------------------------------|--------------|
| Writing                    | One Program from Part A        | 15           |
|                            | One Program from Part B        | 15           |
| Execution                  | Any one of the written Program | 5            |
| Viva Voce                  |                                | 5            |
| <b>Total</b>               |                                | <b>40</b>    |

## Semester: II

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b> CAM21T        | <b>Course Title:</b> Data Structures  |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                 |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20 |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03              |

### Course Learning Outcomes (CLOs):

On successful completion of this course, students will be able to:

**CLO 1:** Understand the basics of Data Structures.

**CLO 2:** Identify the appropriate data structures and algorithms for solving real world problems.

**CLO 3:** Understand the practical applications of Tree and Graph.

**CLO 4:** Understand the fundamentals of sorting and searching algorithms.

### Course Pedagogy:

1. Interactive Lectures and Conceptual Discussions to introduce various Data Structure concepts.
2. Student Assignments and tests related to various data structures and its implementation.

| Course Contents:                                                                                                                                                                                                                                                                                                                                                                                              |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-1</b><br><b>Introduction:</b> Data Structure Definition, Basic Terminology and Concepts, Importance of Data Structures in Programming. Classification of Data Structures. Primitive Data Structures, Non-Primitive Data Structures. <b>Stack:</b> Definition, Memory Representation, Algorithms for Stack Operations (Push, Pop), Applications of Stack.                                              | 11<br>Hours |
| <b>Unit-2</b><br><b>Queue:</b> Definition, Memory Representation, Linear Queue, Circular Queue, Enqueue, Dequeue. Applications of Queue. <b>Linked Lists:</b> Definition, Types. <b>Singly Linked List:</b> Implementation, Insertion [At the Beginning], Deletion [At the End]. <b>Doubly Linked List:</b> Memory Representation of Singly Linked List and Doubly Linked Lists. Applications of Linked List. | 11<br>Hours |

|                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-3</b><br><b>Tree:</b> Definition, Memory Representation Using Array and Linked List. <b>Binary Tree:</b> Definition, Traversal Algorithms [Pre-Order, In-Order, Post-Order], Construction of Tree from In-Order and Pre-Order, In-Order and Post-Order. <b>Binary Search Trees:</b> Insertion of a Node, Deletion of A Node. <b>Advanced Tree Structures AVL And B-Trees:</b> Definition and Applications.                          | 11<br>Hours |
| <b>Unit-4</b><br><b>Graph:</b> Definition, Memory Representation of Graph. Adjacency Matrix, Adjacency List. Graph Traversal Algorithms: Breadth-First Search (BFS), Depth-First Search (DFS). <b>Sorting Techniques:</b> Bubble Sort, Selection Sort [Algorithm, Time & Space Complexity]. <b>Searching Techniques:</b> Linear And Binary Search Sort [Algorithm, Time & Space Complexity]. <b>Heap:</b> Heap Operations and Applications. | 11<br>Hours |

#### **Learning Resources:**

1. Data Structures Through C++ (4th Edition) Yashvant Kanetkar.
2. Data Structures and Algorithm Analysis in C++" by Mark Allen Weiss.
3. Data structure and Algorithms using C++ by Sachi Nandan Mohanty, Pabitra Kumar Tripathy.
4. Data Structures and Algorithms in C++, Second Edition by Adam Drozdek.

## Semester: II

|                                   |                                                |
|-----------------------------------|------------------------------------------------|
| <b>Course Code:</b> CAM21P        | <b>Course Title:</b> Data Structures using C++ |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                          |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10          |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                       |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

**CLO 1:** Implement data structures using C++.

**CLO 2:** Demonstrate searching and sorting techniques using C++.

**CLO 3:** Demonstrate advanced programming skills through C++ programming language.

### Course Pedagogy:

1. Demonstration-based teaching of the various data structures.
2. Hands-on laboratory sessions on the implementation of the data structures and its application.
3. Problem-solving and programming exercises.

### Laboratory Program List

#### Part A:

1. Program to find GCD of two numbers.
2. Program to implement Tower of Hanoi.
3. Program to print Fibonacci series.
4. Program to find largest and smallest element in an array.
5. Program to perform stack operations.
6. Program to perform Linear queue operations
7. Program to insert a node at the beginning of a singly linked list.
8. Program to delete a node at the end of a singly linked list.

#### Part B:

1. Program to construct a binary search tree
2. Program for Binary Tree traversal.
3. Program to implement DFS
4. Program to implement BFS
5. Program to Sort an Array (Selection Sort)
6. Program to Sort an Array (Bubble Sort)
7. Program to perform Linear Search of an Element in an Array.
8. Program to perform Binary Search of an Element in an Array.

**Evaluation Scheme for Lab Examination [Marks: 40]**

| <b>Assessment Criteria</b> |                                | <b>Marks</b> |
|----------------------------|--------------------------------|--------------|
| Writing                    | One Program from Part A        | 15           |
|                            | One Program from Part B        | 15           |
| Execution                  | Any one of the written Program | 5            |
| Viva Voce                  |                                | 5            |
| <b>Total</b>               |                                | <b>40</b>    |

## Semester: II

|                                   |                                                            |
|-----------------------------------|------------------------------------------------------------|
| <b>Course Code:</b> CAM22T        | <b>Course Title:</b> Object Oriented Programming with Java |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                                      |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20                      |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                                   |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

**CLO 1:** Understand the Java programming fundamentals.

**CLO 2:** Describe with examples of basic Java OOP concepts.

**CLO 3:** Understand the Java Interfaces and Packages.

**CLO 4:** Deliberate the Details of Multithreading, Exception Handling & File Handling

**CLO 5:** Design GUI applications using tools like AWT.

### Course Pedagogy:

1. Lecture-based teaching
2. Hands-on programming practice
3. Problem-solving / exercise-based learning
4. Demonstration and interactive discussion.

| <b>Course Contents:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-1:</b><br><b>Fundamentals of Object-oriented Programming:</b><br>Object-oriented Paradigm, Basic Principles of Object-oriented Programming, Advantages of Object-Oriented Programming, Applications of Object-Oriented Programming.<br><b>Introduction to Java Language:</b> Java History, Features, Overview, Difference between C, C++ and Java, Java Environment- JDK, JVM, JRE and API, Java Program Structure, Java Tokens, Implementing a Java Program, Command Line Arguments.<br><b>Java Programming Fundamentals:</b> Data types, Variables & Constants, Keywords & Naming Conventions, Type Casting, Operators and Expressions, Control Structures, Jumping Statements. | 11<br>Hours |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-2:</b><br><b>Classes &amp; Objects</b><br>Basics of Objects and Classes, Constructors, Access Modifiers, Method Overloading, Overloading Constructors, Static members, this keyword. <b>Arrays:</b> One dimensional Arrays, Two dimensional Arrays, Array of Objects. <b>Strings:</b> String Handling functions.<br><b>Inheritance:</b> Types of inheritance, Interfaces, overriding methods, super keyword, Final Variables, Methods and classes, Abstract classes and methods                                                   | 11<br>Hours |
| <b>Unit-3:</b><br><b>Packages:</b> Introduction, Java API packages and user-defined packages.<br><b>Multithreading in Java:</b> Concepts of Thread, Thread Life Cycle, Creating Threads & Implementing Runnable Interface, Thread Synchronization & Thread Priority.<br><b>Exception Handling</b> Concepts of Exception, Types of Exceptions, Using Try-Catch-Finally blocks, Creating User-Defined Exceptions.                                                                                                                           | 11<br>Hours |
| <b>Unit-4:</b><br><b>I/O Streams</b> – Classification of I/O streams, Byte Streams - InputStream & OutputStream Classes, Character Streams – Reader and Writer Classes<br><b>Applet Programming</b> – Difference between Applet & Application program, Applet Life Cycle, Simple applet programs using Graphics Class<br><b>Event Handling &amp; GUI programming</b> Event Types, Event Handling Mechanism, AWT controls – Frames, Panels, Layout managers, Label, Textbox, TextArea, Button, Checkbox, CheckboxGroup List, Choice, Menu. | 11<br>Hours |

#### Learning Resources:

1. D.S. Guru, M.T. Somashekara, & K.S. Manjunatha, Object Oriented Programming with Java, PHI Learning, 2017.
2. E Balagurusamy , Programming with JAVA, TMH, 2007
3. Herbert Schildt , Java 7, The Complete Reference, , 8th Edition, 2009

## Semester: II

|                                   |                                            |
|-----------------------------------|--------------------------------------------|
| <b>Course Code:</b> CAM22P        | <b>Course Title:</b> Programming with Java |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                      |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10      |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                   |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

**CLO 1:** Implement simple programs using Java Fundamental concepts.

**CLO 2:** Identify classes, objects, members of class and the relationships among them needed for finding the solution to specific problems using Objected Oriented Programming concepts of Java.

**CLO 3:** Design & Develop simple GUI programs using AWT GUI tool.

### Course Pedagogy:

1. Hands-on Lab-Based Learning
2. Problem-Solving Approach
3. Incremental Learning
4. Peer Learning and Code Reviews

### Laboratory Program List

#### Part A:

1. Program to find whether the given number is Positive, Negative or Zero.
2. Program to list the factorial of the numbers 1 to 10.
3. Program to demonstrate classes & objects.
4. Program to demonstrate method overloading.
5. Program to demonstrate single inheritance (simple calculator – base class, Advanced Calculator – derived class).
6. Program to find Maximum & Minimum element in one-dimensional array of numbers.
7. Program to check whether the given string is palindrome or not.
8. Program to create a 'Student' class with Reg.no., name and marks of 3 subjects. Calculate the total marks of 3 subjects and create an array of 3 student objects & display the results.

#### Part B:

1. Program to illustrate exception handling using multiple catch blocks.
2. Program to illustrate user defined packages
3. Program to illustrate multi threads
4. Program to create AWT window with 4 buttons M/A/E/Close. Display M for Good Morning, A for Afternoon, E for evening and Close button to exit the window.

5. Program to demonstrate the various mouse handling events.
6. Program to read and write Binary I/O file.
7. Program to display different shapes on an applet.
8. Program to create menu bar and pull-down menus.

**Evaluation Scheme for Lab Examination [Marks: 40]**

| <b>Assessment Criteria</b> |                                | <b>Marks</b> |
|----------------------------|--------------------------------|--------------|
| Writing                    | One Program from Part A        | 15           |
|                            | One Program from Part B        | 15           |
| Execution                  | Any one of the written Program | 5            |
| Viva Voce                  |                                | 5            |
| <b>Total</b>               |                                | <b>40</b>    |

## Semester: II

|                                   |                                        |
|-----------------------------------|----------------------------------------|
| <b>Course Code:</b> CAM23T        | <b>Course Title:</b> Operating Systems |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                  |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20  |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03               |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

**CLO 1:** Understand the fundamentals of the operating system.

**CLO 2:** Describe the concepts of process, process management, CPU Scheduling, process synchronization, Dead locks, memory management and Virtual Memory management.

**CLO 3:** Illustrate the file system and structure.

**CLO 4:** Understand the UNIX OS, Shell Programming and Conditional Control Structures in Shell Programming.

### Course Pedagogy:

1. Foundation-oriented Instruction and Interactive Sessions.
2. Illustrative Examples and Concept Demonstrations.
3. Problem-solving Exercises and Algorithm Analysis.
4. Hands-on Activities and Simulation-based Learning.
5. Group Discussions, Assignments, and Technical Presentations.

| Course Contents:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-1:</b><br><b>Introduction:</b> Definition, Computer System Components, User View, System View and System Goals, Batch Systems, Multi Programmed Systems, Time-Sharing Systems, Real-Time Systems, System Components, Operating System Services.<br><b>Process:</b> Process Concept, Process State Diagram Process Control Block, Process Scheduling- Scheduling Queues, Scheduler, Cooperating Process, Interprocess Communication. <b>CPU Scheduling:</b> Basic Concepts, Preemptive and Non-Preemptive Scheduling, Scheduling Criteria, Scheduling Algorithms-FCFS, Shortest Job First Priority Scheduling, Round Robin Scheduling. | 11<br>Hours |
| <b>Unit-2:</b><br><b>Process Synchronization:</b> The Critical Section Problem, Solution for Critical Section Problem, Bakery Algorithm, Semaphores-Meaning, Types of Semaphores, Synchronization Problems- Bounded Buffer Problem, Readers-Writers Problem.<br><b>Deadlocks:</b> Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.                                                                                                                                                                                                             | 11<br>Hours |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Unit-3</b><br><b>Memory Management:</b> Introduction, Logical Versus Physical Address Space, Dynamic Loading, Dynamic Linking, Swapping, Contiguous Allocation, Partitioned Memory Allocation, Paging, Virtual Memory Management-Segmentation, Segmentation with Paging. <b>File System:</b> File Concepts, File Attributes, File Operations, File Types, File Structure, Access Methods, Directorystructure, File-System Structure, Allocation Methods- Contiguous Allocation, Linked Allocation and Indexed Allocation, Free- Space Management.                                                                                                                                                                         | 11<br>Hours |
| <b>Unit-4</b><br><b>Introduction to Unix System:</b> The Unix Operating System, The UNIX architecture. <b>Shell Programming:</b> Vi editor, shell types, shell command line processing, shell script features, executing a shell script, system and user-defined variables, expr command, shell screen interface, read and echo statement, command substitution, escape sequence characters, shell script arguments, positional parameters, test command, file test, string test, numeric test. <b>Conditional Control Structures:</b> if statement, case statement Looping Control Structure-while, until, for, statements. Jumping Control Structures – break, continue, exit. Shell Programs covering the above concepts. | 11<br>Hours |

#### **Learning Resources:**

1. Operating System Concepts – 5th edition by Abraham Silberschartz and Peter Galvin, McGraw Hill,2000
2. Modern Operating Systems – Andrew S Tanenbaum, Prentice Hall
3. Operating Systems: Internals and Design Principles, William Stallings, Prentice Hall
4. Sumitabha Das: UNIX – Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.

## Semester: II

|                                   |                                        |
|-----------------------------------|----------------------------------------|
| <b>Course Code:</b> CAM23P        | <b>Course Title:</b> Shell Programming |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                  |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10  |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03               |

### Course Learning Outcomes (CLOs):

**On successful completion of this course, students will be able to:**

**CLO 1:** Develop skill in shell scripting to perform simple operations and problems.

**CLO 2:** Perform file manipulation using shell scripts.

**CLO 3:** Understand and implement shell scripts for system information.

### Course Pedagogy:

1. Demonstration-based learning of shell commands, scripting techniques.
2. Hands-On Lab Practice
3. Problem-Based Learning to design and implement shell scripts

### Laboratory Program List

#### Part A:

1. Write a shell script to swap 2 values.
2. Write a shell script to check if the given number is even or odd.
3. Write a shell script to find the largest of 3 numbers.
4. Write a shell script to perform arithmetic operations.
5. Write a shell script to find the sum of first 10 natural numbers.
6. Write a shell script to display multiplication table of a given number.
7. Write a shell script to find the length of a given string.
8. Write a shell script to find factorial of a given number.
9. Write a shell script which counts the numbers of lines and number of words present in a given file.
10. Write a shell script to display the Fibonacci series upto N number.

#### Part B:

1. Write a shell script to search for particular element from an array of elements.
2. Write a shell script to calculate the TA, HRA and DA of an employee.
4. Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions.
5. Develop an interactive script that asks for a word and file name and then tells how many times that word occurred in the file.
6. Write a shell script to extract a sub string from a given string.

7. Perform the following operations
  - a. Concatenate 2 strings
  - b. Rename a file
  - c. Delete a file
  - d. Copy the file
8. Write a shell script to display the
  - a. Version of the shell
  - b. The user information
  - c. Login date and time
  - d. List of processes running on the system
  - e. User home directory
9. Write a C program to display PID of parent and PID of child process.
10. Write a shell script that takes two filename as arguments. It should check whether the contents of two files are same or not, if they are same then second file should be deleted.
11. Assume a file with the given information  
 First Name Middle Name Age  
 -----  
 Write a shell script to
  - a. Sort the first name in alphabetical order
  - b. Sort the age in terms of ascending order
  - c. Sort the age in terms of descending order
  - d. Sort the middle name in alphabetical order

#### Evaluation Scheme for Lab Examination [Marks: 40]

| Assessment Criteria |                                | Marks     |
|---------------------|--------------------------------|-----------|
| Writing             | One Program from Part A        | 15        |
|                     | One Program from Part B        | 15        |
| Execution           | Any one of the written Program | 5         |
| Viva Voce           |                                | 5         |
| <b>Total</b>        |                                | <b>40</b> |

### Semester: III

|                                   |                                          |
|-----------------------------------|------------------------------------------|
| <b>Course Code:</b> CAM31T        | <b>Course Title:</b> C# .NET Programming |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                    |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20    |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                 |

### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Understand C# basics, syntax, control statements, arrays, strings.

**CLO 2:** Apply OOP concepts like classes, inheritance, and interfaces.

**CLO 3:** Use delegates, events, and file I/O in C#.

**CLO 4:** Build GUI apps using Windows Forms and ADO.NET.

### Course Pedagogy

1. Interactive Lectures and Conceptual Discussions to introduce OOP principles, .NET framework concepts, and C# programming fundamentals.
2. Problem-Solving and Programming Exercises to develop logical thinking
3. Code Review and Peer Learning to improve coding practices and collaborative problem-solving skills.

| Course Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Hours |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Unit 1</b><br><b>Introduction:</b> Overview of OOP, Introduction to C # - Characteristics, application, origins of the .NET technology, the .NET framework, C# program structure, command line argument, math function, Literals, variable in C#: Declaration, initialization, constant variables, scope of variables, boxing and unboxing, Operators, expression in C#, Decision making and looping statements in C#, <b>Methods in C#</b> : declaring methods, methods parameters: output, ref, val, params, <b>Arrays</b> :Declaration, initialization, variable size arrays, array class, array list class, <b>String handling:</b> introduction, string library functions. | 11    |
| <b>Unit-2</b><br><b>OOPS with C#:</b> Introduction to Classes & Objects, <b>Constructor:</b> Introduction & Types, Destructor, <b>Inheritance &amp; types:</b> single level inheritance ,multilevel inheritance, hierarchical inheritance, containment inheritance, defining a subclass, visibility control, <b>polymorphism:</b> definition, method overloading, method overriding, <b>operator overloading:</b> definition, overloadable operators, overloading unary and binary operator, <b>Data Abstraction:</b> hiding methods, abstract classes, abstract methods, sealed                                                                                                   | 11    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| classes, sealed methods, <b>Interfaces:</b> Multiple Inheritance: defining an interface, extending an interface, implementing interface, abstract class and interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |
| <b>Unit-3</b><br><b>Delegates and Events:</b> Definition, delegate declaration, delegate methods, delegates instantiation, delegate invocation, multicast delegates, events. <b>Managing Console I/O operations:</b> console class, console input, console output, formatted output, numeric formatting, standard numeric format, custom numeric format. <b>File handling:</b> I/O Classes: write files, read files, File streams: file stream classes, File modes, operations on files                                                                                                                                                       | 11 |
| <b>Unit-4</b><br><b>Introducing windows forms:</b> A tale of three GUI namespaces, Anatomy of a Form, Component class, control class. Programming with windows forms controls: Working with button types, check boxes, labels Radio buttons, track bar, Progress bar, Group boxes, list boxes, calendar control, assigning tooltips for controls. <b>Data access with ADO.NET:</b> Introduction, two faces of ADO.NET, role of ADO.NET data providers, building a simple test database, selecting a data provider, working with connected layer of ADO.NET & OleDb Data reader, inserting, updating and deleting records using OleDb command. | 11 |

#### Learning Resources:

1. Programming in C#, E. Balagurusamy, 4<sup>th</sup> or 5<sup>th</sup> Edition, McGraw Hill Education.
2. C# 9.0 and .NET 5 – Modern Cross-Platform Development, Mark J. Price, 6<sup>th</sup> Edition, Packt Publishing.
3. Pro C# 8 with .NET Core 3, Andrew Troelsen and Philip Japikse, Apress Publications.
4. Head First C#, Andrew Stellman and Jennifer Greene, O'Reilly Media.
5. The Complete Reference C#, Herbert Schildt, McGraw Hill Education.

### Semester: III

|                                   |                                             |
|-----------------------------------|---------------------------------------------|
| <b>Course Code:</b> CAM31P        | <b>Course Title:</b> C#.NET Programming Lab |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                       |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10       |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                    |

### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Demonstrate C# basics using methods, arrays, and strings.

**CLO 2:** Apply OOP concepts like inheritance and overloading in C#.

**CLO 3:** Implement delegates, events, and file handling in C#.

**CLO 4:** Design Windows Forms and connect databases using ADO.NET.

### Course Pedagogy

1. Hands-on Laboratory Sessions and Live Coding Demonstrations to practice C# syntax, control structures, arrays, and string handling.
2. Problem-Solving and Programming Exercises to develop logical thinking through decision-making, looping, and method implementation.
3. Mini Projects and Application Development to design simple C# applications integrating OOP concepts and GUI/console-based programs.
4. Code Review, Debugging Sessions, and Peer Learning to improve coding practices, error handling, and collaborative problem-solving skills.

### Laboratory Program List

#### PART -A

1. Write a C# program to add two numbers using command-line arguments.
2. Write a C# program to demonstrate the use of methods and operators.
3. Write a C# program to demonstrate operations on an ArrayList.
4. Write a C# program to demonstrate string functions.
5. Write a C# program to demonstrate default and parameterized constructors using a student class.
6. Write a C# program to demonstrate multilevel inheritance using classes Person, Employee and Manager.
7. Write a C# program to demonstrate method overloading.
8. Write a C# program to overload the + operator to add two objects of a Complex class.

### **PART-B**

1. Write a C# program to implement multicast delegate.
2. Write a C# program to implement an event handler.
3. Write a C# program to demonstrate the operations of numeric formatting types.
4. Write a C# program to write to and read from a text file.
5. Design a Windows Forms application that includes the following controls: a list box, checkboxes, radio buttons, and image button.
6. Create a Windows Forms application that demonstrates the use of a track bar, progress bar, group boxes and button.
7. Create a Windows Forms application that includes a calendar control to allow the user to select a date and display it on a label.
8. Create a Windows Forms application that connects to a test database using ADO.NET with the OleDb provider. Allow the user to insert new records and display existing data using a DataGridView.

### **Evaluation Scheme for Lab Examination**

| <b>Assessment Criteria</b>            |                                | <b>Marks</b> |
|---------------------------------------|--------------------------------|--------------|
| Writing                               | One Program from Part A        | 15           |
|                                       | One Program from Part B        | 15           |
| Execution                             | Any one of the Written Program | 5            |
| Viva Voce based on C#.NET Programming |                                | 5            |
| <b>Total</b>                          |                                | <b>40</b>    |

### Semester: III

|                                   |                                                 |
|-----------------------------------|-------------------------------------------------|
| <b>Course Code:</b> CAM32T        | <b>Course Title:</b> Database Management System |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                           |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20           |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                        |

### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Understand basic concepts of databases, data models, and ER diagrams.

**CLO 2:** Apply relational algebra and SQL to query and manipulate data.

**CLO3:** Analyze database normalization to improve design and remove anomalies.

**CLO 4:** Evaluate transaction management and database security features.

### Course Pedagogy

1. Lecture Method
2. Visual Learning Approach
3. Problem-Based Learning (PBL) Approach
4. Question–Answer Method
5. Assignment-Based Learning

| <b>Content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Hours</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit-1</b><br><b>Introduction to Databases:</b> Definition of Data, Database, and DBMS, Overview of Database, Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators.<br><b>Data Models:</b> Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS. <b>Database Design:</b> Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema. | 11           |
| <b>Unit-2</b><br><b>Relational Algebra:</b> Introduction to Relational Algebra, <b>Operations:</b> Selection, Projection, Set Operations, Join Operations, Division.<br><b>Structured Query Language (SQL):</b> SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count ()), Logical operators (AND, OR, NOT), Predicates (Like,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 11           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Between, Alias, Distinct), Clauses (Group By, Having, Order by).                                                                                                                                                                                                                                                                                                                                                                                                             |    |
| <b>Unit-3</b><br><b>SQL Joins and Views:</b> Inner Join, Natural Join, Full Outer Join, Left Outer Join, right outer Join, Equi Join, Definition of View, creating a View, Managing Views (Listing, Updating, Deleting). <b>Normalization:</b> Anomalies in relational database design. Functional dependencies - Axioms. Decomposition, Transitive Dependency. <b>Data Normalization:</b> First normal form, Second normal form, Third normal form. Boyce-Codd normal form. | 11 |
| <b>Unit-4</b><br><b>Query Processing Transaction Management:</b> Introduction Transaction Processing, Single user & multiuser systems. <b>Transactions:</b> read & write operations. <b>Need of concurrency control:</b> The lost update problem, Dirty read problem. Types of failures. Transaction states. Desirable properties (ACID properties) of Transactions. Storage of Database, File Operations Database Security.                                                 | 11 |

### Learning Resources:

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7<sup>th</sup> Edition, Pearson.
2. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
3. Introduction to Database System, C J Date, Pearson, 1999.
4. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6<sup>th</sup> Edition, McGraw Hill,
5. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3<sup>rd</sup> Edition, McGraw Hill.

**Semester: III**

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b> CAM32P        | <b>Course Title:</b> DBMS Lab         |
| <b>Course Credits:</b> 02 (0-0-2) | <b>Hours/Week:</b> 04                 |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03              |

**Course Learning Outcomes (CLOs):**

**CLO 1:** Execute single-line SQL queries and apply group functions effectively.

**CLO 2:** Perform database operations using DDL, DML, DCL, and TCL commands.

**CLO 3:** Implement advanced SQL concepts like nested queries and join operations.

**CLO 4:** Create views and apply table-level locking mechanisms for data control.

**Course Pedagogy**

1. Experiential / Hands-on Laboratory Learning
2. Activity-Based Learning Approach
3. Demonstration-Based Teaching
4. Project-Based Learning (Mini Database Projects)

**Laboratory Program List****Part A:**

**Activity 1:** Database: Student (DDL, DML Statements)

**Table: Student**

| <b>Name</b> | <b>Reg. No</b> | <b>Class</b> | <b>Major</b> |
|-------------|----------------|--------------|--------------|
| Smith       | 17             | 1            | CS           |
| Brown       | 8              | 2            | CS           |

**Table: Course**

| <b>Course Name</b>               | <b>Course Number</b> | <b>Credit Hours</b> | <b>Department</b> |
|----------------------------------|----------------------|---------------------|-------------------|
| Introduction to Computer Science | CS1310               | 4                   | CS                |
| Data Structure                   | CS3320               | 4                   | CS                |
| Discrete Mathematics             | MATH2410             | 3                   | MATH              |
| Database Management System       | CS3380               | 3                   | CS                |

**Table: Section**

| Section Identifier | Course Number | Year | Instructor |
|--------------------|---------------|------|------------|
| 85                 | MATH2410      | 98   | King       |
| 92                 | CS1310        | 98   | Andreson   |
| 102                | CS3320        | 99   | Knuth      |
| 112                | MATH2410      | 99   | Chang      |
| 119                | CS1310        | 99   | Andreson   |
| 135                | CS3380        | 99   | Stone      |

**Table: Grade\_Report**

| Reg. No | Section Identifier | Grade |
|---------|--------------------|-------|
| 17      | 112                | B     |
| 17      | 119                | C     |
| 8       | 85                 | A     |
| 8       | 92                 | A     |
| 8       | 102                | B     |
| 8       | 135                | A     |

**Queries**

- Create Table Using create statement.
- Insert rows into individual Tables using insert statement.
- Alter table section add new field section and update the records
- Delete brown's grade report.
- Drop the table section.

**Activity 2: (Select clause, Arithmetic Operators)****Database:** Employee

Create the following tables and insert tuples with suitable constraints.

**Table: EMPLOYEE**

| EMPID | FIRSTNAME | LASTNAME | Hire Date | ADDRESS         | CITY         |
|-------|-----------|----------|-----------|-----------------|--------------|
| 1001  | George    | Smith    | 11-May-06 | 83 First Street | Paris        |
| 1002  | Mary      | Jones    | 25-Feb-08 | 842 Vine Ave    | Losantiville |
| 1012  | Sam       | Tones    | 12-Sep-05 | 33 Elm St.      | Paris        |
| 1015  | Peter     | Thompson | 19-Dec-06 | 11 Red Road     | Paris        |
| 1016  | Sarath    | Sharma   | 22-Aug-07 | 440 MG Road     | New Delhi    |
| 1020  | Monika    | Gupta    | 07-Jun-08 | 9 Bandra        | Mumbai       |

**Table: EMPSALARY**

| EMPID | SALARY | BENEFITS | DESIGNATION |
|-------|--------|----------|-------------|
| 1001  | 10000  | 3000     | Manager     |
| 002   | 8000   | 1200     | Salesman    |
| 1012  | 20000  | 5000     | Director    |
| 1015  | 6500   | 1300     | Clerk       |
| 1016  | 6000   | 1000     | Clerk       |
| 1020  | 8000   | 1200     | Salesman    |

**Queries**

- Display FIRSTNAME, LASTNAME, ADDRESS, and CITY of all employees living in PARIS
- Display the content of the employee table in descending order of FIRSTNAME
- Select FIRSTNAME and SALARY of salesmen
- Display the FIRSTNAME, LASTNAME, and TOTAL SALARY of all employees where  $TOTAL\ SALARY = SALARY + BENEFITS$
- Count the number of distinct DESIGNATIONs from EMPSALARY
- List the employees whose names have exactly 6 characters
- Add a new column PHONE\_NO to the EMPLOYEE table and update the records
- List employee names who have joined before 15-Jun-08 and after 16-Jun-07
- Generate salary slip with Name, Salary, Benefits, HRA=50%, DA=30%, PF=12%, and calculate gross salary. Order by gross salary in descending order.

**Activity 3: (Logical, Relational Operators)****Database:** Library

Create the following tables and insert tuples with suitable constraints.

**Table: Books**

| Book_Id | Book_Name       | Author_Name     | Publishers | Price | Type    | Quantity |
|---------|-----------------|-----------------|------------|-------|---------|----------|
| C0001   | The Klone and I | Lata Kappor     | EPP        | 355   | Novel   | 5        |
| F0001   | The Tears       | William Hopkins | First Publ | 650   | Fiction | 20       |
| T0001   | My First C++    | Brain & Brooke  | First Publ | 350   | Text    | 10       |
| T0002   | C++ Brainwork's | A.W. Rossaine   | TDH        | 350   | Text    | 15       |
| F0002   | Thunderbolts    | Ana Roberts     | First Publ | 750   | Fiction | 50       |

**Table: Issued**

| Book_Id | Quantity_Issued |
|---------|-----------------|
| T0001   | 4               |
| C0001   | 5               |
| F0001   | 2               |
| T0002   | 5               |
| F0002   | 8               |

**Queries**

1. To show Book name, Author name and price of books of First Publ. publisher.
2. Display Book id, Book name and publisher of books having quantity more than 8 and price less than 500.
3. Select Book id, book name, author name of books which is published by other than ERP publishers and price between 300 to 700.
4. Generate a Bill with Book\_id, Book\_name, Publisher, Price, Quantity, 4% of VAT "Total".
5. Display book details with book id's C0001, F0001, T0002, F0002 (Hint: use IN operator).
6. Display Book list other than, type Novel and Fiction.
7. Display book details with author name starts with letter "A".
8. Display book details with author name starts with letter "T" and ends with "S".
9. Select Book\_Id, Book\_Name, Author Name , Quantity Issued where Books.Books\_Id = Issued.Book\_Id.
10. List the book\_name, Author\_name, Price. In ascending order of Book\_name and then on descending order of price.

**Activity 4: (Date Functions)****Database:** Lab

Create Following table and insert tuples with suitable constraints.

**Table: Equipment Details**

| No. | Item Name | Cost Per Item | Quantity | Date of Purchase | Warranty | Operational |
|-----|-----------|---------------|----------|------------------|----------|-------------|
| 1   | Computer  | 30000         | 9        | 21/5/07          | 2        | 7           |
| 2   | Printer   | 5000          | 3        | 21/5/06          | 4        | 2           |
| 3   | Scanner   | 8000          | 1        | 29/8/08          | 3        | 1           |
| 4   | Camera    | 7000          | 2        | 13/6/05          | 1        | 2           |
| 5   | UPS       | 15000         | 5        | 21/5/08          | 1        | 4           |
| 6   | Hub       | 8000          | 1        | 31/10/08         | 2        | 1           |
| 7   | Plotter   | 25000         | 2        | 11/1/09          | 2        | 2           |

**Queries**

1. To select the ItemName purchase before 31/10/07.
2. Extend the warranty of each item by 6 months.
3. Display ItemName , Dateof purchase and number of months between purchase date and present date.
4. To list the ItemName in ascending order of the date of purchase where quantity is more than 3.
5. To count the number, average of costperitem of items purchased before 1/1/08.
6. To display the minimum warranty, maximum warranty period.
7. To Display the day of the date, month, year of purchase in characters.
8. To round of the warranty period to month and year format.
9. To display the next Sunday from the date "07-JUN-96".
10. To list the ItemName, which are within the warranty period till present date.

**Part B:****Activity 5: (Numeric, character functions).****Use Functions for the following.**

1. Find the mod of 165,16.
2. Find Square Root of 5000.
3. Truncate the value 128.3285 to 2 and -1 decimal places
4. Round the value 92.7683 to 2 and -1 decimal places.
5. Convert the string 'Department' to uppercase and lowercase.
6. Display your address convert the first character of each word to uppercase and rest are in

lowercase.

7. Combine your first name and last name under the title Full name.
8. A) Take a string length maximum of 15 displays your name to the left. The remaining space should be filled with '\*'.
9. Take a string length maximum of 20 displays your name to the right. The remaining space should be filled with '#'.
10. Find the length of the string 'JSS College, Mysore'.
11. Display substring 'BASE' from 'DATABASE'.
12. Display the position of the first occurrence of character 'o' in Position and Length.
13. Replace string Database with Data type.
14. Display the ASCII value of ' ' (Space).
15. Display the Character equivalent of 42.

**Activity 6:** Database: subject

Create the following table and insert tuples with suitable constraints.

**Table: Physics**

| Regno   | Name    | Year   | Combination |
|---------|---------|--------|-------------|
| AJ00325 | Ashwin  | First  | PCM         |
| AJ00225 | Swaroop | Second | PMCs        |
| AJ00385 | Sarika  | Third  | PME         |
| AJ00388 | Hamsa   | First  | PMCs        |

**Table: Computer Science**

| Regno   | Name    | Year   | Combination |
|---------|---------|--------|-------------|
| AJ00225 | Swaroop | Second | PMCs        |
| AJ00296 | Tejas   | Second | BCA         |
| AJ00112 | Geetha  | First  | BCA         |
| AJ00388 | Hamsa   | First  | PMCs        |

**Queries**

1. Select all students from Physics and Computer Science.
2. Select student common in Physics and Computer Science.
3. Display all student details who are studying in the second year.
4. Display students who are studying both Physics and Computer Science in the second year.
5. Display the students studying only Physics.

6. Display the students studying only Computer Science.
7. Select all students having PMCs combination.
8. Select all students having BCA combination.
9. Select all students studying in the third year.
10. Rename table Computer Science to CS.

#### Activity 7: (views)

**Database:** Railway Reservation System.

Create the following table and insert tuples with suitable constraints.

**Table: Train Details**

| Train_No | Train_Name        | Start_Place | Destination |
|----------|-------------------|-------------|-------------|
| RJD16    | Rajdhani Express  | Bangalore   | Mumbai      |
| UDE04    | Udhyan Express    | Chennai     | Hyderabad   |
| KKE55    | Karnataka Express | Bangalore   | Chennai     |
| CSE3     | Shivaji Express   | Coimbatore  | Bangalore   |
| JNS8     | Janashatabdi      | Bangalore   | Salem       |

**Table: Availability**

| Train_No | Class          | Start_Place | Destination | No_of_seats |
|----------|----------------|-------------|-------------|-------------|
| RJD16    | Sleeper Class  | Bangalore   | Mumbai      | 15          |
| UDE04    | First Class    | Chennai     | Hyderabad   | 22          |
| KKE55    | First Class AC | Bangalore   | Chennai     | 15          |
| CSE3     | Second Class   | Coimbatore  | Bangalore   | 8           |
| JNS8     | Sleeper Class  | Bangalore   | Salem       | 18          |

#### Queries

1. Create a view **sleeper** to display train number, start place, destination which have sleeper class and perform the following:
  - a. Insert new record.
  - b. Update destination='Manglore' where train no='RJD16'.
  - c. Delete a record which has train no='KKE55'
2. Create a view **detail** to display train number, train name, and class.
3. Create a view **total\_seats** to display train number, start place, use COUNT function on No\_of\_seats, group by start place and perform the following:
  - a. Insert new record.
  - b. Update start place='Hubli' where train no='JNS8'.
  - c. Delete the last row of the view.
4. Rename view **sleeper** to **class**.
5. Delete view **details**.

**Activity 8:** (group by, having clause)**Database:** Bank system

Create the following table and insert tuples with suitable constraints.

**Table: Account**

| Account_No | Cust_Name  | Branch_ID |
|------------|------------|-----------|
| AE0012856  | Reena      | SB002     |
| AE1185698  | Akhil      | SB001     |
| AE1203996  | Daniel     | SB004     |
| AE1225889  | Roy        | SB002     |
| AE8532166  | Sowparnika | SB003     |
| AE8552266  | Anil       | SB003     |
| AE1003996  | Saathwik   | SB004     |
| AE1100996  | Swarna     | SB002     |

**Table: Branch**

| Branch_ID | Branch_Name | Branch_City |
|-----------|-------------|-------------|
| SB001     | Malleswaram | Bangalore   |
| SB002     | MG Road     | Bangalore   |
| SB003     | MG Road     | Mysore      |
| SB004     | Jayanagar   | Mysore      |

**Table: Depositor**

| Account_No | Branch_ID | Balance |
|------------|-----------|---------|
| AE0012856  | SB002     | 12000   |
| AE1203996  | SB004     | 58900   |
| AE8532166  | SB003     | 40000   |
| AE1225889  | SB002     | 150000  |

**Table: Loan**

| Account_No | Branch_ID | Balance |
|------------|-----------|---------|
| AE1185698  | SB001     | 102000  |
| AE8552266  | SB003     | 40000   |
| AE1003996  | SB004     | 15000   |
| AE1100996  | SB002     | 100000  |

**Queries:**

1. Display the total number of accounts present in each branch.
2. Display the total loan amount in each branch.
3. Display the total deposited amount in each branch in descending order.
4. Display the maximum and minimum loan amount present in each city.
5. Display the average amount deposited in each branch for each city.
6. Display the maximum loan amount in each branch where the balance is more than 25000.
7. Display the total number of accounts present in each city.
8. Display all customer details in ascending order of branch ID.
9. Update the balance to 26000 where Account\_No = AE1003996.
10. Display customer names with their branch name.

**Evaluation Scheme for Lab Examination**

| Assessment Criteria                            |                                | Marks |
|------------------------------------------------|--------------------------------|-------|
| Writing                                        | One Program from Part A        | 15    |
|                                                | One Program from Part B        | 15    |
| Execution                                      | Any one of the Written Program | 5     |
| Viva Voce based on Data Base Management System |                                | 5     |
| Total                                          |                                | 40    |

### Semester: III

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b> CAM33T        | <b>Course Title:</b> Web Technologies |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                 |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20 |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03              |

#### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Understand Internet basics, WWW, and HTML5 structure.

**CLO 2:** Design responsive web pages using HTML forms and CSS.

**CLO 3:** Write JavaScript code using variables, functions, and control structures.

**CLO 4:** Use JavaScript objects, arrays, events, and DOM manipulation.

#### Course Pedagogy

1. Interactive Lectures and Conceptual Discussions to introduce Internet fundamentals, WWW architecture, HTTP protocol, and HTML/CSS concepts.
2. Hands-on Practical Sessions and Live Demonstrations to design web pages
3. Activity-Based Learning through Webpage Design Tasks
4. Problem-Solving and Practice Exercises
5. Mini Projects and Application Development
6. Peer Learning, Code Review and Debugging Sessions

| <b>Course Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit-1</b><br><b>Foundations of Internet and World Wide Web:</b> Introduction to the Internet, Internet Protocol Addresses, Domain Names, the World Wide Web, Web Browsers, Web Servers, Web Server Operation, General Server Characteristics, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol: -The Request Phase, The Response Phase, Security issues in WWW.<br><b>Introduction to HTML5:</b> Introduction, HTML Basics, Standard structure, HTML Elements, HTML Attributes, HTML Headings, HTML Paragraphs Text Formatting, Hyperlink and Images, Preserving White Space, Lists and Tables, HTML Block and Inline Elements, HTML Div Element, Horizontal Rules, | 11           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-2</b><br><b>HTML Form:</b> Working with Form elements, Form attributes, Working with IFrames. Building Responsive Webpage. <b>Cascading Style Sheets:</b> Introduction, CSS Syntax, CSS Comments, Applying Styles to HTML Elements, Style specification formats, Selector forms, CSS Margins, CSS Padding, CSS Height, Width, <b>CSS Text:</b> Text Alignment, Text Decoration, Text Transformation, Text Spacing, Text Shadow, Font properties, List properties, The box model, CSS links, CSS List, CSS Position, CSS Z index                                                                                                                                                                                                                          | 11 |
| <b>Unit-3</b><br><b>Advanced CSS:</b> CSS Rounded Corners, CSS Shadow Effects, CSS Text Effects, CSS 2D Transforms, CSS 3D Transforms, CSS Transitions, CSS Animations, CSS Masking. <b>Introduction To JavaScript:</b> Overview of JavaScript, General Syntactic Characteristics Advantages of JavaScript, variables, Comments, data types, constant, Screen Output & Keyboard Input, Operators, Type Conversion, Flow Controls: conditional statements, looping statements, jumping statements. <b>Functions:</b> Function Basic, function parameters, Function Invocation, Return statement, Global and local Variable.                                                                                                                                       | 11 |
| <b>Unit-4</b><br><b>Object and Class:</b> Definition of class, class syntax, class methods, constructor. Definition of object, object creation, object properties, built in objects: <b>Arrays and strings:</b> Definition of array, creation of array, Types of arrays, Accessing Array Elements, Array Properties and Methods, <b>Strings:</b> Definition, Creation of string, String Methods, Element Access in JavaScript. <b>Events and Event Handling:</b> Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Text Box and Password Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Slow Movement of Elements, <b>The navigator Object, Basics of Pattern Matching using RegExp.</b> | 11 |

#### Learning Resources:

1. Robert W. Sebesta: Programming the World Wide Web, Pearson education.
2. Dr. T Vasudev, Dr. Chandrajit M, Arvind G and Vasanthi (2021), HTML 5, CSS 3 and JavaScript Made, Easy, Dream Books Publishing.
3. Thomas A Powell, Fritz schneider The Completer Reference: JavaScript Third Edition.
4. Thomas A. Powell: HTML & CSS: The Complete Reference, Fifth Edition.

### Semester: III

|                                   |                                           |
|-----------------------------------|-------------------------------------------|
| <b>Course Code:</b> CAM33P        | <b>Course Title:</b> Web Technologies Lab |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                     |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10     |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                  |

### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Create web pages using HTML tags, tables, lists, and forms.

**CLO 2:** Style web pages using inline, internal, and external CSS.

**CLO 3:** Use JavaScript for interactivity, validation, and event handling.

**CLO 4:** Build JavaScript programs for clocks, calculators, and animations.

### Course Pedagogy

1. Hands-on Practical Sessions and Live Demonstrations to design web pages
2. Activity-Based Learning through Webpage Design Tasks
3. Problem-Solving and Practice Exercises
4. Mini Projects and Application Development

### Laboratory Program List

#### PART A

1. Develop and demonstrate HTML page containing basic text formatting tags, hyper link, images.
2. Develop and demonstrate HTML page containing III Sem BCA / III Sem B.Sc. [P.M. Cs] Course time table using table tag and its properties such as rowspan, colspan etc.
3. Develop HTML Page Contain College Course Details using Order and Unorder List
4. Design and develop a Student Application Form using HTML Form Elements
5. Design and develop HTML web page with appropriate tags to show the usage of
  - a. External level style specification.
  - b. Document level style specification.
  - c. Inline level CSS style specification.
6. Write an HTML program to create div and apply the following CSS properties on created div
  - a. Margin
  - b. Padding
  - c. Border Box shadow.
7. Write an HTML program to create a circle and create an animation of bouncing of the circle for 10 sec

8. Write HTML Program to Design Your College Name using follow CSS Properties
  - a. CSS Rounded Corners.
  - b. CSS Shadow Effects.
  - c. CSS Text Effects.

### **PART B**

1. Develop a HTML-JavaScript program to find the factorial of an input number (Use Prompt window to accept input).
2. Design and develop HTML-JavaScript program to perform operations of a Simple calculator
3. Write a JavaScript program to implement any five string functions
4. Develop a HTML-JavaScript program to demonstrate the working of login page. (Display the messages in alert window).
5. Develop and demonstrate HTML page containing JavaScript function to change the font style of a paragraph on mouse over and on mouse out events.
6. Develop a HTML-JavaScript program to display Digital clock.
7. Develop a HTML-JavaScript program to validate University Register Number using Regular Expression.
8. Write a JavaScript program to hide and show the Image.

### **Evaluation Scheme for Lab Examination**

| <b>Assessment Criteria</b>          |                                | <b>Marks</b> |
|-------------------------------------|--------------------------------|--------------|
| Writing                             | One Program from Part A        | 15           |
|                                     | One Program from Part B        | 15           |
| Execution                           | Any one of the Written Program | 5            |
| Viva Voce based on Web Technologies |                                | 5            |
| <b>Total</b>                        |                                | <b>40</b>    |

**Semester: III**

|                                      |                                       |
|--------------------------------------|---------------------------------------|
| <b>Course Code:</b> CAE311(Elective) | <b>Course Title:</b> Cyber Security   |
| <b>Course Credits:</b> 02(2:0:0)     | <b>Hours/Week:</b> 02                 |
| <b>Total Contact Hours:</b> 30       | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40                | <b>Exam Duration:</b> 02              |

**Course Learning Outcomes (CLOs):**

Upon successful completion of this Course, Students will be able to

**CLO 1:** Describe cyberspace, internet infrastructure, and cyber security concepts.

**CLO 2;** Identify types of cybercrimes and understand related cyber laws.

**CLO 3:** Analyze social media risks, privacy issues, and legal aspects.

**CLO 4:** Use cyber security tools and apply best practices for protection.

**Course Pedagogy**

1. Interactive Lectures and Conceptual Discussions to introduce cyberspace, cyber security concepts,
2. Case Studies and Real-world Incident Analysis to understand cybercrimes
3. Activity-Based Learning and Group Discussions on social media risks, cyber ethics, privacy concerns
4. Student Seminars, Assignments, and Awareness Activities focusing on cyber hygiene, emerging threats, and best practices for safe online behavior.

| <b>Course Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Hours</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit-1</b><br><b>Introduction to Cyber security:</b> Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.                              | 10           |
| <b>Cybercrime and Cyber law:</b> Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures.                                                            | 10           |
| <b>Unit 3</b><br><b>Social Media Overview and Security:</b> Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media.<br><b>Cyber Security Tools and Technologies:</b> Introduction to antivirus, firewalls. | 10           |

|                                                                                                            |  |
|------------------------------------------------------------------------------------------------------------|--|
| <b>Cyber Hygiene:</b> Importance of strong passwords, regular updates, backups, and secure browsing habits |  |
|------------------------------------------------------------------------------------------------------------|--|

**Learning Resources:**

1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Author Press. Edition 2010.
2. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sunit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
3. Compilers: Principles, Techniques, and Tools by Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, 2nd Edition, Pearson, 2007.
4. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001).
5. Fundamentals of Network Security by E. Maiwald, McGraw Hill.
6. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.

### Semester: III

|                                       |                                           |
|---------------------------------------|-------------------------------------------|
| <b>Course Code:</b> CAE312 (Elective) | <b>Course Title:</b> Software Engineering |
| <b>Course Credits:</b> 02(2:0:0)      | <b>Hours/Week:</b> 02                     |
| <b>Total Contact Hours:</b> 30 Hours  | <b>Formative Assessment Marks:</b> 10     |
| <b>Exam Marks:</b> 40                 | <b>Exam Duration:</b> 02                  |

### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Explain software engineering concepts, process models, and agile practices.

**CLO 2:** Apply techniques to gather and manage software requirements.

**CLO 3:** Model systems using UML diagrams and system modeling techniques.

**CLO 4:** Design software architecture using patterns and UML notations.

### Course Pedagogy

1. Classroom teaching / Discussion Method
2. Case Study-Based Learning
3. Problem-Based Learning (PBL)
4. Seminar / Presentation Method

| Course Content                                                                                                                                                                                                                                                                                                                                                                                                               | Hours |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Unit 1</b><br><b>OVERVIEW:</b> Introduction; Software Engineering Ethics; Software Process Models (Waterfall, V-Model, Incremental, Iterative, Prototyping, Spiral); Process Activities; Coping with Change; Plan- Driven and Agile Development.                                                                                                                                                                          | 10    |
| <b>Unit 2</b><br><b>REQUIREMENTS ENGINEERING:</b> Functional and Non-Functional Requirements; Software Requirements Document; Requirements Engineering Processes; Requirement's Validation; Requirements Management. <b>SYSTEM MODELING:</b> Context Models; Interaction Models- Use Case Modelling, Sequence Diagrams; Structural Models- Class Diagrams, Behavioral Models- Data-Driven Modelling, Event-Driven Modelling. | 10    |
| <b>Unit 3</b><br><b>ARCHITECTURAL DESIGN AND IMPLEMENTATION:</b> Architectural Views; Architectural Patterns- Layered Architecture, Repository Architecture, Client–Server Architecture Pipe and Filter Architecture. Object-Oriented Design Using The UML- System Context and Interactions, Interface Specification; Design Patterns; Implementation Issues.                                                                | 10    |

**Learning Resources:**

1. Software Engineering by Ian Sommerville, Pearson publications;10<sup>th</sup> Edition, 2015.
2. A Concise Introduction to Software Engineering, Pankaj Jalote, 2<sup>nd</sup> Edition, Springer Cham, 2025.
3. Software Engineering, N.S. Gill, Khanna Publishing House, 2023.
4. Software Engineering A Practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

### Semester: III

|                                       |                                       |
|---------------------------------------|---------------------------------------|
| <b>Course Code:</b> CAE313 (Elective) | <b>Course Title:</b> System Software  |
| <b>Course Credits:</b> 02(2:0:0)      | <b>Hours/Week:</b> 02                 |
| <b>Total Contact Hours:</b> 30        | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40                 | <b>Exam Duration:</b> 02              |

#### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Understand system software, SIC/SIC-XE, CISC and RISC.

**CLO 2:** Explain assembler functions and features.

**CLO 3:** Describe loader and linker operations.

#### Course Pedagogy

1. Interactive Lectures and Conceptual Discussions to explain system software concepts, SIC architecture, assemblers, loaders, and related components.
2. Problem-Solving and Analytical Exercises to understand addressing modes, program relocation, linking, and expression evaluation.
3. Diagram-Based Learning and Visualization to represent machine architecture, memory layout, program linking, and control sections.
4. Assignments, Tutorials, and Student Presentations

| Course Content                                                                                                                                                                                                                                                                                                                                                                                     | Hours |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Unit 1</b><br><b>System software:</b> Introduction, System Software and Machine Architecture, The Simplified Instructional Computer (SIC)- SIC Machine Architecture, SIC / XE Machine Architecture, SIC programming examples, Traditional (CISC) Machines and RISC Machines- Introduction, Differences.                                                                                         | 10    |
| <b>Unit 2</b><br><b>Assemblers:</b> Basic Assembler Functions- A Simple SIC Assembler, Assembler Algorithm and Data Structures, <b>Machine Dependent Assembler Features-</b> Instruction Formats and Addressing Modes, Program Relocation, Machine Independent <b>Assembler Features-</b> Literals, Symbol Defining Statements, Expressions, Program Blocks, Control Sections and Program Linking. | 10    |
| <b>Unit 3</b><br><b>Loaders and Linkers:</b> Basic Loader Functions- Design of an Absolute Loader, Machine Dependent Loader Features, Relocation, Program Linking, <b>Machine Independent Loader Features-</b> Automatic Library Search, Loader Options, <b>Loader Design Options-</b> Linkage Editors, Dynamic Linking, Bootstrap Loaders                                                         | 10    |

**Learning Resources:**

1. System Software- An Introduction to Systems Programming, 3<sup>rd</sup> Edition, Leland L. Beck, D Manjula, Pearson Education.
2. Systems Programming, John J Donovan, McGraw Hill Education.
3. Compilers: Principles, Techniques, and Tools by Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, 2nd Edition, Pearson, 2007.
4. Lex & Yacc by Doug Brown, John Levine, and Tony Mason, O'Reilly Media, October 2012.

### Semester: III

|                                       |                                       |
|---------------------------------------|---------------------------------------|
| <b>Course Code:</b> CAE321 (Elective) | <b>Course Title:</b> Cloud Computing  |
| <b>Course Credits:</b> 02(2:0;0)      | <b>Hours/Week:</b> 02                 |
| <b>Total Contact Hours:</b> 30        | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40                 | <b>Exam Duration:</b> 02              |

#### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Understand cloud computing concepts, architecture, benefits, and challenges.

**CLO 2:** Explain cloud service models (IaaS, PaaS, SaaS) and their providers.

**CLO 3:** Describe deployment models, virtualization types, and hypervisors.

**CLO 4:** Explore cloud storage, databases, networking, and DevOps practices.

#### Course Pedagogy

1. Interactive Lectures and Conceptual Discussions to introduce cloud computing fundamentals, service models
2. Demonstration-Based Learning using Cloud Platforms to showcase services like AWS, Azure, and Google Cloud
3. Case Studies and Real-world Applications to understand industry usage of cloud services, DevOps practices, and scalable architectures.

| <b>Course Content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Hours</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br><b>Cloud Fundamentals and Service Models Introduction:</b> Definition and Characteristics of Cloud Computing, History and Evolution, Cloud Computing Architecture, Benefits and Challenges. <b>Cloud Service Models:</b> Infrastructure as a Service (IaaS) with Key Providers (AWS EC2, Azure VMs), Platform as a Service (PaaS) with Key Providers (AWS Elastic Beanstalk, Google App Engine), Software as a Service (SaaS) with Examples (Google Workspace, Microsoft Office 365). | 10Hrs        |
| <b>Unit 2:</b><br><b>Deployment Models and Virtualization Cloud Deployment Models:</b> Public, Private, Hybrid, and Community Cloud. <b>Concept of Virtualization:</b> Definition and Importance, Types of Virtualization. <b>Hypervisors:</b> Role of the Hypervisor, Introduction to VMware, Hyper-V, and KVM.                                                                                                                                                                                        | 10Hrs        |
| <b>Unit 3:</b><br><b>Cloud Infrastructure and DevOps Cloud Storage &amp; Databases:</b> Storage Solutions (S3, Azure Blob), Database Services (AWS RDS, Google Cloud SQL), Introduction to                                                                                                                                                                                                                                                                                                              | 10Hrs        |

|                                                                                                                                                                                                       |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| NoSQL (DynamoDB, Cosmos DB). <b>Cloud Networking:</b> VPC Basics, Load Balancing, Auto Scaling, and CDN. <b>Introduction to DevOps:</b> Principles, CI/CD Pipelines, and Infrastructure as Code (IaC) |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**Learning Resources:**

- 1."Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, PHI.
- 2.AWS Documentation, Azure Documentation, Google Cloud Documentation, **Tools:** AWS Free Tier, Azure Free Account, Google Cloud Free Tier.

### Semester: III

|                                       |                                               |
|---------------------------------------|-----------------------------------------------|
| <b>Course Code:</b> CAE322 (Elective) | <b>Course Title:</b> Digital Image Processing |
| <b>Course Credits:</b> 02(2:0:0)      | <b>Hours/Week:</b> 02                         |
| <b>Total Contact Hours:</b> 30        | <b>Formative Assessment Marks:</b> 10         |
| <b>Exam Marks:</b> 40                 | <b>Exam Duration:</b> 02                      |

### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Understand the fundamentals of digital and color image processing.

**CLO 2:** Apply spatial and frequency domain techniques for image enhancement.

**CLO 3:** Implement image restoration using filtering and degradation models.

**CLO 4:** Perform image segmentation, morphological operations, and compression techniques.

### Course Pedagogy

1. Interactive Lectures and Conceptual Discussions to explain fundamentals of digital image processing, colour models, and image enhancement techniques.
2. Demonstration-Based Teaching using Image Processing Tools to visualize transformations, filtering, and enhancement techniques.
3. Problem-Solving and Analytical Exercises to apply spatial and frequency domain techniques for image enhancement and restoration.

| <b>Course Content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Hours</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br><b>Digital Image Processing:</b> Definition, Applications Of DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Simple Image Formation, Image Sampling and Quantization, Representing Digital Pixels, Image Quality.<br><b>Introduction to Colour Image:</b> Colour Fundamentals, RGB And HSI Models, Pseudo Colour Image Processing. | 10           |
| <b>Unit 2:</b><br><b>Image Enhancement in Spatial Domain:</b> Introduction to Image Enhancement, Basic Grey Level Transforms, Histogram, Histogram-Processing – Equalization and Matching, Enhancement Using Arithmetic/Logic Operations, Spatial Filtering, Smoothing Spatial Filtering, Sharpening Spatial Filtering.                                                                                                                                          | 10           |

|                                                                                                                                                                                                                                                                                                                                                                                            |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Image Transform:</b> Fourier Transform, SHFT, DFT, FFT, DCT, Hadamard Transform, Wavelets transform (CWT, DWT), KLT, SVD, Applications.                                                                                                                                                                                                                                                 |    |
| <b>Unit 3:</b><br><b>Image Enhancement in frequency domain:</b> Smoothing Frequency Domain Filtering, Sharpening Frequency Domain Filtering.<br><b>Image Restoration:</b> Model For Image Degradation/Restoration Process, Noise Model, Mean Filtering, Estimating Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener Filter), Colour Image Smoothing, Sharpening. | 10 |

### Learning Resources:

1. Digital Image Processing- Rafael C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.
2. K. Jain “Fundamental of digital image processing”, Prentice-Hall, 2002.
3. R. C. Gonzalez, R. E. Wood “Digital image processing using MATLAB”, Pearson Education, 2004.
4. M. Sonka, V. Hlavac, R. Boyle, ”Image processing analysis and machine vision” Chapman & Hall, 1998.
5. Digital Image Processing- S. Jayaraman, S. Esakkirajan, T. Veerakumar, Tata McGraw Hill 2014.

### Semester: III

|                                       |                                                  |
|---------------------------------------|--------------------------------------------------|
| <b>Course Code: CAE323 (Elective)</b> | <b>Course Title: E-commerce and E-Governance</b> |
| <b>Course Credits: 02(2:0:0)</b>      | <b>Hours/Week: 02</b>                            |
| <b>Total Contact Hours: 30</b>        | <b>Formative Assessment Marks: 10</b>            |
| <b>Exam Marks: 40</b>                 | <b>Exam Duration: 02</b>                         |

#### Course Learning Outcomes (CLOs):

Upon successful completion of this Course, Students will be able to

**CLO 1:** Understand the fundamentals, models, and infrastructure of E-commerce.

**CLO 2:** Analyze E-commerce strategies, marketing, and real-world applications.

**CLO 3:** Explain E-Governance models, technologies, and service frameworks.

**CLO 4:** Evaluate challenges, innovations, and future trends in E-Governance.

#### Course Pedagogy

1. Interactive Lectures and Conceptual Discussions to introduce fundamentals of e-commerce, business models, infrastructure, and e-governance concepts.
2. Case Studies and Real-world Application Analysis to understand practical implementation of e-commerce strategies and e-governance services.
3. Problem-Solving and Scenario-Based Learning to analyze business strategies, supply chain models, and governance challenges.
4. Seminars, Assignments, and Student Presentations focusing on innovations, future trends, and technological advancements in e-commerce and e-governance.

| <b>Course Contents</b>                                                                                                                                                                                                                                               | <b>Hours</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit-1</b>                                                                                                                                                                                                                                                        |              |
| <b>Introduction to E-commerce:</b> Fundamentals of E-commerce, E-commerce Business Models, E-commerce Infrastructure, E-commerce Security and Payment Systems                                                                                                        | 10           |
| <b>Unit-2</b>                                                                                                                                                                                                                                                        |              |
| <b>E-commerce Strategies and Applications:</b> E-commerce Marketing and Advertising, Supply Chain Management in E-commerce, Emerging Trends in E-Commerce, Applications of E-Commerce                                                                                | 10           |
| <b>Unit-3</b>                                                                                                                                                                                                                                                        |              |
| Introduction to E-Governance, E-Governance Models and Frameworks, Technology and Infrastructure for E-Governance, E- Governance Services and Applications, Challenges in E-Governance, E- Governance in Developing Countries, Emerging Technologies in E-Governance. | 10           |

**Learning Resources:**

1. "E-Commerce 2020: Business, Technology, and Society" by Kenneth C. Laudon and Carol Guercio Traver, Pearson.
2. "Electronic Commerce 2018: A Managerial and Social Networks Perspective" by Efraim Turban, Jon Outland, David King, Jae Lee, Ting-Peng Liang, and Deborrah C. Turban, Springer.
3. "E-Government: Information, Technology, and Transformation" by Hans J. Scholl, Routledge.
4. "E-Governance: Managing or Governing?" by Jeremy Millard, Routledge.
5. "Public Information Technology and E-Governance: Managing the Virtual State" by G. David Garson, Jones & Bartlett Learning.

## Semester: IV

|                                   |                                        |
|-----------------------------------|----------------------------------------|
| <b>Course Code:</b> CAM41T        | <b>Course Title:</b> Computer Networks |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                  |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20  |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03               |

### Course Learning Outcomes (CLOs):

Upon successful completion of this course, student will be able to:

**CLO 1:** Explain digital data transmission between computers.

**CLO 2:** Apply data communication and network types in real life.

**CLO 3:** Compare layers in networking models.

**CLO 4:** Compare protocols in OSI and TCP/IP models.

### Course Pedagogy

1. Interactive Lecture on the concepts of network topologies, ISO/OSI and TCP/IP models, modulation techniques, and network layers.
2. Demonstrate transmission techniques, error detection/correction, and routing algorithms using simulation tools (Packet Tracer, NS2/NS3).
3. Problem-Based Learning to Solve problems on routing algorithms, network congestion control, and transport layer scenarios.
4. Group activities to design LANs, WANs, and simulate network protocols.

| <b>Course Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Hours</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br><b>Introduction:</b> Characteristics-Delivery, Accuracy, Timeliness and Jitter. <b>Components-</b> Message, Sender, Receiver, Transmission medium and protocol, <b>Topology-</b> Mesh, Star, Tree, Bus, Ring and Hybrid Topologies. <b>Transmission modes-</b> Simplex, Half Duplex, Full Duplex. <b>Categories of networks</b> – LAN, WAN, MAN, The ISO/OSI reference model, The TCP/IP reference model.<br><b>Digital- to -Analog Conversion:</b> Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying. | 11           |
| <b>Unit 2:</b><br><b>Analog- to -Analog Conversion:</b> Amplitude Modulation, Frequency Modulation, Phase Modulation. <b>The Physical Layer:</b> Transmission Media – Twisted pair, coaxial cable, optical fiber, radio transmission, microwaves and infrared transmission, Switching – message switching, Multiplexing. Connecting Devices such as Repeater, Hub, Router, Bridge.                                                                                                                                                        | 11           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <p><b>Unit 3:</b></p> <p><b>The Data Link Layer:</b> Data Link Layer design issues, Error detection – Single parity checking, Checksum, polynomial codes – CRC, Error correction- Hamming code, Elementary data link protocols, sliding window protocols</p> <p><b>The Network Layer:</b> Network layer design issues, Routing algorithms – Dijkstra’s shortest path routing. Flooding, Distance vector routing, Hierarchical routing, Link state routing, Congestion, control algorithms – Leaky bucket, token bucket algorithm, admission control, Hop by Hop choke packets.</p> | 11 |
| <p><b>Unit 4:</b></p> <p><b>The Transport Layer and Application Layer:</b> Elements of Transport service, Internet transport protocols (TCP &amp; UDP), Application Layer DNS, Electronic Mailing- Introduction, SMTP, POP3, SNMP, FTP, TELNET and World Wide Web.</p>                                                                                                                                                                                                                                                                                                             | 11 |

### Learning Resources:

1. Data Communication & Networking, Behrouza A Forouzan, McGraw Hill.
2. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education
3. Data and Computer Communications, William Stallings, 10th Edition, Pearson Education, 2017.
4. Data Communication and Computer Networks, Brijendra Singh, 3rd Edition, PHI.
5. Data Communication & Network, Dr. Prasad, Wiley Dreamtech.

## Semester: IV

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b> CAM41P        | <b>Course Title:</b> Networking Lab   |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                 |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03              |

### Course Learning Outcomes (COs):

**Upon successful completion of this course, students will be able to:**

**CLO 1:** Identify and set up basic computer hardware, software, and network configurations.

**CLO 2:** Create and test wired network cables and connect networking devices.

**CLO 3:** Simulate and configure various network topologies using network simulators.

**CLO 4:** Analyze network protocols and services like FTP and wireless LAN through simulation.

### Course Pedagogy

1. Practical demonstrations and hands-on laboratory practice to provide students with fundamental knowledge of computer networking concepts.
2. Demonstrate cable preparation, IP configuration, file sharing, and use of network simulation tools.
3. Hands-on Laboratory Practice to perform networking experiments such as cable crimping, network configuration, topology implementation and simulation exercises.
4. Problem Solving Approach to troubleshoot network configuration problems

### Laboratory Program List

#### Part- A

1. Prepare hardware and software specification for basic computer system and Networking.
2. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
3. Identifying the networking devices on a network.
4. Configure the IP address of the computer.
5. Create a basic network and share file and folders.
6. Study of basic network command and Network configuration commands.
7. Installation process of any open-source network simulation software.

#### Part-B

1. Implement connecting two nodes using network simulator.
2. Implement connecting three nodes considering one node as a central node using network simulator. Implement a network to connect three nodes considering one node as a central node

using network simulator

3. Implement bus topology using network simulator.
4. Implement star topology using network simulator.
5. Implement ring topology using network simulator.
6. Demonstrate the use of wireless LAN using network simulator.
7. Implement FTP using TCP bulk transfer using network simulator.
8. Implement connecting multiple routers and nodes and building a Hybrid topology network simulator.

**Links for open-source simulation software:**

NS3 software: <https://www.nsnam.org/releases/ns-3-30/download/> Packet Tracer

Software: <https://www.netacad.com/courses/packet-tracer> GNS3 software:

<https://www.gns3.com/>

**Evaluation Scheme for Lab Examination**

| Assessment Criteria Marks            |                                | Marks |
|--------------------------------------|--------------------------------|-------|
| Writing                              | One Program from Part A        | 15    |
|                                      | One Program from Part B        | 15    |
| Execution                            | Any one of the Written Program | 5     |
| Viva Voce based on Computer Networks |                                | 5     |
| Total                                |                                | 40    |

**Semester: IV**

|                                   |                                         |
|-----------------------------------|-----------------------------------------|
| <b>Course Code:</b> CAM42T        | <b>Course Title:</b> Python Programming |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                   |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20   |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                |

**Course Learning Outcomes (CLOs):**

**Upon successful completion of this course, students will be able to:**

**CLO 1:** Demonstrate basic Python programs using control structures and arrays.

**CLO 2:** Use functions, strings, lists, and dictionaries in Python.

**CLO 3:** Apply OOP, file handling, and exception handling concepts.

**CLO 4:** Build GUI apps, work with databases, and visualize data using Python libraries.

**Course Pedagogy**

1. Interactive Lecture sessions to explore the Core Python concepts
2. Problem Solving Based Learning by providing logical and real-world programming problems to develop analytical and computational thinking.
3. Assessment through assignments, coding exercises, seminars, quizzes

| <b>Course Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Hours</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br><b>Introduction:</b> Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions-Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples. <b>Python Conditional Statement:</b> Conditional Statements - if, if else, elif, if elif else, match case, looping Statements- while loop, for loop Statement; break, continue statements, range () and exit () functions. <b>Arrays:</b> Definition, syntax, accessing the elements of an arrays, array methods.               | 11           |
| <b>Unit 2:</b><br><b>Python Functions:</b> Types of Functions; Defining Functions, Calling Functions, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions. <b>Strings:</b> Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods. <b>Lists:</b> Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists. <b>Dictionaries:</b> Creating Dictionaries; Operations on Dictionaries; | 11           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
| <b>Unit 3:</b><br><b>Tuples and Sets:</b> Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods. <b>File Handling:</b> File Types, Operations on Files– Opening and Closing files, Reading and Writing files: write( ) and write lines( ) methods, append() method, read( )and read lines( )methods, with keyword, Splitting words, Renaming and deleting files.<br><b>Object Oriented Programming:</b> Classes and Objects; Creating Classes and Objects; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Constructor, types of constructors, Inheritance - Single and Multiple Inheritance, Multilevel and Multipath Inheritance. | 11 |
| <b>Unit 4:</b><br><b>GU Interface:</b> The tkinter Module; Window and Widgets; Layout Management- pack, grid and place. <b>Python SQLite:</b> The SQLite3 module; SQLite Methods- connect, cursor, execute, close; Connect to Database; Create Table; Operations on Tables- Insert, Select, Update. Delete and Drop Records. <b>Data Analysis:</b> NumPy - Introduction to NumPy, Array Creation using NumPy, Operations on Arrays; Pandas- Introduction to Pandas, Series and Data Frames, Creating Data Frames from Excel Sheet and .csv file, Dictionary and Tuples. Operations on Data Frames. <b>Data Visualization:</b> Introduction to Data Visualization; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart, Histogram & Pie chart. | 11 |

### Learning Resources:

1. Python Programming: Using Problem Solving Approach by Reema Thareja, Oxford University Press, 2nd Edition, 2023.
2. Learning Python by Mark Lutz, O'Reilly Media, 5th Edition, 2013.
3. Python: The Complete Reference by Martin C. Brown, McGraw-Hill Education, 2nd Edition, 2018.
4. Python for Data Analysis by Wes McKinney, O'Reilly Media, 3rd Edition, 2022.
5. Head First Python by Paul Barry, O'Reilly Media, 3rd Edition, 2023.
6. Advance Core Python Programming, Meenu Kohli, BPB Publications, 2021.

## Semester: IV

|                                   |                                             |
|-----------------------------------|---------------------------------------------|
| <b>Course Code:</b> CAM42P        | <b>Course Title:</b> Python Programming Lab |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                       |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10       |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                    |

### Course Learning Outcomes (CLOs):

Upon successful completion of this course, students will be able to:

- CLO 1:** Apply basic Python syntax and logic.
- CLO 2:** Use data structures and functions effectively.
- CLO 3:** Build apps with Tkinter, SQLite, NumPy, Matplotlib, and Pandas.
- CLO 4:** Solve real-world problems using modular Python code.

### Course Pedagogy

1. Demonstrate Python scripts such as leap year checking, Fibonacci series, quadratic equation solving, list operations and data visualization techniques.
2. Hands-on Laboratory Practice to implement Python scripts individually to gain practical knowledge of programming logic and syntax.
3. Experiment-Based Learning to perform structured experiments involving strings, lists, tuples, dictionaries, error handling
4. Problem Solving Approach to develop logical thinking through exercises

### Laboratory Program List

#### Part-A

1. Python script for checking the given year is leap year or not.
2. Python script to check if a number belongs to the Fibonacci Sequence
3. Python script to solve Quadratic Equations
4. Python script to display all numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.
5. Python script to display Multiplication Tables
6. Python script to create a calculator program
7. Explore string functions
8. Implementation of python script that takes a list of words and returns the length of the longest one.
9. Python script handles multiple errors with one except statement.
10. Python script to check whether password is valid or not.  
Conditions for a valid password are:
  - Should have at least one number.
  - Should have at least one uppercase and one lowercase character.
  - Should have at least one special symbol.

- Should be between 6 to 20 characters long.

### Part-B

1. Implement python script to remove duplicates from a list.
2. Implement python script to find the repeated items of a tuple.
3. Implement python script to check whether a given key already exists or not in a dictionary.
4. Write a python script to implement method overloading.
5. Create SQLite Database and Perform Operations on Tables.
6. Create a GUI using Tkinter module.
7. Drawing Line chart and Bar chart using Matplotlib.
8. Drawing Histogram and Pie chart using Matplotlib.
9. Create Array using NumPy and Perform Operations on Array.
10. Create DataFrame from Excel sheet using Pandas and Perform Operations on DataFrames.

### Evaluation Scheme for Lab Examination

| Assessment Criteria Marks             |                                | Marks     |
|---------------------------------------|--------------------------------|-----------|
| Writing                               | One Program from Part A        | 15        |
|                                       | One Program from Part B        | 15        |
| Execution                             | Any one of the Written Program | 5         |
| Viva Voce based on Python Programming |                                | 5         |
| <b>Total</b>                          |                                | <b>40</b> |

## Semester: IV

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b> CAM43T        | <b>Course Title:</b> PHP & MySQL      |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                 |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20 |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03              |

### Course Learning Outcomes (CLOs):

Upon successful completion of this course, students will be able to:

**CLO 1:** Understand PHP basics, syntax, variables, data types, and control structures.

**CLO 2:** Use arrays, functions, and strings to create dynamic PHP programs.

**CLO 3:** Apply object-oriented concepts and exception handling in PHP.

**CLO 4:** Build web applications using forms, sessions, and MySQL with PHP.

### Course Pedagogy

1. Class room Lectures session on Fundamental concepts
2. Demonstration Method to demonstrate PHP program execution
3. Problem Solving Approach to solve exercises related to arrays, functions, strings, exception handling and database queries.
4. Group discussions, seminars to design and test web pages and debug errors

| Course Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Hours |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Unit 1:</b><br><b>Introduction to PHP:</b> Introduction to PHP, History and Features of PHP, Installation & Configuration of PHP, Embedding PHP code in Your Web Pages, Understanding PHP, HTML and White Space, Comments in PHP, Sending Data to the Web Browser, Data types, Keywords, Variables, Constants in PHP, Expressions in PHP, Operators in PHP. <b>Conditional statements:</b> if, if-else, switch, The? Operator, <b>Looping statements:</b> while Loop, do-while Loop, for Loop, foreach loop, break, continue. | 11    |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <p><b>Unit 2:</b></p> <p><b>Arrays in PHP:</b> Definition, Creating, Accessing Array, <b>Types of Arrays:</b> Indexed, Associative arrays, Multidimensional arrays, Accessing Array, Manipulating Arrays, displaying array, Array Functions.</p> <p><b>Using Functions in PHP:</b> Definition, Creating, invoking, user-defined functions, Formal parameters, actual parameters, Function and variable scope, Recursion, Library functions, Date and Time Functions.</p> <p><b>Strings in PHP:</b> Definition, Creating, Declaring, formatting strings, String Functions.</p>                                                                                | 11 |
| <p><b>Unit 3:</b></p> <p><b>Object Oriented Concepts:</b> Definition, Creation, Declaration, Accessing of Class &amp; Object, Object properties, Object methods, <b>Constructor:</b> Definition, Types, Destructor, <b>Polymorphism:</b> Method Overloading, Property Overloading. Access Specifiers <b>Inheritance:</b> Definition, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Interfaces, Abstract Class, Overriding.</p> <p><b>Exception Handling:</b> try, catch, multi try, multi catch, throw, finally.</p>                                                                                                                 | 11 |
| <p><b>Unit 4:</b></p> <p><b>Form Handling:</b> Creating HTML Form, Handling HTML Form data in PHP. File Inclusion (Include ( )), Require ( )).</p> <p><b>Session Handling:</b> Definition, session_start (), session_id (), session_destroy () session variables.</p> <p><b>Database Handling Using PHP with MySQL:</b> Introduction to MySQL: Database terms, Data Types.</p> <p><b>Accessing MySQL</b> –Using MySQL Client and Using php MyAdmin, MySQL Commands, Using. PHP MySQL Functions, connecting to MySQL and Selecting the Database, Executing Simple Queries, Retrieving Query Results, Counting Returned Records, Updating Records with PHP</p> | 11 |

### Learning Resources:

1. PHP and MySQL Web Development: Luke Welling, Laura Thomson, Addison-Wesley, 5th Edition, 2016.
2. Learning PHP, MySQL & JavaScript: Robin Nixon, O'Reilly Media, 6th Edition, 2021.
3. Beginning PHP and MySQL: From Novice to Professional – W. Jason Gilmore, Apress, 4th Edition, 2010.

**Semester: IV**

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b> CAM43P        | <b>Course Title:</b> PHP & MySQL Lab  |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                 |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03              |

**Course Learning Outcomes (CLOs):**

**Upon successful completion of this course, students will be able to:**

- CLO 1:** Implement syntax, control structures, and loop constructs to solve problems.
- CLO 2:** Apply arrays, functions, and string operations to build dynamic web features.
- CLO 3:** Implement object-oriented programming and exception handling in PHP.
- CLO 4:** Develop interactive web applications with form handling, sessions, and MySQL integration.

**Course Pedagogy**

1. Hands-on Programming Practice to write and execute PHP scripts to develop logical thinking and practical programming skills.
2. Application-Based Learning to develop small web applications such as admission forms, login forms and session-based applications.
3. Problem Solving Method to solve programming exercises like palindrome checking, factorial calculation, Fibonacci series and array manipulation.

**Laboratory Program List****Part-A**

1. Write a PHP script to find the maximum among three given numbers.
2. Write a PHP script to calculate the factorial of a given number.
3. Write a PHP script to check whether a given number is a palindrome.
4. Write a PHP script to reverse a given number and compute the sum of its digits.
5. Write a PHP script to generate a Fibonacci series using a recursive function.
6. Write a PHP script to demonstrate at least seven string functions.
7. Write a PHP script to demonstrate the functionality of date and time functions in PHP.
8. Write a PHP script to insert a new element into an array at a specified position.

**Part-B**

1. Write a PHP script to demonstrate the use of constructors and destructors in a class.
2. Write a PHP script to demonstrate Multilevel Inheritance.
3. Write a PHP script to demonstrate exception handling by catching a divide-by-zero exception.
4. Write a PHP script to handle form data using the POST method.
5. Write a PHP script to demonstrate session handling by storing and displaying username and user role using session variables.
6. Write a PHP script to create a new database using MySQL and PHP.

7. Write a PHP script to create a table in a MySQL database & insert data using PHP.
8. Develop a PHP application to design a college admission form and store the submitted data into a MySQL database.

#### **Evaluation Scheme for Lab Examination**

| <b>Assessment Criteria Marks</b> |                                | <b>Marks</b> |
|----------------------------------|--------------------------------|--------------|
| Writing                          | One Program from Part A        | 15           |
|                                  | One Program from Part B        | 15           |
| Execution                        | Any one of the Written Program | 5            |
| Viva Voce based on PHP & MySQL   |                                | 5            |
| <b>Total</b>                     |                                | <b>40</b>    |

## Semester: IV

|                                        |                                                   |
|----------------------------------------|---------------------------------------------------|
| <b>Course Code: CAE4E11 (Elective)</b> | <b>Course Title: Fundamentals of Data Science</b> |
| <b>Course Credits: 02(2:0:0)</b>       | <b>Hours/Week: 02</b>                             |
| <b>Total Contact Hours: 30</b>         | <b>Formative Assessment Marks: 10</b>             |
| <b>Exam Marks: 40</b>                  | <b>Exam Duration: 02</b>                          |

### Course Learning Outcomes (CLOs):

**Upon successful completion of this course, students will be able to:**

- CLO 1:** Explain key concepts of data mining, KDD, and its real-world applications.
- CLO 2:** Apply data preprocessing and perform frequent pattern mining using Apriori and FP-Growth.
- CLO 3:** Implement and evaluate classification techniques and prediction models.
- CLO 4:** Apply clustering methods and evaluate clustering results.

### Course Pedagogy

1. Interactive Lectures session on Core concepts using Chalk board and presentations.
2. Case Study Based Learning on Real-world applications of data mining.
3. Problem Solving Approach to solve numerical problems related to support, confidence, confusion matrix and clustering.
4. Interactive Discussions on challenges, issues and ethical aspects of data mining.
5. Assignments, seminars and presentations

| <b>Course Content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Hours</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br><b>Data Mining:</b> Introduction, Data Mining Definitions, Steps in Knowledge Discovery in Databases (KDD), Kinds of Data That Can Be Mined in Data Mining, DM functionalities –kinds of patterns can be mined, KDD Vs Data Mining, DBMS Vs Data Mining, DM techniques, Problems, Issues and Challenges in DM, DM applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 10           |
| <b>Unit 2:</b><br><b>Data Warehouse:</b> Introduction, Definition, Data Warehousing: Three Tier Architecture, Multidimensional Data Model, Schemas for Multidimensional Data Models, OLAP Operations, <b>Data Cleaning:</b> Introduction, types of data cleaning tasks (handling missing values, handling noisy data), <b>Data Integration:</b> Introduction, Challenges, <b>Data reduction:</b> Introduction, Strategies, <b>Data Transformation:</b> Introduction, Strategies, Data Transformation by Normalization.<br><b>Mining Frequent Patterns:</b> Basic Concepts (Items, Itemset, Support, Confidence, Maximal Itemset, Closed Itemset), - Association Rule, Mining Association Rules, Frequent Item Set Mining Methods -Apriori and Frequent Pattern Growth (FPGrowth) algorithms. Vertical Data Format in Frequent Itemset Mining. | 10           |

|                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit 3:</b><br><b>Classification:</b> Basic Concepts, Issues, <b>Algorithms:</b> Decision Tree Induction, Attribute Selection Measures, Bayes Classification Methods, Rule-Based Classification, Lazy Learners (or Learning from your Neighbours), k Nearest Neighbour. Metrics for Evaluating Classifier Performance (Precision and Recall), Confusion Matrix. <b>Clustering:</b> Cluster Analysis, K-Means clustering. | 10 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|

### Learning Resources:

1. Jiawei Han and Micheline Kamber – “Data Mining Concepts and Techniques” Second Edition Morgan Kaufmann Publishers.
2. Arun K Pujari – “Data Mining Techniques” 4th Edition, Universities Press
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2012.
4. K.P. Soman, Shyam Diwakar, V.Ajay: Insight into Data Mining – Theory and Practice, PHI

**Semester: IV**

|                                        |                                         |
|----------------------------------------|-----------------------------------------|
| <b>Course Code: CAE4E12 (Elective)</b> | <b>Course Title: Internet of Things</b> |
| <b>CourseCredits:02(2:0:0)</b>         | <b>Hours/Week:02</b>                    |
| <b>Total Contact Hours:30</b>          | <b>Formative Assessment Marks: 10</b>   |
| <b>ExamMarks:40</b>                    | <b>ExamDuration:02</b>                  |

**Course Learning Outcomes (CLOs):**

**Upon successful completion of this course, students will be able to:**

- CLO 1:** Define key concepts, architecture, and challenges of IoT.
- CLO 2:** Explain the role of sensors, actuators, and communication in IoT networks.
- CLO 3:** Illustrate the use of IoT protocols and data analytics tools.
- CLO 4:** Apply IoT concepts to basic smart city use cases.

**Course Pedagogy**

- Interactive Lectures session on using Chalk board and PPTs
- Demonstrations of IoT components such as sensors, smart devices and communication models will be conducted using diagrams, videos and simulation tools.
- Case Study Based Learning on Real-world IoT applications such as smart cities, smart homes and industrial IoT will be discussed to provide practical exposure.
- Problem Solving Approach to analyze IoT challenges such as security, scalability and interoperability.
- Group discussions and seminars on emerging IoT technologies and trends.
- Industrial visits to Explore IoT applications

| <b>Course Content</b>                                                                                                                                                                                                                                                                                                               | <b>Hours</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br><b>Introduction to IoT:</b> Definition, IoT and Digitization, IoT impact, convergence of IT and OT, IoT Challenges, Comparing IoT Architectures, Core IoT Functional stack, IoT data management and compute stack.                                                                                                | 10           |
| <b>Unit 2:</b><br><b>IoT Networks:</b> Sensors Actuators and smart objects, sensor networks, communication criteria, IoT Access Technologies, need for optimization, optimizing IP for IoT.                                                                                                                                         | 10           |
| <b>Unit 3:</b><br><b>Application Protocols:</b> The transport Layer, IoT Application Transport Methods, Data Analytics for IoT, Machine Learning, Big data Analytics tools and technology, network analytics.<br><b>IoT in Industry:</b> Smart and connected cities – IoT strategy for smarter cities, smart city IoT architecture. | 10           |

**Learning Resources:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Inter of Things" 1<sup>st</sup> Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 9789386873743)
2. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill. 2nd edition June 2022.
3. Arsheep Bahga, Vijay Madisetti, Internet Of Things - A Hands-On Approach, Orient Blackswan Private Limited, 2015.

## Semester: IV

|                                        |                                       |
|----------------------------------------|---------------------------------------|
| <b>Course Code: CAE4E13 (Elective)</b> | <b>Course Title: Software Testing</b> |
| <b>CourseCredits:02(2:0:0)</b>         | <b>Hours/Week:02</b>                  |
| <b>Total Contact Hours:30</b>          | <b>Formative Assessment Marks: 10</b> |
| <b>ExamMarks:40</b>                    | <b>ExamDuration:02</b>                |

### Course Learning Outcomes (CLOs):

**Upon successful completion of this course, students will be able to:**

**CLO 1:** Understand basics of software testing and test case design.

**CLO 2:** Apply decision table and data flow testing methods.

**CLO 3:** Analyze integration and system testing techniques.

**CLO 4:** Evaluate object-oriented and GUI testing approaches.

### Course Pedagogy

1. Interactive Lectures session on using Chalk board and PPTs.
2. Demonstrations of IoT components such as sensors, smart devices and communication models will be conducted using diagrams, videos and simulation tools.
3. Case Study Based Learning on Real-life examples such as the Triangle Problem, Next Date function, Commission Problem smart homes and industrial IoT will be discussed to provide practical exposure.
4. Problem Solving Approach to analyze software problems and identify appropriate testing strategies
5. Group discussions and seminars and peer review of test cases and testing strategies to encourage collaborative problem-solving.

| <b>Course Content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br><b>Basics of Software Testing and Examples:</b> Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing, Generalized pseudo code, The triangle problem, The Next Date function, The commission problem, The SATM (Simple Automatic Teller Machine) problem.<br><b>Decision Table-Based Testing:</b> Decision tables, Test cases for the triangle problem, Test cases for the Next Date function, Test cases for the commission problem. | 10           |
| <b>Unit 2:</b><br><b>Data Flow Testing:</b> Definition-Use testing, Slice-based testing, Guidelines and observations. <b>Life Cycle-Based Testing:</b> Traditional Waterfall Testing, Testing in Iterative Life Cycles, Agile Testing, <b>Model-Based Testing:</b> Testing Based on Models, Peterson's Lattice, Expressive Capabilities of Mainline Models, Modeling Issues, Making Appropriate Choices. <b>Integration Testing:</b> Introduction, Decomposition-based, call graph-based, Path-based integrations.                   | 10           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit 3:</b><br><b>System Testing:</b> Definition, Possibilities, Basic concepts for requirements specification, Model-Based Threads, Use Case-Based Threads, ASF (Atomic System Functions). <b>Object-Oriented Testing:</b> Units for object-oriented testing, Implications of composition and encapsulation, inheritance, and polymorphism, Levels of object-oriented testing, GUI testing, Dataflow testing for object-oriented software <b>Class Testing:</b> Methods as units, Classes as units. | 10 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|

#### **Learning Resources:**

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications.
2. Aditya P Mathur: Foundations of Software Testing, Pearson.
3. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, 1st edition, John Wiley & Sons.
4. Srinivasan Desikan, Gopalaswamy Ramesh: Software testing Principles and Practices.

**Semester: IV**

|                                                    |                                                |
|----------------------------------------------------|------------------------------------------------|
| <b>Course Code: CSCP41P<br/>(Compulsory Paper)</b> | <b>Course Title: Digital Marketing<br/>LAB</b> |
| <b>Course Credits: 02 (0:0:2)</b>                  | <b>Hours/Week: 04</b>                          |
| <b>Total Contact Hours: 60</b>                     | <b>Formative Assessment Marks: 10</b>          |
| <b>Exam Marks: 40</b>                              | <b>Exam Duration: 03</b>                       |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

**CLO 1:** Identify and differentiate various digital marketing channels and tools.

**CLO 2:** Create and optimize social media profiles, content, and promotional Campaigns.

**CLO 3:** Design marketing content for different platforms including email, social Media, and mobile.

**CLO 4:** Analyze digital advertisements, campaigns, and metrics to evaluate Effectiveness.

**CLO 5:** Develop and implement a digital marketing plan for real-world business scenarios.

**CLO 6:** Conduct surveys and research to understand digital tool adoption in small businesses.

**Course Pedagogy**

1. Perform hands-on exercises: social media profile creation, content design, campaign planning, and survey preparation.
2. Demonstrate the use of tools such as Canva, Google Ads, WordPress, and email marketing platforms.
3. Implement a mini-project simulating a digital marketing campaign.
4. Analyze and present campaign results.
5. Group activities for campaign design, content planning, and survey analysis.

**List of Practical experiments****Activity 1: Digital Marketing Channel Identification**

- I. List out at least 5 companies (example: Amazon, Flipkart, Myntra).
- II. Identify what digital marketing channels they use:
  - a. Website
  - b. Social media
  - c. Email marketing
  - d. Mobile apps

**Activity 2: Social Media Profile Creation**

- I. Create a sample business profile on any platform (Instagram/Facebook/LinkedIn).
- II. Design:
  - a. Profile name
  - b. Logo
  - c. Bio

- d. 3 promotional posts

**Activity 3: Content Creation Activity**

Create the following using canva/power point/any free design tool

- a. One promotional post, b. One educational post, c. One product advertisement

**Activity 4: Digital Marketing Strategy Preparation**

Prepare a digital marketing plan for:

- I. A college event
- II. A new product
- III. A startup idea

**Activity 5: Select one advertisement from YouTube or Instagram. and Identify:**

- a. Target audience
- b. Marketing objective
- c. Type of content
- d. Strengths

**Activity 6: Create the Digital Marketing Webpage**

**Activity 7: Digital Marketing Implementation in Business Scenario**

**Activity 8: Advertising through Google Ads**

**Activity 9: Creating Promotional banner through Canva**

**Activity 10: Digital Marketing Implementation in Business Scenario**

**Activity 11: Prepare a survey Report on usage of digital tools in their business in nearby shops**

**Evaluation Scheme for Lab Examination**

| Assessment Criteria |                              | Marks     |
|---------------------|------------------------------|-----------|
| Writing             | Any two activities           | 15        |
|                     |                              | 15        |
| Result              | Implementation and Execution | 5         |
| Viva Voce           |                              | 5         |
| <b>Total</b>        |                              | <b>40</b> |

➤ **CIE, SEE and QP Pattern for Theory Courses (2 Credits):**

**Total Lecture hours per paper: 30, No. of Units: 3 (10 Hours Each)**

**Internal Assessment: C1 - 5 Marks, C2 - 5 Marks**

**Semester End Theory Exam: C3 - 40 Marks**

➤ **Question paper pattern for Theory Courses (2 Credits):**

**Maximum Marks – 40**

**Part A: Answer any 5 questions out of 6: (5x2=10 Marks)**

**Question No. 1 to 6**

**Part B: Answer the following questions: (10x3=30 Marks)**

**7.a) 7. b) or 7. c) 7. d)**

**8.a) 8 .b) or 8. c) 8. d)**

**9.a) 9.b) or 9. c) 9. d)**

➤ **CIE, SEE and QP Pattern for Theory Courses (3 Credits):**

**Total Lecture hours per paper: 44**

**No. of Units: 4 (11 Hours Each)**

**Internal Assessment: C1 -10 Marks, C2 - 10 Marks**

**Semester End Theory Exam: C3 - 80 Marks**

➤ **Question paper pattern for Theory Courses (3 Credits):**

**Instructions: Answer Part-A and Part-B:**

**Part-A**

**Answer any 10 out of 12 Questions (3 Questions drawn from each unit).**

**Each question carries 2 Marks. (10 X 2 =20)**

**Q. No. 1 to Q. No. 12.**

**Part-B**

**Answer all the Questions. Each question carries 15 Marks. (4 X 15 =60)**

**(Each question with internal choice and with maximum of 3 sub question)**

## **Programme Learning Outcomes (PLOs)**

### **PLO 1: Computational Knowledge**

Apply the knowledge of computing fundamentals, mathematics, and domain concepts to solve complex computing problems in areas such as operating systems, computer networks, algorithms, artificial intelligence, and data analytics.

### **PLO 2: Problem solving skills**

Identify, formulate, and analyze complex computing problems using logical reasoning, algorithmic thinking, and appropriate computational techniques.

### **PLO 3: Modern Tool Usage**

Select and apply modern tools, technologies, and platforms such as AI tools, data analytics software, block chain systems, and visualization tools for effective problem-solving.

### **PLO 4: Experimentation & Data Analysis**

Conduct experiments, analyze data, and interpret results using statistical, computational, and visualization techniques to support decision-making.

### **PLO 5: Professional Ethics & Security**

Apply ethical principles and commit to professional responsibilities, including data security, privacy, and legal compliance in computing practices.

### **PLO 6: Team Work**

Function effectively as a member or leader in multidisciplinary teams to accomplish shared goals.

### **PLO 7: Project Management**

Apply project management principles, including planning, scheduling, risk management, and resource allocation in software and IT projects.

## **Sustainable Development Goals (SDGs)**

**SDG 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

**SDG 5:** Achieve gender equality and empower all women and girls.

**SDG 9:** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**SDG 13:** Take urgent action to combat climate change and its impacts.

## PLOs – COURSE COMPLIANCE MATRIX

| Sl. No. | Course Title                                   | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 |
|---------|------------------------------------------------|------|------|------|------|------|------|------|
| 1       | Digital Computer Organization                  | ✓    | ✓    | ✓    | ✓    | -    | -    | -    |
| 2       | Office Automation and HTML                     | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | -    |
| 3       | Problem Solving using C++                      | ✓    | ✓    | ✓    | ✓    | ✓    | -    | -    |
| 4       | C++ Programming                                | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | -    |
| 5       | Mathematical and Statistical Computing         | ✓    | ✓    | ✓    | ✓    | -    | -    | -    |
| 6       | Mathematical and Statistical Computing using R | ✓    | ✓    | ✓    | ✓    | ✓    | -    | -    |
| 7       | Data Structures                                | ✓    | ✓    | -    | ✓    | -    | ✓    | -    |
| 8       | Data Structures using C++                      | ✓    | ✓    | -    | ✓    | -    | ✓    | -    |
| 9       | Object Oriented Programming with Java          | ✓    | ✓    | ✓    | ✓    | -    | ✓    | -    |
| 10      | Programming with Java                          | ✓    | ✓    | ✓    | ✓    | -    | ✓    | -    |
| 11      | Operating Systems                              | ✓    | ✓    | -    | ✓    | -    | ✓    | -    |
| 12      | Shell Programming                              | ✓    | ✓    | -    | ✓    | -    | ✓    | -    |
| 1       | C#.NET Programming                             | ✓    | ✓    | ✓    | ✓    | ✓    | -    | ✓    |
| 2       | C#.NET Programming Lab                         | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |
| 3       | Database Management System                     | ✓    | ✓    | ✓    | ✓    | ✓    | -    | -    |
| 4       | DBMS Lab                                       | ✓    | ✓    | ✓    | ✓    | -    | ✓    | -    |
| 5       | Web Technologies                               | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |
| 6       | Web Technologies Lab                           | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |
| 7       | Cyber Security                                 | ✓    | ✓    | ✓    | -    | ✓    | -    | -    |
| 8       | Software Engineering                           | ✓    | ✓    | ✓    | -    | ✓    | ✓    | ✓    |
| 9       | System Software                                | ✓    | ✓    | -    | -    | -    | ✓    | -    |
| 10      | Cloud Computing                                | ✓    | ✓    | ✓    | ✓    | -    | -    | -    |
| 11      | Digital Image Processing                       | ✓    | ✓    | ✓    | ✓    | -    | -    | -    |
| 12      | E-Commerce and E-Governance                    | ✓    | ✓    | ✓    | -    | ✓    | -    | -    |
| 13      | Computer Networks                              | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | -    |
| 14      | Computer Networks Lab                          | ✓    | ✓    | ✓    | ✓    |      | ✓    | -    |

|    |                              |   |   |   |   |   |   |   |
|----|------------------------------|---|---|---|---|---|---|---|
| 15 | Python Programming           | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 16 | Python Programming Lab       | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ |
| 17 | PHP & MySQL                  | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ |
| 18 | PHP & MySQL Lab              | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
| 19 | Fundamentals of Data Science | ✓ | ✓ | ✓ | ✓ | ✓ | - | - |
| 20 | Internet of Things           | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - |
| 21 | Software Testing             | ✓ | ✓ | ✓ | ✓ | ✓ | - | - |
| 22 | Digital Marketing LAB        | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

### SUSTAINABLE DEVELOPMENT GOALS (SDGs) – COURSE MAPPING

| Sl. No. | Course Title                                   | SDG4 | SDG5 | SDG9 | SDG13 |
|---------|------------------------------------------------|------|------|------|-------|
| 1       | Digital Computer Organization                  | ✓    | ✓    | ✓    | -     |
| 2       | Office Automation and HTML                     | ✓    | ✓    | ✓    | -     |
| 3       | Problem Solving using C++                      | ✓    | -    | ✓    | -     |
| 4       | C++ Programming                                | ✓    | -    | ✓    | -     |
| 5       | Mathematical and Statistical Computing         | ✓    | ✓    | ✓    | -     |
| 6       | Mathematical and Statistical Computing using R | ✓    | ✓    | ✓    | -     |
| 7       | Data Structures                                | ✓    | ✓    | ✓    | -     |
| 8       | Data Structures using C++                      | ✓    | ✓    | ✓    | -     |
| 9       | Object Oriented Programming with Java          | ✓    | ✓    | ✓    | -     |
| 10      | Programming with Java                          | ✓    | ✓    | ✓    | -     |
| 11      | Operating Systems                              | ✓    | ✓    | ✓    | -     |
| 12      | Shell Programming                              | ✓    | ✓    | ✓    | -     |
| 1       | C#.NET Programming                             | ✓    | ✓    | ✓    | -     |
| 2       | C#.NET Programming Lab                         | ✓    | ✓    | ✓    | -     |
| 3       | Database Management System                     | ✓    | -    | ✓    | -     |
| 4       | DBMS Lab                                       | ✓    | -    | ✓    | -     |
| 5       | Web Technologies                               | ✓    | ✓    | ✓    | -     |
| 6       | Web Technologies Lab                           | ✓    | ✓    | ✓    | -     |
| 7       | Cyber Security                                 | ✓    | ✓    | ✓    | -     |
| 8       | Software Engineering                           | ✓    | -    | ✓    | -     |
| 9       | System Software                                | ✓    | ✓    | -    | -     |

|           |                                     |   |   |   |     |
|-----------|-------------------------------------|---|---|---|-----|
| <b>10</b> | <b>Cloud Computing</b>              | ✓ | ✓ | ✓ | -   |
| <b>11</b> | <b>Digital Image Processing</b>     | ✓ | - | ✓ | -   |
| <b>12</b> | <b>E-Commerce and E-Governance</b>  | ✓ | - | ✓ | -   |
| <b>13</b> | <b>Computer Networks</b>            | ✓ | ✓ | ✓ | ✓   |
| <b>14</b> | <b>Computer Networks Lab</b>        | ✓ | - | ✓ | ✓   |
| <b>15</b> | <b>Python Programming</b>           | ✓ | - | ✓ | ✓   |
| <b>16</b> | <b>Python Programming Lab</b>       | ✓ | - | ✓ | ✓   |
| <b>17</b> | <b>PHP &amp; MySQL</b>              | ✓ | ✓ | ✓ | -   |
| <b>18</b> | <b>PHP &amp; MySQL Lab</b>          | ✓ | ✓ | ✓ | -   |
| <b>19</b> | <b>Fundamentals of Data Science</b> | ✓ | - | ✓ | ✓ - |
| <b>20</b> | <b>Internet of Things</b>           | ✓ | - | ✓ | ✓   |
| <b>21</b> | <b>Software Testing</b>             | ✓ | - | ✓ | -   |
| <b>22</b> | <b>Digital Marketing LAB</b>        | ✓ | ✓ | ✓ | ✓   |

# **Annexure-B**

## **BCA**

### **Fifth and Sixth Semesters Syllabus, 2026-27**

#### **University of Mysore**

**Curriculum**  
**Program: BCA**  
**Subject: Computer Applications**

| Semester | Course No. | Theory/<br>Practical            | Credits | L-T-P | No. of<br>Hours | Paper Title                             | Marks |     |
|----------|------------|---------------------------------|---------|-------|-----------------|-----------------------------------------|-------|-----|
|          |            |                                 |         |       |                 |                                         | SEE   | CIE |
| V        | CAM51T     | Theory                          | 03      | 3-0-0 | 03              | Network Security                        | 80    | 20  |
|          | CAM51P     | Practical                       | 02      | 0-0-2 | 04              | Network Security Lab                    | 40    | 10  |
|          | CAM52T     | Theory                          | 03      | 3-0-0 | 03              | Design and Analysis of Algorithms       | 80    | 20  |
|          | CAM52P     | Practical                       | 02      | 0-0-2 | 04              | Design and Analysis of Algorithms Lab   | 40    | 10  |
|          | CAM53T     | Theory                          | 03      | 3-0-0 | 03              | Computer Graphics & Multimedia          | 80    | 20  |
|          | CAM53P     | Practical                       | 02      | 0-0-2 | 04              | Computer Graphics & Multimedia Lab      | 40    | 10  |
|          | CAM54T     | Theory                          | 03      | 3-0-0 | 03              | Blockchain Technology                   | 80    | 20  |
|          | CAM55T     | Theory                          | 03      | 3-0-0 | 03              | Enterprise Resource Planning            | 80    | 20  |
|          | CAM56T     | Theory                          | 03      | 3-0-0 | 03              | Fundamentals of Artificial Intelligence | 80    | 20  |
|          | CACP51P    | Practical<br>(Compulsory Paper) | 02      | 0-0-2 | 04              | AI Tools and its applications           | 40    | 10  |

| Semester | Course No. | Theory/<br>Practical                | Credits | L-T-P | No. of<br>Hours | Paper Title                            | Marks |     |
|----------|------------|-------------------------------------|---------|-------|-----------------|----------------------------------------|-------|-----|
|          |            |                                     |         |       |                 |                                        | SEE   | CIE |
| VI       | CAM61T     | Theory                              | 03      | 3-0-0 | 03              | Scientific Computing<br>Techniques     | 80    | 20  |
|          | CAM61P     | Practical                           | 02      | 0-0-2 | 04              | Scientific Computing<br>Techniques Lab | 40    | 10  |
|          | CAM62T     | Theory                              | 03      | 3-0-0 | 03              | Big Data Analytics                     | 80    | 20  |
|          | CAM62P     | Practical                           | 02      | 0-0-2 | 04              | Big Data Analytics Lab                 | 40    | 10  |
|          | CAM63T     | Theory                              | 03      | 3-0-0 | 03              | Web Content<br>Management System       | 80    | 20  |
|          | CAM63P     | Practical                           | 02      | 0-0-2 | 04              | Web Based Mini Project                 | 40    | 10  |
|          | CAM64T     | Theory                              | 03      | 3-0-0 | 03              | Software Project<br>Management         | 80    | 20  |
|          | CAM65T     | Theory                              | 03      | 3-0-0 | 03              | Mobile Communication                   | 80    | 20  |
|          | CACP61P    | Practical<br>(Compulsor<br>y Paper) | 02      | 0-0-2 | 04              | Power BI                               | 40    | 10  |

**Semester: V**

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Network Security</b> |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                 |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20 |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03              |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

**CLO 1:** Build foundational knowledge.

**CLO 2:** Focus on cryptography and secure communication.

**CLO 3:** Emphasize practical tools and mechanisms.

**CLO 4:** Introduce advanced, real-world applications and legal aspects.

**Course Pedagogy:**

1. Interactive Lectures and Conceptual Discussions to introduce network security principles, cryptographic techniques, and security protocols.
2. Case Studies and Real-world Security Incidents Analysis to understand cyber-attacks, security breaches, and preventive measures.
3. Student Seminars, Assignments focusing on emerging trends such as cloud security, IoT security, ethical hacking, and cyber laws.

| <b>Course Content</b>                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
| <b>Fundamentals of Network Security</b> - Introduction to Information Security: CIA triad (Confidentiality, Integrity, Availability), Threats and Attacks: Malware, phishing, denial of service, man-in-the-middle, Security Services: Authentication, authorization, non-repudiation, Cryptography Basics: Symmetric vs. asymmetric encryption, hashing, digital signatures, Overview of Security Policies and Standards (ISO/IEC 27001, NIST). | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
| <b>Cryptography and Secure Communication</b> - Symmetric Key Algorithms: DES, AES, Asymmetric Key Algorithms: RSA, Diffie-Hellman key exchange, Hash Functions: MD5, SHA family, Public Key Infrastructure (PKI) and Certificates, Secure Communication Protocols: SSL/TLS, HTTPS, IPSec, VPNs, Email Security: PGP, S/MIME.                                                                                                                     | 11           |
| <b>Unit 3:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
| <b>Network Security Tools and Mechanisms</b> - Firewalls: Types (packet filtering, proxy, stateful inspection), configuration basics, Intrusion Detection and Prevention Systems (IDS/IPS), Virtual Private Networks (VPNs) and tunneling protocols, Wireless Security: WEP, WPA, WPA2, WPA3, Security in Cloud and IoT environments, Case Studies: Real-world breaches and lessons learned.                                                     | 11           |

|                                                                                                                                                                                                                                                                                                                                                                                                       |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit 4:</b>                                                                                                                                                                                                                                                                                                                                                                                        |    |
| <b>Advanced Topics and Management</b> - Security in Operating Systems and Applications, Incident Response and Disaster Recovery Planning, Security Auditing and Vulnerability Assessment, Ethical Hacking and Penetration Testing basics, Emerging Trends: Zero Trust Architecture, AI in Security, Blockchain for Security, Legal and Ethical Issues: Cyber laws in India, IT Act 2000, GDPR basics. | 11 |

### **Learning Resources:**

1. Atul Kahate - Cryptography and Network Security (Tata McGraw Hill)
2. Data Communications and Networking– Behrouz A. Forouzan (adapted Indian edition, McGraw Hill)
3. William Stallings – Cryptography and Network Security: Principles and Practice (Pearson)
4. William Stallings – Network Security Essentials: Applications and Standards (Pearson)
5. Saurabh Sharma – Information Security and Cyber Laws (Katson Books)
6. Charlie Kaufman, Radia Perlman, Mike Speciner – Network Security: Private Communication in a Public World (Pearson)

**Semester: V**

|                                   |                                           |
|-----------------------------------|-------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Network Security Lab</b> |
| <b>Course Credits: 02 (0:0:2)</b> | <b>Hours/Week: 04</b>                     |
| <b>Total Contact Hours: 60</b>    | <b>Formative Assessment Marks: 10</b>     |
| <b>Exam Marks: 40</b>             | <b>Exam Duration: 03</b>                  |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

**CLO 1:** Demonstrate the use of network security tools such as Wireshark and Nmap for monitoring and analyzing network traffic.

**CLO 2:** Implement basic cryptographic algorithms such as Caesar Cipher, Playfair Cipher, Hill Cipher, and RSA for secure communication.

**CLO 3:** Apply network security mechanisms including firewall configuration

**Course Pedagogy:**

1. Hands-on Laboratory Sessions where students practice network monitoring, encryption techniques, and security tool usage.
2. Demonstration-based Teaching by the instructor to explain the working of network security tools and cryptographic algorithms.
3. Problem-solving and Programming Exercises for implementing encryption, decryption, and security algorithms.

**List of Practical Experiments:****Part -A**

1. Program to implement the Caesar Cipher substitution method.
2. Program to implement Mono alphabetic Cipher with the given key and input.
3. Program to implement Poly alphabetic Cipher
4. Program to implement the Playfair Cipher algorithm for secure message encryption.
5. Program to implement the Hill Cipher algorithm for encryption and decryption.
6. Program to implement single and double transposition techniques

**Part - B**

7. Program to implement simple DES algorithm
8. Demonstration of symmetric key encryption using AES algorithm.
9. Program to implement RSA algorithm for public key encryption and decryption.
10. Program to generate and verify Digital Signatures using cryptographic techniques.
11. Generate Pseudo Random Numbers using Linear Congruential method
12. Demonstrate Diffie Helmn Key Exchange Algorithm.

**Evaluation Scheme for Practical Examination:**

| <b>Assessment Criteria</b> |                                 | <b>Marks</b> |
|----------------------------|---------------------------------|--------------|
| Writing                    | One Program from Part A         | 15           |
|                            | One Program from Part B         | 15           |
| Execution                  | Any one of the Written programs | 5            |
| Viva Voce                  |                                 | 5            |
| <b>Total</b>               |                                 | <b>40</b>    |

Semester: V

|                                  |                                                        |
|----------------------------------|--------------------------------------------------------|
| <b>Course code:</b>              | <b>Course title: Design and Analysis of Algorithms</b> |
| <b>Course credits:03 (3:0:0)</b> | <b>Hours/Week: 3</b>                                   |
| <b>Total contact class: 44</b>   | <b>Formative assessment marks:20</b>                   |
| <b>Exam marks: 80</b>            | <b>Exam duration: 3 Hours</b>                          |

### Course Learning Outcomes (CLOs):

Upon successful completion of this course, students will be able to:

- CLO 1:** Understand fundamental concepts of algorithms and analyze their time and space complexity using asymptotic notations.
- CLO 2:** Apply brute force and divide-and-conquer techniques to solve searching and sorting problems.
- CLO 3:** Design solutions for optimization problems using greedy method and understand minimum spanning tree algorithms.
- CLO 4:** Know the concepts of backtracking and dynamic programming and apply them to solve computational problems.

### Course pedagogy

1. Interactive classroom teaching using board and PPT to explain algorithm design techniques, asymptotic analysis, and problem-solving strategies.
2. Step-by-step demonstration of algorithms like Binary Search, Quick Sort, Merge Sort, Prim's and Kruskal's algorithms.
3. Practical/Programming Approach to implement algorithms using C/Python to understand efficiency and complexity analysis.
4. Problem Solving approach to solve numerical problems on time complexity, Greedy method, Knapsack, N-Queens and Travelling Salesman Problem.
5. Interactive Learning Methods: Assignments, quizzes, group discussions and case studies to improve analytical and logical thinking skills.

| <b>Course contents</b>                                                                                                                                                                                                                                                                                                                               | <b>Hours</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                                                                                       |              |
| INTRODUCTION: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Worst-case, Best-case and Average-case efficiencies, Asymptotic Notation, Big oh notation, Omega notation, Theta notation. Mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms. | <b>11</b>    |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                                                                                       |              |
| Brute Force and Exhaustive Search: Introduction to Brute Force approach, Selection Sort and Bubble Sort, Sequential search, Exhaustive Search-Travelling Salesman Problem and Knapsack Problem. Divide and Conquer:                                                                                                                                  | <b>11</b>    |

|                                                                                                                                                                                                                                                                                     |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| General method, Applications-Binary search, Quick sort, Merge sort                                                                                                                                                                                                                  |           |
| <b>Unit 3:</b>                                                                                                                                                                                                                                                                      |           |
| Greedy Method- Introduction to Greedy Method, Definition of Greedy algorithm, Characteristics of Greedy Strategy, General structure of greedy algorithms, Fractional Knapsack Problem, Job Sequencing with Deadlines, Minimum Spanning Tree- Prim's Algorithm, Kruskal's Algorithm. | <b>11</b> |
| <b>Unit 4:</b>                                                                                                                                                                                                                                                                      |           |
| Transform and Conquer: Introduction, Heaps and Heap Sort Backtracking: Introduction, N-Queens problem (4 queens), Introduction to Dynamic Programming, need of dynamic programming, introduction to dynamic programming approaches                                                  | <b>11</b> |

### Learning Resources:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009, Pearson.
2. Ellis Horowitz, Satraj Sahni and Rajasekharan, Fundamentals of Computer Algorithms, 2nd Edition, University Press, 2008
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, PHI.
4. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)
5. Design and Analysis of Algorithms, P. H. Dave, H. B. Dave, 2nd edition, Pearson Education

**Semester: V**

|                                  |                                                            |
|----------------------------------|------------------------------------------------------------|
| <b>Course code:</b>              | <b>Course title: Design and Analysis of Algorithms Lab</b> |
| <b>Course credits:02 (0:0:2)</b> | <b>Hours/Week: 4</b>                                       |
| <b>Total contact class: 60</b>   | <b>Formative assessment marks: 10</b>                      |
| <b>Exam marks: 40</b>            | <b>Exam duration: 3 Hours</b>                              |

**Course Learning Outcomes (CLOs):**

Upon successful completion of this course, students will be able to:

**CLO 1:** Implement searching and sorting algorithms.

**CLO 2:** Analyze time and space complexity of algorithms.

**CLO 3:** Implement divide and conquer and greedy algorithms.

**CLO 4:** Apply algorithm design techniques to solve computational problems.

**Course Pedagogy:**

1. Design algorithm based various techniques.
2. Implementation of various sorting and searching algorithms.
3. Hands-on experiments to implement algorithms and analyze complexity.
4. Students plot graph to compare apriori and aposteriori analysis.

**List of practical experiments**

1. Program to search an element by sequential search method and estimate the time and space complexity
2. Program to generate Fibonacci series without recursion and estimate the time and space complexity
3. Program to search an element by binary search and estimate the time and space Complexity
4. Program to find factorial of a number using recursion and estimate the time and space complexity
5. Program to implement merge sort algorithm and estimate the time and space complexity
6. Program to generate N random numbers and sort them using quick sort.
7. Write a program to find minimum and maximum value in an array using divide and Conquer
8. Implementation of Fractional Knapsack Algorithm using Greedy Approach
9. Program to find the minimum cost spanning tree using prim's algorithm and estimate time space complexity
10. Program to find the minimum cost spanning tree using Kruskal's algorithm and estimate the time and space complexity

**General instructions**

1. Design the Algorithm
2. Perform apriori analysis and plot the graph
3. Implement the algorithm in C++
4. Tabulate the Results for different set of inputs
5. Perform aposteriori analysis and plot the Graph

**Evaluation scheme for practical examination:**

| <b>Assessment Criteria</b>                                   |                                                    | <b>Marks</b> |
|--------------------------------------------------------------|----------------------------------------------------|--------------|
| Writing Only (One problem)                                   | Writing the Algorithm and apriori analysis         | 10           |
|                                                              | Writing the given Program                          | 15           |
| Execution                                                    | Execution of the program                           | 5            |
| Result Analysis using aposteriori analysis by plotting Graph | Tabulating the results for different set of inputs | 5            |
| Viva Voce                                                    |                                                    | 5            |
| <b>Total</b>                                                 |                                                    | <b>40</b>    |

**Semester: V**

|                                   |                                                         |
|-----------------------------------|---------------------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Computer Graphics &amp; Multimedia</b> |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                                   |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20                   |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                                |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

**CLO 1:** Understand the fundamentals of computer graphics and multimedia

**CLO 2:** Apply different graphics algorithms for drawing and displaying graphical objects such as lines, circles and polygons.

**CLO3:** Implement geometric transformations such as translation, rotation, scaling, reflection, and shearing in computer graphic

**CLO4:** Analyze multimedia elements such as text, images, audio, video, and animation used in multimedia applications.

**CLO5:** Use multimedia tools and software such as Adobe Photoshop, Blender, and Adobe Animate for creating multimedia content.

**Course Pedagogy:**

1. Classroom lectures to explain fundamental concepts of computer graphics and multimedia systems.
2. Topics include graphics algorithms, transformations, and multimedia components
3. Demonstration of graphics techniques such as line drawing, clipping, and transformations.
4. Students practice drawing objects, applying transformations, and creating animations.

| <b>Course Content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |
| Computer graphics fundamentals – Introduction, Application Areas of Computer Graphics, Overview of Graphics Systems, Video-Display Devices, Raster-Scan Systems, Random Scan Systems, Graphics Monitors and Work Stations and Input Devices. Points and Lines - Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms, Scan Line Polygon Fill Algorithm, Boundary Fill and Flood-Fill Algorithms. Curve Representation: Parametric Curves, Parametric Representation of a Circle, Parametric representation of cubic curves, drawing Bezier curve | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |
| Two-Dimensional Transformations: Coordinate and Geometric Transformations; Translation, Rotation, Scaling; Matrix representations and Homogeneous coordinates, Composite transformations, General Pivot Point rotation, General Fixed-Point Scaling, Shearing; Reflection; Reflection about an arbitrary line. 2-D Viewing: Viewing pipeline; Window, Viewport, Window-to-Viewport transformation; Zooming, panning; Pointing and Positioning techniques; Rubber band technique; Dragging. Clipping                                                          | 11           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-Point Subdivision line clipping.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
| <b>Unit 3:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |
| 3-D Graphics & Modeling: Visualization techniques for Realism; 3D Object Representation; Solid Model Representation Schemes; Euclidean Geometry methods: Regularized Boolean Set Operations, Primitive Instancing, Boundary Representations, Curved lines and surfaces, Sweep Representations, Spatial-Partitioning Representations - Octree representation, Constructive Solid Geometry; Procedural Methods: Fractals, Shape Grammars, Particle systems, Physically Based modeling, Visualization techniques; 3D transformations. Three-Dimensional Viewing: Viewing Pipeline; Parallel Projection: Orthographic and Oblique Projection.                                                                                                                                                          | 11 |
| <b>Unit 4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |
| Introduction to Animation: Fundamentals of Animation, Traditional Animation, Computer Animation, Types of computer Animation, Challenges and the future of computer animation Designing of Animation Sequences; Key-Frame Systems; Introduction to Photoshop: Drawing and Creating Design, Designing Pamphlets, Image Color Corrections, Morphing One Image with the Other Images, Doing B&W Photo to Color Designing & Crating Logos Working with Brush, Pen, Text Tools Blending Options Creating Text Effects Designing Layout for the Web Page Designing Web Banners and Buttons Doing Actions in Photoshop Doing Animation in Photoshop Creating Posters with Text Effects Creating the Out Line Designs Drawing the Basic Shapes with Pencil and Pen Designing the Frame Layouts for Photos. | 11 |

### Learning Resources:

1. Hearn D and Baker P. "Computer Graphics Open GL Version", Fourth Edition, Prentice Hall of India; 2013.
2. Lance Flavell, "Beginning Blender: Open-source 3D Modeling, Animation, and Game Design", Apress, 2010
3. James Chronister, "Blender basics classroom tutorial book", Fourth edition, 2011
4. Plastook R A and Kalley G. "Theory and Problems of Computer Graphics", Schaum's Outline Series, TMH;1985.
5. Foley J D D, Eiener S K and Hughes J.F. "Computer Graphics Principles and Practice", Second Edition, Pearson Education;1996.

**Semester: V**

|                                   |                                                             |
|-----------------------------------|-------------------------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Computer Graphics &amp; Multimedia Lab</b> |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                                       |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10                       |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                                    |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

- CLO 1:** Implement basic computer graphics algorithms to draw lines, circles, and other graphical objects.
- CLO 2:** Apply 2D transformations such as translation, rotation, scaling, reflection, and shearing to graphical object
- CLO 3:** Implement clipping and filling algorithms used in computer graphics application.
- CLO 4:** Create simple graphics programs to display shapes, patterns, and animations.
- CLO 5:** Use multimedia tools such as Adobe Photoshop, Audacity, and Blender for editing images, audio, and animation.

**Course pedagogy:**

1. Demonstrates graphics algorithms, image editing, audio/video editing, and animation techniques before the students perform the experiments.
2. Hands-on Practical Sessions: Students perform lab experiments to implement graphics algorithms and create multimedia content using tools such as Adobe Photoshop, Audacity and Blender.

**List of Practical Experiments:****Part A**

1. Program to draw basic graphics primitives
2. Program to implement Digital Differential Analyzer (DDA) Line Drawing Algorithm.
3. Program to implement Bresenham's Line Drawing Algorithm
4. Program to draw a circle using Bresenham's Circle Algorithm
5. Program to perform 2D Transformations
6. Program for Line Clipping using Cohen-Sutherland Algorithm
7. Program for Polygon Clipping
8. Program to perform 3D Transformations

**(Note: The above-mentioned programs are implemented using C++)**

**Part B**

1. Create and edit images using image editing software such as Adobe Photoshop or GIMP.
2. Perform image enhancement operations such as cropping, resizing, brightness, and contrast adjustment.

3. Design a poster or banner using graphics tools.
4. Record and edit audio using software such as Audacity.
5. Perform audio operations such as noise reduction, trimming, mixing, and adding sound effects.
6. Create a short audio clip with background music and voice narration.
7. Create and edit videos using tools such as Adobe Premiere Pro or OpenShot Video Editor.
8. Create a short video presentation or advertisement.

**Evaluation Scheme for Lab Examination:**

| <b>Assessment Criteria</b> |                                 | <b>Marks</b> |
|----------------------------|---------------------------------|--------------|
| Writing                    | One Program from Part A         | 15           |
|                            | One Program from Part B         | 15           |
| Execution                  | Any one of the Written programs | 5            |
| Viva Voce                  |                                 | 5            |
| <b>Total</b>               |                                 | <b>40</b>    |

**Semester: V**

|                                   |                                            |
|-----------------------------------|--------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Blockchain Technology</b> |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                      |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20      |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                   |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

- CLO 1:** Describe the fundamental concepts of blockchain technology including distributed ledger systems, block structure, hashing, and types of blockchain.
- CLO 2:** Demonstrate the role of cryptographic techniques such as hash functions, digital signatures, and public key cryptography in ensuring blockchain security.
- CLO 3:** Analyze the working of cryptocurrencies and Bitcoin including transaction processes, mining, and consensus mechanisms.
- CLO 4:** Apply the concepts of smart contracts and blockchain platforms such as Ethereum and Hyperledger to understand real-world blockchain applications.

**Course Pedagogy**

1. Interactive Lectures and Conceptual Discussions to explain blockchain architecture, distributed systems, and cryptographic principles.
2. Hands-on Sessions on blockchain tools, cryptocurrency transactions, and smart contract platforms.
3. Case Studies and Real-world Examples focusing on blockchain applications in finance, supply chain management, healthcare, and governance.
4. Student Seminars / Mini Projects where students explore emerging blockchain platforms, cryptocurrencies, or smart contract applications.

| <b>Content</b>                                                                                                                                                                                                                                                                                                                                                                                           | <b>Hours</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                                                                                                                                           |              |
| <b>Introduction to Blockchain Technology</b> - Evolution of Digital Systems, Introduction to Blockchain Technology, Distributed Systems and Distributed Ledger Technology (DLT), Blockchain Architecture and Components, Structure of Blocks, Hashing Concept, Chain Formation Process, Centralized vs Decentralized Systems, Types of Blockchains, Advantages of Blockchain, Limitations and Challenges | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                                                                                                                                           |              |
| <b>Cryptography in Blockchain</b> - Introduction to Cryptography, Cryptographic Hash Functions, Digital Signatures, Public Key and Private Key Cryptography, Merkle Trees, Role of Cryptography in Blockchain, Wallets and Blockchain Addresses, Blockchain Security Concepts, Double Spending Problem, 51% Attack, Privacy and Security Issues.                                                         | 11           |
| <b>Unit 3:</b>                                                                                                                                                                                                                                                                                                                                                                                           |              |

|                                                                                                                                                                                                                                                                                                                                                                                                |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Cryptocurrencies and Bitcoin</b> - Introduction to Cryptocurrencies, History and Evolution of Bitcoin, Bitcoin Network Architecture, Bitcoin Transactions, Blockchain Transaction Lifecycle, Mining Process, Proof of Work Consensus Mechanism, Cryptocurrency Wallets, Cryptocurrency Exchanges, Advantages and Limitations of Bitcoin and Regulatory Issues in Cryptocurrency.            | 11 |
| <b>Unit 4:</b>                                                                                                                                                                                                                                                                                                                                                                                 |    |
| <b>Smart Contracts and Blockchain Platforms</b> - Introduction to Smart Contracts, Working of Smart Contracts, Features and Benefits of Smart Contracts, Introduction to Ethereum, Ethereum Architecture, Ethereum Virtual Machine (EVM), Gas and Transaction Fees, Blockchain Platforms Overview, Comparison of Ethereum, Hyperledger, and Binance Smart Chain, Use Cases of Smart Contracts. | 11 |

### Learning Resources:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps – Daniel Drescher, Apress Publications.
2. Mastering Bitcoin – Andreas M. Antonopoulos, O'Reilly Media.
3. Mastering Ethereum – Andreas M. Antonopoulos and Gavin Wood, O'Reilly Media.
4. Blockchain Technology Explained – Alan T. Norman, CreateSpace Independent Publishing.
5. Blockchain Revolution – Don Tapscott and Alex Tapscott, Portfolio Publications.
6. Introducing Blockchain with Lisp – Ken Huang, Apress Publications.
7. Blockchain: Blueprint for a New Economy – Melanie Swan, O'Reilly Media.

**Semester: V**

|                                 |                                                   |
|---------------------------------|---------------------------------------------------|
| <b>Course code:</b>             | <b>Course title: Enterprise Resource Planning</b> |
| <b>Course credits:03(3:0:0)</b> | <b>Hours/Week: 3</b>                              |
| <b>Total contact class: 44</b>  | <b>Formative assessment marks :20</b>             |
| <b>Exam marks: 80</b>           | <b>Exam duration: 3 Hours</b>                     |

**Course Learning Outcomes:**

Upon successful completion of this course, students will be able to,

**CLO1:** Understand ERP Fundamentals.

**CLO 2:** Integrate Related Technologies.

**CLO 3:** Evaluate ERP Marketplace

**CLO 4:** Manage Implementation Lifecycle.

**CLO 5:** Adapt to Emerging Trends.

**Course pedagogy**

1. Interactive Lectures and Conceptual Discussions
2. Hands-on Demonstrations and Tool-based Learning.
3. Case Studies and Industry-oriented Analysis
4. Assignments, Student Seminars/Presentations

| <b>Course Contents</b>                                                                                                                                                                                                                                                                                       | <b>Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br>Enterprise Resource Planning (ERP): Introduction, history, advantages<br>Enterprise: Introduction, business modeling, integrated data model, integrated management information, Basic concepts of ERP, Risks and benefits of ERP                                                           | 11           |
| <b>Unit 2:</b><br>ERP and Related Technologies: Introduction to MRP, MRP-II and ERP Business Process Reengineering, (BPR), Data warehousing, data mining and Online Analytical Processing (OLAP), Product Life Cycle Management (PLM), Supply Chain Management (SCM), Customer Relationship Management (CRM) | 11           |
| <b>Unit 3:</b><br>ERP Marketplace: overview, dynamics, ERP- the Indian Scenario, Functional modules of ERP software, Integration of ERP, SCM and CRM.                                                                                                                                                        | 11           |
| <b>Unit 4:</b><br>ERP package selection, ERP Implementation basics, ERP Implementation Life Cycle. ERP Maintenance and Support, Data Migration and Performance Measurement, Maximizing and Scaling up ERP Systems, Emerging Trends-Cloud ERP, Mobile ERP.                                                    | 11           |

**Learning Resources:**

1. ERP Demystified, Alexis Leon, 3rd Edition, McGraw-Hill Education, 2014.
2. Concepts in Enterprise Resource Planning, Joseph A. Brady, Ellen F. Monk, Bret J. Wagner, Cengage Learning, 2001.
3. Enterprise Resource Planning – Concepts and Practice, Vinod Kumar Garg, N.K. Venkitakrishnan, 2nd Edition, Prentice-Hall of India Pvt. Ltd., 2008.

**Semester: V**

|                                  |                                                              |
|----------------------------------|--------------------------------------------------------------|
| <b>Course code:</b>              | <b>Course title: Fundamentals of Artificial Intelligence</b> |
| <b>Course credits:03 (3:0:0)</b> | <b>Hours/Week: 3</b>                                         |
| <b>Total contact class: 44</b>   | <b>Formative assessment marks:20</b>                         |
| <b>Exam marks: 80</b>            | <b>Exam duration: 3 Hours</b>                                |

**Course Learning Outcomes (CLOs):**

Upon successful completion of this course, students will be able to:

**CLO 1:** Explain the basic concepts, history, scope, and applications of Artificial Intelligence

**CLO 2:** Describe intelligent agents, their structure, types, and apply basic AI problem- solving and search techniques.

**CLO 3:** Understand Machine Learning fundamentals including supervised, unsupervised and Reinforcement learning concepts.

**CLO 4:** Gain the knowledge of representation techniques, logic-based representation and Expert systems.

**CLO 5:** Demonstrate basic usage of AI tools for simple real-world applications.

**Course Pedagogy**

1. Interactive Lecture Method in Classroom teaching using board and PPT for AI concepts.
2. Hands-on exercises using Python and AI tools.
3. Demonstrating AI applications and tools.
4. Group discussions, seminars, quizzes, and problem-solving tasks to improve understanding and analytical skills.

| <b>Course contents</b>                                                                                                                                                                                                                                                                                                                                                                | <b>Hours</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                                                                                                                        |              |
| Definition, Scope, and Importance of AI, History and Evolution of AI, Overview of AI system, AI Applications in Real-world: Healthcare, Education, Banking, etc. AI vs. Human Intelligence, Types of AI: Narrow AI, General AI. Ethics and Challenges in AI                                                                                                                           | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                                                                                                                        |              |
| Intelligent agents-definition and structure of intelligent agents, Types-simple, reflex, model based, goal based, utility based. Problem-Solving Techniques in AI, problem formulation, State Space Representation, Search techniques- Breadth-First Search, Depth-First Search, Informed Search: Best-First Search, A* Algorithm, Heuristics in AI, Constraint Satisfaction Problems | 11           |
| <b>Unit 3:</b>                                                                                                                                                                                                                                                                                                                                                                        |              |

|                                                                                                                                                                                                                                                                                                                  |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Machine Learning Overview, Types- Supervised, Unsupervised, reinforcement learning, Machine Learning concept- training, testing, validation, classification and clustering, Knowledge Representation in AI - Logic-Based Representation: Propositional and Predicate Logic, Rule-Based Systems and Expert System | 11 |
| <b>Unit 4:</b>                                                                                                                                                                                                                                                                                                   |    |
| Deep Learning: Concept of Deep Learning, Introduction to Neural Networks, Types of Deep Learning models, Deep learning applications, AI Tools introduction: ChatGPT, DALL-E, Canva AI, Teachable Machine.                                                                                                        | 11 |

### **Learning Resources:**

1. Artificial Intelligence: A Modern Approach – Stuart Russell and Peter Norvig, Pearson.
2. Artificial Intelligence – Elaine Rich, Kevin Knight, McGraw Hill.
3. Introduction to Artificial Intelligence – Eugene Charniak and Drew McDermott
4. Machine Learning – Tom M. Mitchell, McGraw Hill.
5. Deep Learning – Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press.
6. Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow –
7. Aurélien Géron, O'Reilly. AI Superpowers – Kai-Fu Lee

**Semester: V**

|                                   |                                                    |
|-----------------------------------|----------------------------------------------------|
| <b>Course code:</b>               | <b>Course title: AI Tools and its applications</b> |
| <b>Course credits: 02 (0:0:2)</b> | <b>Hours/Week: 4</b>                               |
| <b>Total contact class: 60</b>    | <b>Formative assessment marks: 10</b>              |
| <b>Exam marks: 40</b>             | <b>Exam duration: 3 Hours</b>                      |

**Course Learning Outcomes (CLOs)**

After successful completion of this practical course, students will be able to:

**CLO 1:** Use AI tools to generate text, images, presentations and reports effectively.

**CLO 2:** Apply AI tools for solving basic computational and programming problems.

**CLO 3:** Analyze data and generate meaningful insights using AI assistance.

**CLO 4:** Compare different AI tools and select appropriate tools for specific tasks.

**CLO 5:** Demonstrate the use of AI tools in academic work such as resume creation, translation and documentation.

**Course Pedagogy**

1. Demonstrates the usage of AI tools (e.g., ChatGPT, Canva, Gamma).
2. Hands-On Practical Learning by conducting experiments individually or in small groups.
3. Problem-Based Learning (PBL) - solve real-world or academic problems using AI tools.

**List of Practical Experiments:****Part A**

1. Create an account and explore features of ChatGPT (text generation, summarization).
2. Use ChatGPT to generate a technical literature review on one of topic (IoT / AI in Healthcare / Smart Grid) and refine it into IEEE abstract format
3. Use Google Gemini to generate a short essay on “AI past and future”.
4. Generate an image of future smart class and analyze
5. Design a project poster using Canva AI tools including smart layout, AI background removal, and presentation enhancement.
6. Create a technical presentation using AI presentation generator on “Future of Edge AI in Engineering Applications”- Gamma.
7. Write a paragraph with mistakes, Upload in Grammarly, Note corrections and Rewrite corrected paragraph
8. Create invitation and flyer for Science day celebration function in your college
9. Develop a no-code, student grievance management prototype using Google AI.

**Part B**

10. Create AI-generated diagrams for system architecture of a smart campus project using AI diagram tools.

11. Generate an MCQ with 25 questions on Data structure, DBMS and Computer networks with appropriate headings
12. Build a workflow automation using no-code tools for attendance management or report approval system.
13. Compare outputs of two AI chatbots for solving one numerical problem and evaluate response accuracy.
14. Interact with AI Chatbot. Ask 5 academic questions, note responses, Evaluate correctness
15. Use AI tool to record the answers and observation on Operating system
16. Upload erroneous Python/C++ code into AI tool, debug it, optimize it, and explain performance improvements. Create a resume using Gemini
17. Use Microsoft Excel AI functions to clean a raw dataset, detect anomalies, and generate trend analysis with formulas and charts.

**Evaluation scheme for practical examination:**

| <b>Assessment criteria</b> |                                 | <b>Marks</b> |
|----------------------------|---------------------------------|--------------|
| Writing                    | One program from part A         | 15           |
|                            | One program from part B         | 15           |
| Execution                  | Any one of the written problems | 5            |
| Viva voce                  |                                 | 5            |
| <b>Total Marks</b>         |                                 | <b>40</b>    |

**Semester: VI**

|                                   |                                                      |
|-----------------------------------|------------------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Scientific Computing Techniques</b> |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                                |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20                |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                             |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

- CLO 1:** Understand the concepts of computer arithmetic including fixed-point and floating-point representation, normalization, and error analysis in numerical computations.
- CLO 2:** Apply iterative methods such as Bisection, Newton–Raphson, Regula Falsi, and Secant methods to find roots of polynomial equations.
- CLO 3:** Solve ordinary differential equations and numerical integration problems using methods such as Euler’s method, Runge–Kutta methods, Simpson’s rule, and the Trapezoidal rule.
- CLO 4:** Analyze and compute solutions of simultaneous linear equations using numerical techniques such as Gauss Elimination, Gauss–Jordan, LU Decomposition, and Gauss–Seidel methods.

**Course Pedagogy**

1. Conceptual Lectures and Problem-solving Sessions to explain numerical methods, floating-point arithmetic, and error analysis.
2. Worked Examples and Tutorial Exercises to practice iterative methods, numerical integration, and differential equation solutions.
3. Assignments and Analytical Comparisons where students compare direct and iterative numerical methods for efficiency and accuracy.

| <b>Content</b>                                                                                                                                                                                                                                                                                                                 | <b>Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                                                                 |              |
| Computer Arithmetic: Need of Computer Oriented Numerical Analysis, Fixed and Floating-point representation of numbers, Normalization, arithmetic operations with normalization, consequences of normalized floating-point representation of numbers, Concept of Zero in floating point, Errors in computing, Measure of errors | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                                                                 |              |
| Finding the roots of an equation: Iterative method: Introduction, types of equation Methods of solution, Beginning an iterative method, Bisection method, Newton Raphson method,                                                                                                                                               | 11           |

|                                                                                                                                                                                                                                                 |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Regula Falsi method, Secant method. Comparison of Iterative methods. (Problems only on polynomial equations)                                                                                                                                    |    |
| <b>Unit 3:</b>                                                                                                                                                                                                                                  |    |
| Ordinary differential equations: Euler's method, Taylor series method, Runge Kutta II and IV order methods.<br>Numerical Integration: Introduction, Simpson's 1/3 and 3/8 rule, Trapezoidal rule.                                               | 11 |
| <b>Unit 4:</b>                                                                                                                                                                                                                                  |    |
| Solving simultaneous linear equations: Introduction, Gauss Elimination method, pivoting, ill-conditioned equations, Gauss Jordan method, LU Decomposition method and Gauss-Seidel iterative method. Comparison of direct and iterative methods. | 11 |

### **Learning Resources:**

1. Computer Oriented Numerical Methods by Rajaraman. V.
2. Fundamentals of Mathematical Statistics by Gupta and Kapoor (Sultan Chand).
3. Probability and Statistics for engineers and scientists by Ronald E. Walpole and Raymond H Mayers.
4. Mathematical Statistics by John Freund (Prentice Hall India Pvt. Ltd.)
5. Numerical Methods by Jain M.K., S.R.K. Iyengar and R.K. Jain

**Semester: VI**

|                                   |                                                          |
|-----------------------------------|----------------------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Scientific Computing Techniques Lab</b> |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                                    |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10                    |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                                 |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

- CLO 1:** Implement numerical methods such as Bisection, Regula Falsi, and Newton–Raphson to determine the roots of algebraic equations using programming.
- CLO 2:** Apply numerical techniques like Euler’s method and Runge–Kutta methods to solve ordinary differential equations computationally.
- CLO 3:** Compute numerical integration using methods such as Trapezoidal rule, Simpson’s 1/3 rule, and Simpson’s 3/8 rule.
- CLO 4:** Develop programs to solve systems of simultaneous linear equations using methods like Gauss Elimination, Gauss–Jordan, and Gauss–Seidel.

**Course Pedagogy**

1. Demonstration-based Laboratory Sessions where instructors explain numerical algorithms and their implementation in C++ programming.
2. Hands-on Programming Exercises enabling students to write, compile, and test programs for various numerical methods.
3. Problem-solving and Debugging Activities to help students understand computational errors, accuracy, and convergence of numerical methods.
4. Lab Assignments and Mini Experiments where students modify programs, test with different inputs, and compare results of different numerical techniques.

**List of Practical Experiments:****PART-A**

1. Program to solve the given equation  $x^2 - 14 = 0$  by using Bisection method.
2. Program to solve the given equation  $x^2 + 5x - 6 = 0$  by using Regula Falsi method.
3. Program to solve the given equation  $x^3 - 12 = 0$  by using Newton Raphson method.
4. Program to solve the given equation  $dy/dx = 1 + y^2$  where  $y(0) = 1$ ,  $h = 0.1$ , find  $y(0.4)$  using Eulers method.
5. Program to solve the given equation  $dy/dx = x^2 y$  where  $y(1) = 2$ ,  $h = 0.3$ , find  $y(1.4)$  by using Runge-kutta’s II order method.
6. Program to solve the given equation  $dy/dx = x^2 y$  where  $y(1) = 2$ ,  $h = 0.3$ , find  $y(1.4)$  by using Runge-kutta’s IV order method.

## PART-B

7. Program to solve the given equation  $\int dx/(1+x)$  where,  $a=0$ ,  $b=1$ ,  $n=10$  by using Trapezoidal method.
8. Program to solve the given equation  $\int \sin x \, dx$  where  $a=0$ ,  $b=\pi/2$ ,  $n=6$  by using Simpson's 1/3 rule.
9. Program to solve the given equation  $\int \sin x \, dx$  where  $a=0$ ,  $b=\pi/2$ ,  $n=6$  by using Simpson's 3/8 rule.
10. Program to solve the following set of simultaneous equation  $x+y+4z=12$ ,  $8x-3y+2z=20$ ,  $4x+11y-z=33$  using the Gauss Elimination method.
11. Program to solve the following set of simultaneous equation  $2x_1+6x_2-x_3=-14$ ,  $5x_1-x_2+2x_3=29$ ,  $-3x_1-4x_2+x_3=4$  using Gauss Jordan method.
12. Program to solve the following set of simultaneous equation  $2x_1-x_2+x_3=5$ ,  $x_1+3x_2-2x_3=7$ ,  $x_1+2x_2+3x_3=10$  using Gauss Seidel method.

### Evaluation Scheme for Lab Examination:

| Assessment Criteria |                                | Marks |
|---------------------|--------------------------------|-------|
| Writing             | One Program from Part A        | 15    |
|                     | One Program from Part B        | 15    |
| Execution           | Any one of the Written Program | 5     |
| Viva Voce           |                                | 5     |
| Total               |                                | 40    |

**Semester: VI**

|                                  |                                         |
|----------------------------------|-----------------------------------------|
| <b>Course code:</b>              | <b>Course title: Big Data Analytics</b> |
| <b>Course credits:03 (3:0:0)</b> | <b>Hours/Week: 3</b>                    |
| <b>Total contact class: 44</b>   | <b>Formative assessment marks :20</b>   |
| <b>Exam marks: 80</b>            | <b>Exam duration: 3 Hours</b>           |

**Course Learning Outcomes (CLOs):**

Upon successful completion of this course, students will be able to:

**CLO 1:** Identify and list various Big Data concepts, tools and applications.

**CLO 2:** Describe Hadoop architecture and ecosystem.

**CLO 3:** Analyze MapReduce data processing.

**CLO 4:** Understand NoSQL databases and gain the basic knowledge of Hive queries.

**CLO 5:** Understand social network analysis basics.

**Course Pedagogy**

1. Interactive Lecture Method in Classroom teaching using board and PPT to explain Big Data concepts and Hadoop framework.
2. Demonstration of Hadoop ecosystem, Hive queries and MapReduce concepts.
3. Interactive Learning through Group discussions, quizzes and seminars on Big Data applications.
4. Assignment/Case Study Method for Problem solving tasks and case studies on real-world Big Data applications.

| <b>Course contents</b>                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Hours</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                                                                                                                                                            |              |
| Introduction to Big Data, Characteristics of Big Data (5 V's), Types of Big Data, Traditional Data vs Big Data, Evolution of Big Data, Challenges in Big Data Analytics: Big data Analytics-definition, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools, NoSQL, Hadoop                                                                | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                                                                                                                                                            |              |
| Introduction to Hadoop, Features – Advantages – Versions – Overview of Hadoop, Hadoop Components, Hadoop Limitations, Hadoop vs. SQL, HDFS (Hadoop Distributed File System), Processing data with Hadoop, YARN Resource Management.<br>Introduction to MapReduce, advantages of MapReduce, MapReduce Framework, MapReduce Architecture, Working of MapReduce, Phases of MapReduce- Map phase, Shuffle phase, Reduce phase | 11           |
| <b>UNIT-3:</b>                                                                                                                                                                                                                                                                                                                                                                                                            |              |

|                                                                                                                                                                                                                                                                                                                                   |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Introduction to NoSQL, Need for NoSQL databases, Types of NoSQL databases, Key-value stores, Document databases, Column family databases, Graph databases, Comparison of SQL vs NoSQL.<br>Introduction to MongoDB, Basic MongoDB operations, Data ingestion concepts, Data processing techniques.<br>Introduction to Apache Spark | 11 |
| <b>UNIT-4:</b>                                                                                                                                                                                                                                                                                                                    |    |
| Introduction to Hive, Hive, Architecture, Hive Data Types, Hive Query Language (HQL). Introduction to Social Network Mining, Applications, Social Networks as Graphs, Types of Social Networks, Clustering of Social Graphs, Community Discovery, Recommender Systems                                                             | 11 |

### Learning Resources:

1. Seema Acharya and Subhashini Chellappan “Big data and Analytics” Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, “Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning”, McGraw Hill Publication, 2019.
3. Understanding Big Data, McGraw-Hill.
4. Adam Shook and Donald Mine, “MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems” - O'Reilly 2012
5. Tom White, “Hadoop: The Definitive Guide” 4th Edition, O'reilly Media, 2015.
6. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016

**Semester: VI**

|                                  |                                             |
|----------------------------------|---------------------------------------------|
| <b>Course code:</b>              | <b>Course title: Big Data Analytics Lab</b> |
| <b>Course credits:02 (0:0:2)</b> | <b>Hours/Week: 4</b>                        |
| <b>Total contact class: 60</b>   | <b>Formative assessment marks :10</b>       |
| <b>Exam marks: 40</b>            | <b>Exam duration: 3 Hours</b>               |

### **Course Learning Objectives (CLOs)**

Upon successful completion of this course, students will be able to:

**CLO 1:** Understand Big Data environment and configure basic Hadoop ecosystem tools.

**CLO 2:** Develop basic MapReduce programs for data processing tasks such as word count, maximum, minimum and data analysis.

**CLO 3:** Perform NoSQL database operations using MongoDB including CRUD operations and data retrieval.

**CLO 4:** Apply Hive queries for managing and analyzing large datasets.

**CLO 5:** Implement simple Big Data applications using MongoDB and Hadoop tools.

### **Course Pedagogy**

1. Demonstrates Hadoop, MongoDB and Hive commands.
2. Hands-on Practical sessions to execute programs individually in the lab.
3. Problem Solving Approach **to** solve real data processing problems using MapReduce.
4. Mini Assignments on MongoDB queries and Hive operations.

### **List of Experiments:**

#### **Part A**

1. Install Hadoop (Standalone/Pseudo Mode) or study Hadoop installation procedure and write the steps to start Hadoop services.
2. Write a MapReduce program to count words in a given text file (Word Count Problem).
3. Write a MapReduce program to find the maximum number from a given dataset.
4. Write a MapReduce program to find the minimum number from a given dataset.
5. Write a MapReduce program to find total and average marks of students from a given dataset.
6. Write a MapReduce program to count frequency of numbers or names in a dataset.
7. Write a MapReduce program to find maximum temperature from a weather dataset.

#### **Part B**

8. Create a database and collection in MongoDB and display the created database.
9. Insert student records into MongoDB collection and perform query operations:
  - i. Display all records
  - ii. Display records with condition
  - iii. Display selected fields

10. Implement update and delete operations in MongoDB.
11. Implement NoSQL database operations using MongoDB:
  - i. CRUD operations (Create, Read, Update, Delete)
  - ii. Working with Arrays in MongoDB
12. Implement MongoDB functions:
  - i. Count
  - ii. Sort
  - iii. Limit
  - iv. Skip
  - v. Aggregate functions
13. Create Hive table and load data. Perform basic Hive queries:
  - i. Select records
  - ii. Where condition
  - iii. Order by clause
14. Implement a simple application that stores big data in MongoDB  
(Example: Student database, Employee database, Product database).

**Evaluation Scheme for Lab Examination:**

| Assessment Criteria |                                | Marks     |
|---------------------|--------------------------------|-----------|
| Writing             | One Program from Part A        | 15        |
|                     | One Program from Part B        | 15        |
| Execution           | Any one of the Written Program | 5         |
| Viva Voce           |                                | 5         |
| <b>Total</b>        |                                | <b>40</b> |

**Semester: VI**

|                                   |                                                    |
|-----------------------------------|----------------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Web Content Management System</b> |
| <b>Course Credits: 03 (3:0:0)</b> | <b>Hours/Week: 03</b>                              |
| <b>Total Contact Hours: 44</b>    | <b>Formative Assessment Marks: 20</b>              |
| <b>Exam Marks: 80</b>             | <b>Exam Duration: 03</b>                           |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

- CLO 1:** Explain the principles of web content development, content formats, and guidelines for creating effective digital multimedia content.
- CLO 2:** Develop digital media elements such as graphics, audio, presentations, and multilingual web content using appropriate tools.
- CLO 3:** Design and manage dynamic web content including blogs, wiki sites, and websites using CSS and content management techniques.
- CLO 4:** Apply modern web technologies and platforms such as Moodle, Joomla, and Drupal for course creation, content management, and online publishing.

**Course Pedagogy**

1. Interactive Lectures and Demonstrations to introduce web content development concepts, multimedia tools, and CMS platforms.
2. Case study-based Learning where students develop multimedia web content or create a small website using CMS platforms.
3. Student Presentations and Collaborative Activities using presentation tools, screen casting techniques, and online learning platforms.

| <b>Content</b>                                                                                                                                                                                                                          | <b>Hours</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                          |              |
| Web Content Development and Management, Content Types and Formats, Norms and Guidelines of Content Development, Creating Digital Graphics, Audio Production and Editing.                                                                | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                          |              |
| Web Hosting and Managing Multimedia Content, Creating and Maintaining a Wiki Site. Presentation Software Part I, Presentation Software Part II, Screen casting Tools and Techniques, Multilingual Content Development.                  | 11           |
| <b>Unit 3:</b>                                                                                                                                                                                                                          |              |
| Planning and Developing Dynamic Web Content Sites, Website Design Using CSS Creating and Maintaining a WIKI Site, Creating and Managing a Blog Site, E- Publication Concept, E- Pub Tools, Simulation and Virtual Reality Applications. | 11           |
| <b>Unit 4:</b>                                                                                                                                                                                                                          |              |
| Creating 2D and 3 D Animations. Introduction to Moodle, Creating a New Course and Uploading. Create and Add Assessment, Add and Enroll User and Discussion Forum,                                                                       | 11           |

|                                                                      |  |
|----------------------------------------------------------------------|--|
| Content Management System: Joomla, Content Management System: Drupal |  |
|----------------------------------------------------------------------|--|

### **Learning Resources:**

1. Web Content Management: Systems, Features, and Best Practices 1st Edition by Deane Barker.
2. Content Management Bible (2nd Edition) 2nd Edition by Bob Boiko.
3. Moodle for Learning Management System (LMS): A Practical and Visual Guidebook of Administrator and Instructor for Distance Education Paperback – October 12, 2020 by James Koo
4. Using Joomla!: Efficiently Build and Manage Custom Websites 2nd Edition by Ron Severdia

**Semester: VI**

|                                   |                                             |
|-----------------------------------|---------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Web Based Mini Project</b> |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                       |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10       |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03                    |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

- CLO 1:** Identify and analyze real-world problems and propose suitable web-based solutions using modern web technologies.
- CLO 2:** Design and develop dynamic and responsive web applications using technologies such as HTML, CSS, JavaScript, and server-side scripting (e.g., PHP).
- CLO 3:** Apply software development life cycle (SDLC) phases including planning, design, implementation, testing, and deployment in a mini project.
- CLO 4:** Demonstrate the ability to integrate front-end and back-end components to build a complete functional web application.
- CLO 5:** Work effectively in teams, manage project tasks, and demonstrate professional ethics in project development.
- CLO 6:** Prepare technical documentation and present the project effectively using appropriate tools and communication skills.

**Course Pedagogy**

1. Project-Based Learning by developing a complete web application addressing real-world problems.
2. Hands-on practice through coding, debugging, testing, and deployment.
3. Identify the problems, analyze requirements, and implement feasible solutions.
4. Group-based mini projects to enhance teamwork and communication skills.

**List of Web-Based Mini Projects:**

1. Student Record Management System
2. Employee Details Management
3. Library Management (Mini Version)
4. Online Complaint Registration System
5. College Event Registration Portal
6. Online Assignment Submission System
7. Student Feedback System
8. Attendance Management System (Web-based)
9. Result Publishing System
10. Online Book Store
11. Food Ordering System (basic version)
12. Bus/Train Ticket Booking (demo system)

13. Online Rental System (rooms, bikes, etc.)
14. Personal Expense Tracker
15. To-Do List / Task Manager
16. Online Notes Sharing Platform
17. Weather App (API-based)
18. Online Quiz System
19. Online Voting System (with login authentication)
20. Course Recommendation System
21. Web-Based Health Monitoring System
22. Student Performance Analysis System
23. Employee Timesheet System
24. Online Survey & Feedback Analyzer

**(Note: Choose any one mini project based on above theme /choose any similar kind of mini project titles)**

**Technology to use:**

**Frontend:** HTML, CSS, JavaScript, Bootstrap etc.,

**Backend:** PHP / Python (Flask/Django) / Node.js etc.,

**Database:** MySQL / MongoDB etc.,

**Project Guidelines:**

1. Maximum 4 students shall be allowed to take up the mini project.
2. Each student will have to work for 4 hours per week in the lab premises
3. Each student shall submit his/her mini project synopsis to the concerned teacher .
4. Each student has to carry out 2 project seminars compulsorily in project duration.

Each seminar will be considered for their internal assessment.

**Scheme of valuation - 50 Marks**

**1. IA – 10 Marks**

- Synopsis - **05 Marks**
- Seminar - **05 Marks**

**2. Dissertation – 40 Marks**

- Documentation - **15 Marks**
- Presentation / Demonstration - **15 Marks**

**3. Viva- 10 Marks**

**Semester: VI**

|                                  |                                                  |
|----------------------------------|--------------------------------------------------|
| <b>Course code:</b>              | <b>Course title: Software Project Management</b> |
| <b>Course credits:03 (3:0:0)</b> | <b>Hours/Week: 3</b>                             |
| <b>Total contact class: 44</b>   | <b>Formative assessment marks: 20</b>            |
| <b>Exam marks: 80</b>            | <b>Exam duration: 3 Hours</b>                    |

**Course Learning Outcomes (CLOs):**

Upon successful completion of this course, students will be able to,

**CLO 1:** Understand software project basics.

**CLO 2:** Analyze the requirements and formulate appropriate plan.

**CLO 3:** Design Software effort estimation by adopting different project control measures activity planning

**CLO 4:** Use resource allocation and risk project management techniques appropriately.

**CLO 5:** Demonstrate Managing people and organizing teams uploading software quality management guidelines.

**Course Pedagogy**

1. Interactive teaching and guided discussions
2. Application-driven Learning through Case Examples
3. Collaborative Learning Activities and Team-based Tasks
4. Seminars, Reports, and Presentations

| <b>Course Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Hours</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b><br>Introduction, importance of software project management, project definition, Software projects versus other types of projects, Contract management and technical project management, Activities covered by software project management, Plans, methods and methodologies, some ways of categorizing software projects, Stakeholders, Setting objectives, The business case, Project success and failure, management and management control. An overview of project planning: Select project, identify scope and objectives, identify project infrastructure, Analysis project Characteristics, identify project products and activities, estimate efforts for each activity, identify activity risks, allocate resources, Review/publicize plan, execute plan and lower levels of planning. | 11           |
| <b>Unit 2:</b><br>Project evaluation: Introduction, a business case, Project portfolio management, Evaluation of individual projects, Cost-benefit evaluation techniques, Risk                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 11           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| evaluation, Programme management, Managing the allocation of resources within programmes, Strategic programme management, Creating a programme, Aids to programme management, Benefits management. Selection of an appropriate project approach: Introduction, Build or buy, choosing methodologies and technologies, Choice of process models, Structure versus speed of delivery, The waterfall model, The spiral model, Software prototyping, Agile methods, managing iterative Processes, Selecting the most appropriate process model.                                                                                                                                                       |    |
| <b>Unit 3:</b><br>Software effort estimation: Introduction, need of estimation. Problems with over and under-estimates, the basis for software estimating, Software efforts estimation techniques, Bottom-up estimating, the top-down approach and parametric models, Expert judgment, estimating by analogy. Activity planning: Introduction, objectives, Project schedules, Projects and activities, Sequencing and scheduling activities, Network planning models, Shortening the project duration, Identifying critical activities. Risk Management: Introduction, Categories of risk, framework for dealing with risk, risk identification, risk assessment, risk planning, risk management. | 11 |
| <b>Unit 4:</b><br>Resource allocation: Introduction, the nature of resources, identifying resources requirements, scheduling resources, creating critical paths, Counting the cost, being specific, Publishing the resources schedule, Cost schedules. Managing people and organizing teams: Introduction, understanding behavior, Motivation, team work, Decision Making, Leadership. Software quality: Introduction, importance, Product versus process quality management, Techniques to help enhance software quality, Quality plans.                                                                                                                                                         | 11 |

### Learning Resources:

1. Software Project Management, Bob Hughes, Mike Cotterell, 5th Edition, McGraw-Hill Education, 2009.
2. Project Management, Harvey Maylor, 3rd Edition, Pearson, 2004.
3. Project Management and Agile Systems, Kalpesh Ashar, 5th Edition, Vibrant Publishers, 2020.

**Semester: VI**

|                                   |                                           |
|-----------------------------------|-------------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Mobile Communication</b> |
| <b>Course Credits:</b> 03 (3:0:0) | <b>Hours/Week:</b> 03                     |
| <b>Total Contact Hours:</b> 44    | <b>Formative Assessment Marks:</b> 20     |
| <b>Exam Marks:</b> 80             | <b>Exam Duration:</b> 03                  |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

**CLO 1:** Understand the basic concepts of wireless and mobile communication

**CLO 2:** Explain multiple access techniques used in mobile communication such as FDMA, TDMA, and CDMA.

**CLO 3:** Analyze radio propagation mechanisms and wireless transmission techniques used in mobile communication environments.

**CLO 4:** Focus on cellular network design concepts, including frequency reuse, handoff strategies, and channel allocation.

**Course pedagogy**

1. Classroom lectures to explain fundamental concepts of wireless and cellular communication systems.
2. Demonstration of wireless communication concepts such as signal transmission, cellular structure, and handoff mechanisms.
3. Case Studies: Study of real-world mobile communication systems and applications to understand practical implementations.
4. Group Discussions and Presentations.

| <b>Course Contents</b>                                                                                                                                                                                                                                                               | <b>Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1:</b>                                                                                                                                                                                                                                                                       |              |
| Introduction to Mobile Communication: Evolution of mobile communication systems. Basic concepts of wireless communication, Cellular communication principles, Frequency reuse and channel assignment strategies, multiple access techniques such as FDMA, TDMA, and CDMA.            | 11           |
| <b>Unit 2:</b>                                                                                                                                                                                                                                                                       |              |
| Wireless Transmission and Propagation: Free space propagation model, Radio wave propagation mechanisms, Path loss and shadowing, fading models, Doppler Effect in mobile communication. : Cellular Network Design, Cell structure and cell splitting Handoff and handover strategies | 11           |
| <b>Unit 3:</b>                                                                                                                                                                                                                                                                       |              |

|                                                                                                                                                                                                                                                                                                |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Traffic engineering in cellular systems, Channel allocation techniques, Capacity improvement techniques. Wireless Network Technologies: Architecture and operation of GSM, Overview of 3G, 4G, and 5G networks, Mobile switching and call processing, Wireless LAN and Bluetooth technologies. | 11 |
| <b>Unit 4:</b>                                                                                                                                                                                                                                                                                 |    |
| Mobile Network Protocols and Security: Mobile IP and mobility management, Routing in mobile networks, Security issues in wireless networks, Authentication and encryption techniques, Mobile application services.                                                                             | 11 |

### **Learning Resources:**

1. Mobile Communications – by Jochen Schiller, Publisher: Addison-Wesley
2. Wireless and Mobile Communication – by Upena Dalal and Manoj K. Shukla
3. Principles of Mobile Communication – by Gordon L. Stüber
4. Mobile Wireless Communications – by Mischa Schwartz.
5. Wireless Communications: Theory and Techniques – by Asrar U. H. Sheikh
6. Mobile Communications Handbook – edited by Jerry D. Gibson

**Semester: VI**

|                                   |                                       |
|-----------------------------------|---------------------------------------|
| <b>Course Code:</b>               | <b>Course Title: Power BI</b>         |
| <b>Course Credits:</b> 02 (0:0:2) | <b>Hours/Week:</b> 04                 |
| <b>Total Contact Hours:</b> 60    | <b>Formative Assessment Marks:</b> 10 |
| <b>Exam Marks:</b> 40             | <b>Exam Duration:</b> 03              |

**Course Learning Outcomes (CLOs)**

Upon successful completion of this course, students will be able to:

- CLO 1:** Import, clean, and transform datasets using tools such as Power Query Editor for effective data preparation.
- CLO 2:** Create meaningful data visualizations including bar charts, line charts, pie charts, and donut charts to represent business data.
- CLO 3:** Develop interactive reports and dashboards to analyze key performance indicators (KPIs) and business performance.
- CLO 4:** Apply data modeling techniques and DAX expressions to establish relationships between tables and generate calculated fields for advanced analysis.

**Course Pedagogy**

1. Hands-on Laboratory Sessions using Power BI for data import, transformation, visualization, and dashboard creation.
2. Demonstration-based Teaching where the instructor explains Power BI tools such as Power Query Editor, data modeling, and DAX functions.
3. Practical Assignments and Exercises requiring students to analyze datasets and build visual reports and dashboards.

**List of Practical Experiments:****Part -A**

1. Import a dataset from an Excel file and clean the data by removing duplicates and handling missing values.
2. Use Power Query Editor to transform a dataset, such as splitting columns, merging tables, or changing data types.
3. Create a bar chart to show the total sales by region.
4. Create a line chart to display the trend of sales over time.
5. Build a report that includes various visualizations, such as pie charts, bar charts, and tables, to analyze sales data.

**Part -B**

6. Create a dashboard that combines several key performance indicators (KPIs) to give an overview of business performance.
7. Create a relationship between tables manually through Power BI.
8. Use the DAX expression to add a new column in the data source.

9. Use the Donut Chart for Profit Analysis.
10. Analyze the more profitable day from the sales analysis table using Bar Chart in Power BI.

**Evaluation Scheme for Lab Examination:**

| <b>Assessment Criteria</b> |                                 | <b>Marks</b> |
|----------------------------|---------------------------------|--------------|
| Writing                    | One program from Part A         | 15           |
|                            | One program from Part B         | 15           |
| Execution                  | Any one of the Written programs | 5            |
| Viva Voce                  |                                 | 5            |
| <b>Total</b>               |                                 | <b>40</b>    |

**CIE, SEE and QP Pattern for Theory Courses (2 Credits):**

Total Lecture hours per paper: 30, No. of Units: 3 (10 Hours Each)

Internal Assessment: C1 - 5 Marks, C2 - 5 Marks

Semester End Theory Exam: C3 - 40 Marks

**Question paper pattern for Theory Courses (2 Credits):**

Maximum Marks – 40

Part A: Answer any 5 questions out of 6: (5x2=10 Marks) Question No. 1 to 6

Part B: Answer the following questions: (10x3=30 Marks)

7.a) 7. b) or 7. c) 7. d)

8.a) 8. b) or 8. c) 8. d)

9.a) 9. b) or 9. c) 9. d)

**CIE, SEE and QP Pattern for Theory Courses (3 Credits):**

Total Lecture hours per paper: 44

No. of Units 4 (11 Hours Each)

Internal Assessment: C1 - 10 Marks, C2 - 10 Marks

Semester End Theory Exam: C3 - 80 Marks

**Question paper pattern for Theory Courses (3 Credits):**

Instructions: Answer Part-A and Part-B:

Part-A

Answer any 10 out of 12 Questions (3 Questions drawn from each unit).

Each question carries 2 Marks. (10 X 2 =20)

Q. No. 1 to Q. No. 12.

Part-B

Answer all the Questions. Each question carries 15 Marks. (4 X 15 =60) (Each question with internal choice and with maximum of 3 sub questions)

## **Programme Learning Outcomes (PLOs)**

### **PLO 1: Computational Knowledge**

Apply the knowledge of computing fundamentals, mathematics, and domain concepts to solve complex computing problems in areas such as operating systems, computer networks, algorithms, artificial intelligence, and data analytics.

### **PLO 2: Problem solving skills**

Identify, formulate, and analyze complex computing problems using logical reasoning, algorithmic thinking, and appropriate computational techniques.

### **PLO 3: Modern Tool Usage**

Select and apply modern tools, technologies, and platforms such as AI tools, data analytics software, block chain systems, and visualization tools for effective problem-solving.

### **PLO 4: Experimentation & Data Analysis**

Conduct experiments, analyze data, and interpret results using statistical, computational, and visualization techniques to support decision-making.

### **PLO 5: Professional Ethics & Security**

Apply ethical principles and commit to professional responsibilities, including data security, privacy, and legal compliance in computing practices.

### **PLO 6: Team Work**

Function effectively as a member or leader in multidisciplinary teams to accomplish shared goals.

### **PLO 7: Project Management**

Apply project management principles, including planning, scheduling, risk management, and resource allocation in software and IT projects.

## **Sustainable Development Goals (SDGs)**

**SDG 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

**SDG 5:** Achieve gender equality and empower all women and girls.

**SDG 9:** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**SDG 13:** Take urgent action to combat climate change and its impacts.

## Programme Learning Outcomes (PLOs) and Sustainable Development Goals (SDGs) - Course Compliance Matrix

| Sl. No. | Course Title                            | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 |
|---------|-----------------------------------------|------|------|------|------|------|------|------|
| 1       | Network Security                        | ✓    | ✓    | ✓    | ✓    | ✓    | -    | -    |
| 2       | Network Security Lab                    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | -    |
| 3       | Design and Analysis of Algorithms       | ✓    | ✓    | ✓    | ✓    | -    | ✓    | -    |
| 4       | Design and Analysis of Algorithms Lab   | ✓    | ✓    | ✓    | ✓    | -    | ✓    | -    |
| 5       | Computer Graphics & Multimedia          | ✓    | ✓    | ✓    | ✓    | -    | ✓    | ✓    |
| 6       | Computer Graphics & Multimedia Lab      | ✓    | ✓    | ✓    | ✓    | -    | ✓    | ✓    |
| 7       | Blockchain Technology                   | ✓    | ✓    | ✓    | ✓    | ✓    | -    | ✓    |
| 8       | Enterprise Resource Planning            | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |
| 9       | Fundamentals of Artificial Intelligence | ✓    | ✓    | ✓    | ✓    | ✓    | -    | ✓    |
| 10      | AI Tools and its applications           | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |
| 11      | Scientific Computing Techniques         | ✓    | ✓    | -    | ✓    | -    | -    | -    |
| 12      | Scientific Computing Techniques Lab     | ✓    | ✓    | ✓    | ✓    | -    | ✓    | -    |
| 13      | Big Data Analytics                      | ✓    | ✓    | ✓    | ✓    | -    | -    | ✓    |
| 14      | Big Data Analytics Lab                  | ✓    | ✓    | ✓    | ✓    | -    | ✓    | ✓    |
| 15      | Web Content Management System           | ✓    | ✓    | ✓    | ✓    | -    | ✓    | ✓    |
| 16      | Web Based Mini Project                  | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |
| 17      | Software Project Management             | ✓    | ✓    | -    | ✓    | ✓    | ✓    | ✓    |
| 18      | Mobile Communication                    | ✓    | ✓    | -    | ✓    | ✓    | -    | -    |
| 19      | Power BI                                | ✓    | ✓    | ✓    | ✓    | -    | ✓    | -    |

| <b>Sl. No.</b> | <b>Course Title</b>                            | <b>SDG4</b> | <b>SDG5</b> | <b>SDG9</b> | <b>SDG13</b> |
|----------------|------------------------------------------------|-------------|-------------|-------------|--------------|
| <b>1</b>       | <b>Network Security</b>                        | ✓           | ✓           | ✓           | -            |
| <b>2</b>       | <b>Network Security Lab</b>                    | ✓           | ✓           | ✓           | -            |
| <b>3</b>       | <b>Design and Analysis of Algorithms</b>       | ✓           | ✓           | -           | -            |
| <b>4</b>       | <b>Design and Analysis of Algorithms Lab</b>   | ✓           | ✓           | -           | -            |
| <b>5</b>       | <b>Computer Graphics &amp; Multimedia</b>      | ✓           | ✓           | ✓           | -            |
| <b>6</b>       | <b>Computer Graphics &amp; Multimedia Lab</b>  | ✓           | ✓           | ✓           | -            |
| <b>7</b>       | <b>Blockchain Technology</b>                   | ✓           | ✓           | ✓           | -            |
| <b>8</b>       | <b>Enterprise Resource Planning</b>            | ✓           | ✓           | ✓           | -            |
| <b>9</b>       | <b>Fundamentals of Artificial Intelligence</b> | ✓           | ✓           | ✓           | ✓            |
| <b>10</b>      | <b>AI Tools and its applications</b>           | ✓           | ✓           | ✓           | ✓            |
| <b>11</b>      | <b>Scientific Computing Techniques</b>         | ✓           | -           | ✓           | -            |
| <b>12</b>      | <b>Scientific Computing Techniques Lab</b>     | ✓           | -           | ✓           | -            |
| <b>13</b>      | <b>Big Data Analytics</b>                      | ✓           | -           | ✓           | ✓            |
| <b>14</b>      | <b>Big Data Analytics Lab</b>                  | ✓           | -           | ✓           | ✓            |
| <b>15</b>      | <b>Web Content Management System</b>           | ✓           | -           | ✓           | -            |
| <b>16</b>      | <b>Web Based Mini Project</b>                  | ✓           | ✓           | ✓           | -            |
| <b>17</b>      | <b>Software Project Management</b>             | ✓           | -           | ✓           | -            |
| <b>18</b>      | <b>Mobile Communication</b>                    | ✓           | -           | ✓           | -            |
| <b>19</b>      | <b>Power BI</b>                                | ✓           | -           | ✓           | ✓            |