



## **Department of Computer Science & Engineering**

### **Scheme of Examination and Syllabus for Under Graduate Programme**

**Under Multiple Entry and Exit, Internship and  
CBCS-LOCF as per NEP-2020  
w.e.f. session 2024-25 (in phased manner)**

**Subject: Computer Science**



**Guru Jambheshwar University of Science & Technology  
Hisar-125001, Haryana**

**(A+ NAAC Accredited State Govt. University)**





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**Hisar-125001, Haryana**  
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Scheme of Examination and Syllabus for Under Graduate Programme w.e.f. session 2024-25  
 for affiliated Degree Colleges according to National Education Policy-2020

**(Offered by the Department)**  
**Subject: Computer Science**

**SECOND YEAR**

| SEMESTER-III                       |             |                               |         |               |                |                |             |                        |
|------------------------------------|-------------|-------------------------------|---------|---------------|----------------|----------------|-------------|------------------------|
| Type of Course                     | Course Code | Nomenclature of Paper/Course  | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course         | C24COS301T  | Data Base Management Systems  | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                    | C24COS301P  | DBMS Lab                      | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course/<br>Vocational Course | C24MIC302T  | IT & E-Commerce               | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                    | C24MIC302P  | IT & E-Commerce Lab           | 1       | 2             | 10             | 20             | 30          | 3                      |
| Multidisciplinary Course           | C24MDC305T  | C Programming                 | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                    | C24MDC305P  | C Programming Lab             | 1       | 2             | 10             | 15             | 25          | 3                      |
| Skill Enhancement Course           | C24SEC303T  | Data Analysis Using Excel     | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                    | C24SEC303P  | Data Analysis Using Excel Lab | 1       | 2             | 10             | 15             | 25          | 3                      |
| SEMESTER-IV                        |             |                               |         |               |                |                |             |                        |
| Type of Course                     | Course Code | Nomenclature of Paper/Course  | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course         | C24COS401T  | Computer Networks             | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                    | C24COS401P  | Computer Networks Lab         | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course/<br>Vocational Course | C24VOC402T  | Basics of Programming Using R | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                    | C24VOC402P  | R Programming Lab             | 2       | 4             | 15             | 35             | 50          | 3                      |
| Value Added Course                 | C24VAC313T  | Internet Ethics               | 2       | 2             | 15             | 35             | 50          | 2                      |



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Scheme of Examination and Syllabus for Under Graduate Programme w.e.f. session 2024-25  
 for affiliated Degree Colleges according to National Education Policy-2020

**(Programme-wise)**  
**Subject: Computer Science**

**SECOND YEAR**

| SEMESTER-III                       |             |                               |         |               |                |                |             |                        |
|------------------------------------|-------------|-------------------------------|---------|---------------|----------------|----------------|-------------|------------------------|
| Type of Course                     | Course Code | Nomenclature of Paper/Course  | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course         | C24COS301T  | Data Base Management Systems  | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                    | C24COS301P  | DBMS Lab                      | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course/<br>Vocational Course |             | To be taken from MIC Pool     | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                    |             | To be taken from MIC Pool     | 1       | 2             | 10             | 20             | 30          | 3                      |
| Multidisciplinary Course           |             | To be taken from MDC Pool     | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                    |             | To be taken from MDC Pool     | 1       | 2             | 10             | 15             | 25          | 3                      |
| Ability Enhancement Course         |             | To be taken from AEC Pool     | 2       | 2             | 15             | 35             | 50          | 2                      |
| Skill Enhancement Course           |             | To be taken from SEC Pool     | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                    |             | To be taken from SEC Pool     | 1       | 2             | 10             | 15             | 25          | 3                      |
|                                    |             |                               |         |               |                |                |             |                        |
| SEMESTER-IV                        |             |                               |         |               |                |                |             |                        |
| Type of Course                     | Course Code | Nomenclature of Paper/Course  | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course         | C24COS401T  | Computer Networks             | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                    | C24COS401P  | Computer Networks Lab         | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course/<br>Vocational Course |             | To be taken from MIC/VOC Pool | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                    |             | To be taken from MIC/VOC Pool | 2       | 4             | 15             | 35             | 50          | 3                      |
| Ability Enhancement Course         |             | To be taken from AEC Pool     | 2       | 2             | 15             | 35             | 50          | 2                      |
| Value Added Course                 |             | To be taken from VAC Pool     | 2       | 2             | 15             | 35             | 50          | 2                      |



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**Name of the Programme: Computer Science UG Programs (B.Sc./B.A.)**  
**Scheme of Examination for Affiliated Degree College**  
 According to National Education Policy-2020  
**Offered by the Department)**  
**Subject: Computer Science**

**THIRD YEAR**

| SEMESTER-V                          |             |                              |         |               |                |                |             |                        |
|-------------------------------------|-------------|------------------------------|---------|---------------|----------------|----------------|-------------|------------------------|
| Type of Course                      | Course Code | Nomenclature of Paper/Course | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course          | C24COS501T  | Operating System             | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                     | C24COS501P  | Operating System Lab         | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course/ Vocational Course     | C24MIC502T  | Programming in Python        | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                     | C24MIC502T  | Programming in Python Lab    | 2       | 4             | 15             | 35             | 50          | 3                      |
| Skill Enhancement Course/Internship | C24SEI500P  | Internship                   | 4       |               | 100            |                | 100         | 3                      |
| SEMESTER-VI                         |             |                              |         |               |                |                |             |                        |
| Type of Course                      | Course Code | Nomenclature of Paper/Course | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course          | C24COS601T  | Programming in Python        | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                     | C24COS601P  | Programming in Python Lab    | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course                        | C24MIC602T  | Data Analytics               | 4       | 4             | 30             | 70             | 100         | 3                      |
| Vocational Course                   | C24VOC601T  | Cloud Computing              | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                     | C24VOC602P  | Cloud Computing Lab          | 2       | 4             | 15             | 35             | 50          | 3                      |



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**Name of the Programme: Computer Science UG Programs (B.Sc./B.A.)**  
**Scheme of Examination for Affiliated Degree College**  
 According to National Education Policy-2020

**(Programme-wise)**  
**Subject: Computer Science**

**THIRD YEAR**

| SEMESTER-V                          |             |                              |         |               |                |                |             |                        |
|-------------------------------------|-------------|------------------------------|---------|---------------|----------------|----------------|-------------|------------------------|
| Type of Course                      | Course Code | Nomenclature of Paper/Course | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course          | C24COS501T  | Operating System             | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                     | C24COS501P  | Operating System Lab         | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course/<br>Vocational Course  |             | To be taken from MIC Pool    | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                     |             | To be taken from MIC Pool    | 2       | 4             | 15             | 35             | 50          | 3                      |
| Skill Enhancement Course/Internship |             | Internship                   | 4       |               | 100            |                | 100         |                        |
| SEMESTER-VI                         |             |                              |         |               |                |                |             |                        |
| Type of Course                      | Course Code | Nomenclature of Paper/Course | Credits | Contact Hours | Internal Marks | External Marks | Total Marks | Duration of Exam (Hrs) |
| Discipline Specific Course          | C24COS601T  | Programming in Python        | 3       | 3             | 20             | 50             | 70          | 2.5                    |
|                                     | C24COS601P  | Programming in Python Lab    | 1       | 2             | 10             | 20             | 30          | 3                      |
| Minor Course                        |             | To be taken from MIC Pool    | 4       | 4             | 30             | 70             | 100         | 3                      |
| Vocational Course                   |             | To be taken from VOC Pool    | 2       | 2             | 15             | 35             | 50          | 2                      |
|                                     |             | To be taken from VOC Pool    | 2       | 4             | 15             | 35             | 50          | 3                      |

**Computer Science**  
**Fundamentals of Computer and Programming in C (Semester-I)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS101T**

**45 Hrs (3 Hrs /Week)**

**Credits: 3**

**Exam. Time: 2.5 Hrs**

**External Marks : 50**

**Internal Marks : 20**

**Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

**Course Objective:** The course covers an introduction to computer fundamentals, including hardware and software components. It then transitions into programming basics in C, covering data types, variables, operators, control structures, functions, arrays, pointers and structure in C programming.

**Unit-I**

**Basics of Computers:** Definition of a Computer - Characteristics and Applications of Computers – Block Diagram of a Digital Computer – Classification of Computers based on size and working – Central Processing Unit – I/O Devices.

**Storage:** Primary, Auxiliary and Cache Memory – Memory Devices. Software, Hardware, Firmware.

**Operating System** – Definition and Functions of an Operating System – MS-DOS – MS Windows – Desktop, Computer, Documents, Pictures, Music, Videos, Recycle Bin, Task Bar – Control Panel.

**Unit-II**

**C Programming Fundamentals:** Keywords, Variables and Constants, Structure of a C Program, Input/Output.

**Operators & Expressions:** Arithmetic, Unary, Logical. Bit-wise, Assignment & Conditional Operators

**Decision Making:** Decision making using if...else. Else If Ladder; Switch, break. Continue and Goto statements.

**Loop Control Structure:** While and do-while, for loop and Nested for loop, Decision using switch; goto, break and continue statements.

**Unit-III**

**Functions:** Introduction, using functions – Function declaration/ prototype – Function definition function call – return statement – Passing parameters, Recursive functions

**Arrays:** Introduction, Declaration of Arrays, Accessing elements of the Array – Storing Values in Array, Passing array element to a function: Call by Value and Call by Reference, One dimensional array -declaration, initialization, Accessing one dimensional array, Two dimensional Arrays-declaration, initialization, Accessing two dimensional arrays.

**Unit-IV**

**Strings:** Introduction, String and Character functions, String Operations using String functions- strcat() , strcmp() , strcpy() , strlen().

**Pointers:** Declaring Pointer Variable, Pointer Expressions and Pointer Arithmetic, Passing Arguments to Functions using Pointers. Dynamic Memory Allocation: malloc(), calloc(), realloc(), free() functions

**Structures and Unions:** Declaration of structures, Structure Initialization, Accessing structure members, Arrays of structure, Nested structures, Structure with pointers, Union

**Text/ Reference Books:**

1. P. K. Sinha, "Computer Fundamentals", 6th edition
2. E. Balaguruswamy, "Fundamentals of Computer" (First Edition- 2009), McGraw-Hill
3. Yashvant Kanetkar, "Let Us C", 15th Edition, BPB Publications
4. E. Balaguruswami : Programming with C Language, Tata McGraw Hill, New Delhi.

**Course Outcomes:**

*At the end of the course , the students would be able to :*

CO1: **Recall** components and classification of computer systems.

CO2: **Explain** CPU functions, I/O devices, and memory types.

CO3: **Apply** software, hardware, and firmware concepts in computing.

CO4: **Analyze** and compare programming constructs such as loops and operators.

CO5: **Evaluate** advanced programming concepts such as functions, array.

CO6\*: **Develop** programs based on learned concepts.

**Mapping of COs with POs: (C24COS101T)**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Programming in C Lab

**Paper Code: C24COS101P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam.Time: 3 Hrs**

**External Marks: 20**

**Internal Marks: 10**

**Total Marks: 30**

The following activities be carried out/ discussed in the lab during the semester.

### List of Experiments: C Programming Lab

1. Write a C program to find roots of quadratic equation.
2. Program to accept a positive integer and find the sum of the digits in it.
3. Program to check whether the given number is Prime or Not.
4. Program to Check whether given number is Palindrome or Not.
5. Program to perform i) Matrix Addition ii) Matrix Multiplication.
6. Program to find GCD and LCM using non-recursive function.
7. Program to find largest number in the array.
8. Program to find factorial of a given number using functions.
9. Program to accept and display Student Details using Structures
10. Program to swap two numbers using different parameter passing techniques.

**Note: In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.**

### Course Outcomes:

*At the end of the course , the students would be able to :*

CO1. **Develop** basic C programs using appropriate syntax and semantics.

CO2. **Analyze and debug** C programs to identify and fix errors effectively.

CO3. **Evaluate** the impact of different coding practices on the performance and readability of C programs.

CO4. **Design and execute** programs involving control structures, arrays, and functions.

CO5. **Create** lab assignment record that includes problem definitions, solutions, results, and conclusions.

CO6. **Demonstrate** ethical practices while solving problems individually or in groups.

### Mapping of COs with POs: (C24COS101P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Computer Programming Fundamentals (Semester-I)**  
**Minor Course (MIC)**

**Paper Code: C24MIC102T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Course Objective:** This introduces core concepts like variables, loops, and conditionals, essential for all aspiring programmers. This course covers the building blocks of coding, emphasizing problem-solving and algorithmic thinking.

**Unit - I**

**Introduction to Programming:** Overview of programming concepts, **Computer Languages:** Machine Language, Assembly Language, High Level Language; Source code, Compiler, Interpreter, Object Code; Algorithm, Flow Chart and pseudocode, Basics of problem-solving in programming, Debugging, **Error:** Types of Error.

**Unit – II**

**Programming fundamentals: Data types:** Integers, floating-point numbers, strings, and Booleans, Variables and constants, Input/output operations, Operators and expressions, **Conditional statements:** if, else if, else, **Loops:** while loops, for loops; Control structures: break, continue;

**Text and Reference Books:**

1. E. Balagurusamy, Fundamentals of Computer and Programming, Tata McGraw-Hill Education
2. J.B. Dixit, Fundamentals of Computer Programming and IT, Laxmi Publications
3. P. K. Sinha, "Computer Fundamentals", 6th edition, 2003.

**Course Outcomes**

*At the end of the course, the students would be able to :*

CO1: **Recall** fundamental programming language concepts. (LOTS: Level 1 - Remember)

CO2: **Define** data types input/output operations, and control structures. (LOTS: Level 2 -Understand)

CO3: **Apply** problem-solving techniques in programming (LOTS: Level 3 - Apply)

CO4: **Compare** various conditional and control statements. (HOTS: Level 4 – Analyze)

CO5: **Evaluate** advanced programming concepts to solve complex programming problems effectively. (HOTS: Level 5 - Evaluate)

**Mapping of COs with POs: C24MIC102T:**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Problem Solving using C (Semester-I)**  
**Minor Course (MIN)**

**Paper Code: C24MIN102T**

**45 Hrs (3 Hrs /Week)**

**Credits: 3**

**Exam. Time: 2.5 Hrs**

**External Marks : 50**

**Internal Marks : 20**

**Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

**Course Objective:** Programming for problem Solving is a basic and important for every graduate in Engineering. This course introduces basic constructs of programming language like algorithms, conversion of algorithms to programs etc. By studying this course students will get to know about C programming language with its various programming paradigms like branching, looping, arrays, functions, recursion, structure, pointers, etc. to be implemented for solving real world problems. It includes various sorting and searching algorithms as well with notion of order of complexity through simple programs

**Unit - I**

**Introduction to Programming:** Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.).

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart/Pseudo code with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

**Unit – II**

Arithmetic expressions and precedence, Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Arrays: Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

**Unit-III**

**Function:** Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

**Structure:** Structures, Defining structures and Array of Structures.

**Unit-IV**

**Pointers:** Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linkedlist (no implementation)

File handling (only if time is available, otherwise should be done as part of the lab)

**Text and Reference Books:**

1. E. Balagurusamy, Fundamentals of Computer and Programming, Tata McGraw-Hill Education
2. J.B.Dixit, Fundamentals of Computer Programming and IT, Laxmi Publications
3. P. K. Sinha, "Computer Fundamentals", 6th edition, 2003.

## Course Outcomes

*At the end of the course , the students would be able to :*

CO1. **Describe** the algorithms to programs (in C language) to test and execute the programs and correct syntax and logical errors.

CO2. **Demonstrate** the use of conditional branching, iteration and recursion.

CO3. **Apply** programming to solve matrix addition and multiplication problems and searching and sorting problem, apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

CO4. **Compare** the suitability of arrays, pointers and structures to formulate algorithms and programs for various problem situations

CO5. **Justify** a problem into functions and synthesize a complete program using divide and conquer approach.

### Mapping of COs with POs: C24MIN102T:

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Problem Solving using C Lab

**Paper Code: C24MIN102P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam.Time: 3 Hrs**

**External Marks: 20**

**Internal Marks: 10**

**Total Marks: 30**

The following activities be carried out/ discussed in the lab during the semester.

### List of Experiments: C Programming Lab

1. One assignment to familiarize with programming environment.
2. One assignment on simple computational problems using arithmetic expressions.
3. One assignment on problems involving if-then-else structures.
4. One assignment on iterative problems e.g., sum of series.
5. One assignment on One Dimensional Array manipulation.
6. One assignment on different Matrix problems, String operations.
7. One assignment on implementing simple functions.
8. One assignment on Recursive functions.
9. One assignment on pointers and structures.
10. One assignment on file operations

**Note: In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.**

### Course Outcomes:

*At the end of the course , the students would be able to :*

CO1. Implement simple, iterative as well as recursive programs. (LOTS: Level 3: Apply)

CO2. Analyze given algorithms to a working and correct program. (LOTS: Level 4: Analyze)

CO3. Compare solutions on the basis of the appropriateness of data structure used like arrays, strings and structures and manipulate through implementation. (HOTS: Level 5: Evaluate)

CO4. Integrate knowledge of programming with identification and correcting logical errors encountered at run time. (HOTS: Level 6: Create)

CO5. Create written records for the given assignments with problem definition, design of solution and conclusions.. (HOTS: Level 6: Create)

CO6. **Demonstrate** ethical practices while solving problems individually or in groups (LOTS: Level 3: Apply).

### Mapping of COs with POs: (C24MIN102P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Information Technology (Semester-I)**  
**Multidisciplinary Course (MDC)**

**Paper Code: C24MDC105T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Course Objective:** To make student understanding in various components of Information Technology and Learn IT Concepts.

**Unit – I**

Introduction to Computers, Characteristics and Limitations of Computers, Block Diagram of Computer, Classification of Computers, Hardware and Software, Types of software, Computer Languages. Data and information, Types of data & information, Data processing using Computer.

Units of a Computer, CPU, ALU, Types of Memory and Memory Hierarchy, Registers, Input Output devices, Mother Board. Processing numerical data using Spreadsheets, Processing and displaying textual data using word processor.

**Unit – II**

Societal impact of IT, social use of WWW, privacy security and integrity of Information, Internet, Web Browsers, Internet Connection Types, How Internet Works, ISPs, Search Engines, Emails and Its Working, Internet Security, Uses of Internet, Introduction to Cloud and its Applications.

**Text and Reference Books:**

1. Introduction to Information Technology by V. Rajaraman., PHI
2. Information Technology by P.K. Sinha, PHI
3. ITL Education Solutions Limited, "Introduction to Computer Science", Pearson Education, 2nd Edition 2012.

**Course Outcome**

*At the end of the course , the students would be able to :*

- CO1: **Recognize** Computer system components and classifications. (LOTS: Level 1 - Remember)  
CO2: **Understand** Computer System functions.(LOTS: Level 2Understand)  
CO3: **Explore** Software productivity tools such as MS word and Excel. (LOTS: Level 3 - Explore)  
CO4: **Insights** The Internet and Cloud Computing concepts.(HOTS: Level4-Analyze)  
CO5: **Evaluate** Advanced IT concepts and MS office. (HOTS: Level 5 - Evaluate)  
CO6: **Create** Programs based on acquired knowledge.(HOTS: Level 6– Create)

**Mapping of COs with POs: (C24MDC105T)**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Information Technology Lab

**Paper Code: C24MDC105P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam. Time: 3 Hrs**

**External Marks : 15**

**Internal Marks : 10**

**Total Marks: 25**

**Course Objective:** To make student understand various components of computer and their working, Learn Basic IT Concepts.

The following activities to be carried out/discuss in the Lab during the practical.

### List of Experiments:

1. Create a class timetable using table option in MS- Word.
2. Make your resume in MS-Word.
3. Create worksheet of 10 students and apply basic formula and functions in MS Excel.
4. Create worksheet of a company employee and calculate their salary and other benefits.
5. Basics knowledge about Internet and Google's applications (including Google Chrome, Google Docs, Gmail, Google weather, google sheet etc.).
6. To Compose and send an email to single person and multiple recipients. Also use CC and BCC option of email.
7. To send an email with an attachment.
8. To use Digilocker app and Google drive.

**Note:** In addition to above experiments, the teacher concerned may add more experiments based on theory syllabus

### Course Outcome

*At the end of the course, the students would be able to:*

CO1. **Develop** basic programs with MS Word, Excel & IT Concepts

CO2. **Explore** programs to identify formatting effectively.

CO3. **Evaluate** the impact of formatting documents.

CO4. **Design** programs involving formulas, functions.

CO5. **Create** lab assignment record that includes problem definitions, solutions, results, and conclusions.

CO6. **Demonstrate** ethical practices while solving problems individually or in groups.

### Mapping of COs with POs: (C24MDC105P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science  
Office Tools (Semester-I/II)  
Skill Enhancement Course (SEC)**

**Paper Code: C24SEC103T**

**30 Hrs. (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks: 35**

**Internal Marks: 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**About the Course:** To impart the basic knowledge about the software and hardware. The student will learn about the basics of operating systems and spreadsheets.

**Unit I**

**Operating System** - Definition, Functions, Types of Operating System, Basics of Popular Operating Systems, The User Interface, Exploring Computer, Icons, taskbar, desktop, Using Menu and Menu-selection, managing files and folders, Control panel – display properties, add/remove software and hardware, Common utilities.

**Basic Word Processing** - Introduction to Word Processing, Menus, Creating, Editing & Formatting Document, Spell Checking, Printing.

**Unit II**

**Advanced Word Processing:** Views, Tables, modifying page setup, applying document themes, applying document style sets, Inserting headers and footers

**Spread Sheet:** Elements of Electronics Spread Sheet, Applications, Creating and Opening of Spread Sheet, Menus, Manipulation of cells: Enter texts numbers and dates, Cell Height and Widths, copying of cells, Mathematical, Statistical and Financial function, Drawing different types of charts, Sort and Filter Data. Creating Presentation, Type of presentation views. Using sound, Animation, Working with Objects, Printing.

**Text books and references:**

1. Help files from Apache Open Office, <https://wiki.openoffice.org/wiki/Documentation>
2. Channelle Andy, “Beginning OpenOffice 3: From Novice to Professional”, a Press Publications
3. Beginning OpenOffice 3: From Novice to Professional, Andichannele, Apress.
4. Microsoft Office 2016 Step by Step: MS Office 2016 Step by Step, By Joan Lambert,
5. Curtis Frye
6. Computer Fundamentals - By Pradeep K. Sinha, Priti Sinha, BPB Publications, 6th Edition
7. Getting Started with Libre Office, Friends of Open Documents Inc.,
8. <https://www.freetechbooks.com/friends-of-opendocument-inc-p1851.html>
9. Documentation from LibreOffice, <https://documentation.libreoffice.org/en/englishdocumentation>

**Course Outcome**

*At the end of the course a student is able to:*

**CO1: Recall** classification of operating system.

**CO2: Define** basic functions of operating systems and word processing.

**CO3: Apply** editing and formatting in a document.

**CO4: Compare** working of word processor and spread-sheets.

**CO5: Evaluate** the spread-sheets using built-in functions.

**Mapping of COs with POs: (C24SEC103T)**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Office Tools Lab (Semester-I/II)

**Paper Code: C24SEC103P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam. Time: 3 Hrs**

**External Marks : 15**

**Internal Marks : 10**

**Total Marks: 25**

**The following activities to be carried out/discuss in the Lab during the practical.**

Operating System:

- Starting with basics of Operating Systems and its functionalities

Word Processing:

- Create and format word documents.
- Use tables, word Art and other features in your documents.
- Use macros to simplify the tasks in a document.
- Use mail merge to write once for many.

Spread Sheet:

- Use spreadsheet for basic data handling
- Apply formulas to sheet for automation.
- Use Charts & Shapes for better visualization of the data.
- Use sorting and filtering of the data

Presentation Software:

- Prepare and format presentations.
- Apply slide transitions, animations and sequencing for slides.
- Apply different formatting and insert options to make presentation better.
- Applying sound and animation.

**Note: In addition to above experiments, the teacher concerned may add more experiments based on theory syllabus**

### Course Outcome

*At the end of the course a student is able to:*

**CO1:** Basic working and functions of operating system.

**CO2:** Effective use of formatting skills on paragraphs, tables, lists, and pages.

**CO3:** Demonstrate the mechanics and uses of Word tables to organize and present data.

**CO4:** To evaluate accounting operations.

**CO5:** Utility of functions and formulas on excel spreadsheet.

**CO6:** Manipulate data using data names and ranges, filters and sort, and validation lists.

### Mapping of COs with POs: (C24SEC103P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Digital Efficiency Tools (Semester-I/II)**  
**Skill Enhancement Course (SEC)**

**Paper Code: C24SEC203T**

**30 Hrs. (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks: 35**

**Internal Marks: 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Course Objective:** This course introduces simple and practical techniques to improve digital productivity. Students will learn about basic time management tools, digital collaboration using G Suite applications, organizing files, and handling digital distractions. The course aims to help students streamline their digital tasks, reduce distractions, and increase efficiency.

**Unit-I**

**Introduction to Digital Efficiency:** What is Digital Efficiency? Benefits of Being Digitally Efficient, Handling Digital Distractions. **Basic Time Management Tools:** Using Digital Calendars (Google Calendar), Google Tasks.

**Email management and File organisation:** Basics of Digital Note-Taking (Google Keep), Simple File and Folder Organization, Managing Emails Effectively (Gmail).

**Unit – II**

**Digital Collaboration with G Suite:** File sharing and storage (Google Drive), Online Meetings (Google Meet), Collaborative Document Editing (Google Docs, Google Sheets), Using Google Classroom for Education, Creating Surveys and Forms (Google Forms)

**Text and Reference:**

1. Newport, C., Digital Minimalism: Choosing a Focused Life in a Noisy World, Portfolio, 2019
2. Google keep: <https://support.google.com/keep/answer/2888240?hl=en&co=GENIE.Platform%3DAndroid&sjid=1235277822480263684-AP>
3. Google drive: <https://support.google.com/drive/answer/2424384?hl=en&co=GENIE.Platform%3DAndroid&sjid=1235277822480263684-AP>
4. Google meet: <https://support.google.com/a/users/answer/9282720?hl=en&sjid=1235277822480263684-AP>
5. Google docs: <https://support.google.com/a/users/answer/9282664?hl=en&sjid=1235277822480263684-AP>
6. Google sheet: <https://support.google.com/a/users/answer/9282959?hl=en>
7. Google forms: <https://support.google.com/a/users/answer/9303071?hl=en>
8. Managing Emails Effectively: <https://support.google.com/a/users/answer/9260550?hl=en>
9. Google classroom: <https://sites.google.com/view/classroom-workspace/>

**Course Outcomes**

*At the end of the course students will be able to:*

- CO1. **Define** basic concepts of digital efficiency.
- CO2. **Explain** simple tools and strategies for managing digital tasks.
- CO3. **Apply** basic digital tools to improve personal productivity.
- CO4. **Compare** different digital tools for specific tasks.
- CO5. **Develop** a simple digital efficiency plan using selected tools.

**Mapping of COs with POs:**

| <b>Outcomes</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1             |     |     |     |     |     |     |     |     |
| CO2             |     |     |     |     |     |     |     |     |
| CO3             |     |     |     |     |     |     |     |     |
| CO4             |     |     |     |     |     |     |     |     |
| CO5             |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Digital Efficiency Tools Lab (Semester-I/II)

**Paper Code: C24SEC203P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exa. Time: 3 Hrs**

**External Marks : 15**

**Internal Marks : 10**

**Total Marks: 25**

**Course Objective:** This lab course provides hands-on practice with tools and techniques covered in the Digital Efficiency course. Students will gain practical experience in using digital productivity tools, managing files, and collaborating effectively using G Suite applications.

### List of experiments/assignments:

1. **Setting Up Google Calendar:** Create a Google account if not already done. Set up Google Calendar and explore its interface. Add personal events, set reminders, and manage notifications.
2. **Task Management with Google Tasks:** Sign up for Google Tasks or a similar task management tool. Create task lists for daily, weekly, and long-term goals. Prioritize tasks using labels, due dates, and priority levels.
3. **Managing Emails with Gmail:** Use Gmail to manage emails effectively. Organize emails using labels, folders, and filters. Practice archiving, deleting, and searching for emails.
4. **Digital Note-Taking with Google Keep:** Explore Google Keep for creating and organizing notes. Use labels, colours, and reminders for better organization. Share notes with peers and collaborate on a note-taking activity.
5. **File Management with Google Drive:** Upload files to Google Drive and organize them into folders. Share files with specific permissions (view, edit, comment). Practice searching for files and using advanced features like offline access.
6. **Collaborative Document Editing:** Collaborate on a document using Google Docs. Edit the document simultaneously with peers. Use comments, suggestions, and version history features.
7. **Online Meetings with Google Meet:** Schedule an online meeting using Google Calendar. Host and join meetings using Google Meet. Share screens, collaborate on documents, and record meetings for future reference.

Note: In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.

### Course Outcomes

*At the end of the course, students will be able to:*

- CO1. **Apply** digital tools for efficient personal organization and productivity.
- CO2. **Analyse** and prioritize tasks using task management strategies.
- CO3. **Critique** the usability and user experience of each tool based on practical use.
- CO4. **Design** comprehensive digital documentation.
- CO5. **Create** lab assignment record that includes problem definitions, solutions, results, and conclusions.
- CO6. **Demonstrate** ethical practices while solving problems individually or in groups.

### Mapping of COs with POs: (C24SEC203P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Digital Empowerment (Semester-I/Semester-II)**  
**Value Aided Courses (VAC)**

**Paper code: C24VAC109T**

**30 Hrs. (2 Hrs /week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks: 35**

**Internal Marks: 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Course Objective:** The course aims to promote digital empowerment by understanding the digital landscape, creating awareness of Digital India, and emphasizing cyber safety and security for effective communication and collaboration in cyberspace.

**Unit - I**

**Digital Empowerment:** Needs and challenges, Vision of Digital India: DigiLocker, E-Hospitals, e-Pathshala, BHIM, e-Kranti (Electronic Delivery of Services), e-Health Campaigns; Public utility portals of Govt. of India such as RTI, Health, Finance, Income Tax filing, Education.

**Unit – II**

**Electronic Communication:** Electronic mail, blogs, social media, Tools/platforms for online learning, Collaboration using file sharing, messaging, video conferencing; **Safe and Secure Cyberspace:** Online security and privacy, Data breach and Cyber Attacks, Security Initiatives by the Govt of India, Ethics in Cyberspace.

**Text and Reference Books:**

1. Rodney H. Jones, Christoph A. Hafner, Understanding Digital Literacies: A Practical Introduction, Routledge Books, 2<sup>nd</sup> Edition, 2021
2. David Sutton, Cyber Security: A practitioner's guide, BCS Learning & Development Limited, UK, 2017

**Course Outcomes**

*At the end of the course students will be able to:*

CO1: **Recall** fundamental concepts of digital empowerment.

CO2: **Understand** different initiatives of digital empowerment.

CO3: **Apply** electronics communication tools like Email and social media.

CO4: **Analyze** different types cyber attack and security concerns.

**Mapping of COs with POs: (C24VAC109T)**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Data Structure using C (Semester-II)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS201T**  
**45 Hrs (3 Hrs /Week)**  
**Credits: 3**  
**Exam. Time: 2.5 Hrs**

**External Marks : 50**  
**Internal Marks : 20**  
**Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

**Course Objective:** Achieve an understanding of fundamental data structures, which allow one to store collections of data with fast updates and queries. Study theoretical analysis, implementation and application of data structures.

**Unit I**

**Introduction:** Data Structures Definition and its types, Data Structure operations, Static and dynamic memory storage, Algorithms complexity and time-space tradeoff, Big-O notation. **Strings:** Introduction, storing strings, String operations, Pattern matching algorithms.

**Unit II**

**Arrays:** one-dimensional arrays, matrices, sparse matrices, multi-dimensional arrays, operations on arrays, Linear search, Binary search, Insertion sort, selection sort, Bubble sort, Merge sort.

**Linked List:** Array vs linked list, Types (singly, doubly, singly circular, header, doubly circular,). Operations on Lists – create, insert, delete, search, Applications of linked lists.

**Unit III**

**Stack:** Definition, Array implementation of stacks, Linked implementation of stacks, Applications of Stacks: Infix, Postfix and prefix expression, conversions and evaluation of expressions, Recursion, Quick Sort.

**Queue:** Definition, Array implementation of queues, Linked implementation of queues, Circular queues, Priority queues, Double-ended queues, Applications of queue.

**Unit IV**

**Trees:** Binary Trees and their properties, Linked and static Representation of binary trees, Complete Binary Tree, Threaded Binary tree, Different tree traversal algorithms, Binary Search Tree (create, delete, search, insert, display).

**Graph:** Definition, Array and linked representation of graphs, Graph Traversal (BFS and DFS), Adjacency matrix and adjacency lists, path matrix, Finding Shortest Path - Warshall's Algorithm.

**Text and Reference Books:**

1. Seymour Lipschutz, "Data Structures", Tata McGraw- Hill Publishing Company Limited, Schaum's Outlines, New Delhi.
2. Yedidyan Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, "Data Structures Using C", Pearson Education., New Delhi.
3. Bala Guruswamy, "Data Structures Using C", TMH.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Addison- Wesley.

**Course Outcome:**

*At the end of the course , the students would be able to :*

- CO1: **Identify** components and classifications of computer systems.
- CO2: **Understand** CPU functions, I/O devices, and memory types.
- CO3: **Apply** software, hardware, and firmware concepts in computing.
- CO4: **Analyze and compare** programming constructs like loops and operators.
- CO5: **Evaluate** advanced programming concepts including functions and arrays.
- CO6: **Develop** programs based on learned concepts. (HOTS: Level 6 – Create)

**Mapping of CO's with PO's: (C24COS201T)**

| <b>Outcomes</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1             |     |     |     |     |     |     |     |     |
| CO2             |     |     |     |     |     |     |     |     |
| CO3             |     |     |     |     |     |     |     |     |
| CO4             |     |     |     |     |     |     |     |     |
| CO5             |     |     |     |     |     |     |     |     |
| CO6             |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Data Structure using C Lab

**Paper Code: C24COS201P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam. Time: 3 Hrs**

**External Marks: 20**

**Internal Marks: 10**

**Total Marks: 30**

**Course:** Achieve an understanding of fundamental data structures, which allow one to store collections of data with fast updates and queries. Study theoretical analysis, implementation and application of data structures.

**The following activities be carried out/ discussed in the lab during the initial period of the semester.**

### List of Laboratory Assignments Data Structure Using C:

1. Write a program to insert an element in an array.
2. Write a program to delete an element from an array.
3. Write a program for Pattern Matching Algorithm.
4. Write a program for Bubble Sort/ Selection Sort/ Insertion Sort.
5. Write a program for Linear Search/ Binary search.
6. Write a program to insert a node in linked list at beginning, end, after a given node, before a given node.
7. Write a program to delete the starting node, last node or a given node from a linked list.
8. Write a program to implement push and pop operation in a stack using array.
9. Write a program to implement push and pop operation in stack using Linked List.
10. Write a program for Quick Sort.
11. Write a program to insert and delete an element in Queue using array.
12. Write a program to insert and delete an element in Queue using Linked List.

**Note:** In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.

### Course Outcome:

*At the end of the course, the students would be able to :*

- CO1. **Develop** basic data structure programs using appropriate syntax and semantics in C.
- CO2. **Analyze and debug** programs to identify and debug errors.
- CO3. **Explore** how various coding practices affect the performance and readability of C programs.
- CO4. **Design and execute** programs that include control structures, arrays, and functions.
- CO5. **Create** lab assignment record that includes problem definitions, solutions, results, and conclusions.
- CO6. **Demonstrate** ethical practices while solving problems individually or in groups.

### Mapping of COs with POs: (C24COS201P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Internet and Web Design (Semester-II)**  
**Minor Course (MIC)**

**Paper Code: C24MIC202T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Course Objective:** This course introduces core concepts of Internet and web designing emphasizing on HTML.

**Unit I**

**Introduction to Internet:** Internet Evolution and Concept, Internet Vs Intranet, Growth of Internet, Internet Service Provider (ISP) & its Function, Connectivity- Dialup, Leased line; URL, Protocols.

**E-MAIL:** Email Basics, Address, Features, Sending & Receiving email, Email Protocols, Labels in Email, Email services providers, Internet chatting - Voice chat, Text chat

**World Wide Web (www):**History of WWW, Web Browser, Web server, Search Engines, working of Search Engine, Web Protocols (HTTP, FTP, SNMP etc.), TCP/IP layer with protocols.

**Unit II**

**Web Designing:** Steps for developing a Website; contents selection; Webpage, Home page; Domain Names; website publishing.

**HTML:** Concepts of Hypertext, Versions of HTML, Elements of HTML, Syntax, Tags & Attributes, Head & Body Sections, Inserting Texts, Images, Hyperlinks, Backgrounds and Color Controls, Different HTML Tags, Table Layout and Presentation, Creating Lists, Use of Font Size & Attributes, List Types and Its Tags, Use of Frames and Forms in Web Pages.

**Text and Reference Books:**

1. Raj Kamal, Internet and Web Technologies, Tata McGraw- Hill, 2002.
2. Wendy Willard, HTML Beginners Guide, Tata McGraw- Hill, 2009.
3. Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI, 2004.

**Course Outcomes**

*At the end of the course, the students would be able to:*

CO1: **Recall** the basic concepts of Internet and WWW.

CO2: **Explain** ISPs and different connection types for networking

CO3: **Apply** basic web designing tool: HTML.

CO4: **Analyze** and discuss various components of a web page.

CO5: **Evaluate** and prepare a report describing or making recommendations for a website design.

CO6: **Design** a basic webpage having different elements of HTML.

**Mapping of COs with POs: (C24MIC202T)**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Internet and Web Design (Semester-II)**  
**Minor Course (MIN)**

**Paper Code: C24MIN202T**

**45 Hrs (3 Hrs /Week)**

**Credits: 3**

**Exam. Time: 2.5 Hrs**

**External Marks : 50**

**Internal Marks : 20**

**Total Marks: 70**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Course Objective:** This course introduces core concepts of Internet and web designing emphasizing on HTML.

**Unit I**

**Introduction to Internet:** Internet Evolution and Concept, Internet Vs Intranet, Growth of Internet, Internet Service Provider (ISP) & its Function, Connectivity- Dialup, Leased line; URL, Protocols.

**E-MAIL:** Email Basics, Address, Features, Sending & Receiving email, Email Protocols, Labels in Email, Email services providers, Internet chatting - Voice chat, Text chat

**Unit-II**

**World Wide Web (www):** History of WWW, Web Browser, Web server, Search Engines, working of Search Engine, Web Protocols (HTTP, FTP, SNMP etc.), TCP/IP layer with protocols.

**Unit III**

**Web Designing:** Steps for developing a Website; contents selection; Webpage, Home page; Domain Names; website publishing.

**Unit-IV**

**HTML:** Concepts of Hypertext, Versions of HTML, Elements of HTML, Syntax, Tags & Attributes, Head & Body Sections, Inserting Texts, Images, Hyperlinks, Backgrounds and Color Controls, Different HTML Tags, Table Layout and Presentation, Creating Lists, Use of Font Size & Attributes, List Types and Its Tags, Use of Frames and Forms in Web Pages.

**Text and Reference Books:**

- Raj Kamal, Internet and Web Technologies, Tata McGraw- Hill, 2002.
- Wendy Willard, HTML Beginners Guide, Tata McGraw- Hill, 2009.
- Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI, 2004.

**Course Outcomes**

*At the end of the course, the students would be able to:*

CO1: **Recall** the basic concepts of Internet and WWW. (LOTS: Level 1 - Remember)

CO2: **Explain** ISPs and different connection types for networking (LOTS: Level 2 - Understand)

CO3: **Apply** basic web designing tool: HTML. (LOTS: Level 3 - Apply)

CO4: **Analyze** and discuss various components of a web page. (HOTS: Level 4 - Analyze)

CO5: **Evaluate** and prepare a report describing or making recommendations for a website design. (HOTS: Level 5 - Evaluate)

CO6: **Design** a basic webpage having different elements of HTML (HOTS: Level 6 – Create)

**Mapping of COs with POs: (C24MIN202T)**

| <b>Outcomes</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1             |     |     |     |     |     |     |     |     |
| CO2             |     |     |     |     |     |     |     |     |
| CO3             |     |     |     |     |     |     |     |     |
| CO4             |     |     |     |     |     |     |     |     |
| CO5             |     |     |     |     |     |     |     |     |
| CO6             |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Internet and Web Design Lab

**Paper Code: C24MIN202P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam. Time: 3 Hrs**

**External Marks : 20**

**Internal Marks : 10**

**Total Marks: 30**

**The following activities to be carried out/discuss in the Lab during the practical.**

### List of Experiments:

1. Use the HTML tags for Font features.
2. Create Ordered and Unordered List in Table.
3. Create a simple webpage using HTML.
4. Designing of registration form with table and use of hyperlink.
5. Design a page with frames to include Images and Videos.
6. Add a cascading style sheet for designing the web page.
7. Use user defined function to get array of values and sort them in ascending order on web page
8. Demonstrate Request and Response object using HTML Form.
9. Register your website domain with DNS Provider.

**Note: In addition to above experiments, the teacher concerned may add more experiments based on theory syllabus**

### Course Outcome

*At the end of the course, the students would be able to:*

CO1. **Develop** Different Web pages using appropriate syntax and semantics. (LOTS: Level 3: Apply)

CO2. **Analyze and debug** webpage and fix errors effectively. (LOTS: Level 4: Analyze)

CO3. **Evaluate** the impact of different coding practices on the performance and readability of HTML tags. (HOTS: Level 5: Evaluate)

CO4. **Design and execute** programs inserting image, videos etc in webpage. (HOTS: Level 6: Create)

CO5. **Create** lab assignment record that includes problem definitions, solutions, results, and conclusions. (HOTS: Level 6: Create)

CO6. **Demonstrate** ethical practices while creating website projects individually or in groups (LOTS: Level 3: Apply).

### Mapping of COs with POs: (C24MIN202P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Internet and Web Design (Semester-II)**  
**Multidisciplinary Course (MDC)**

**Paper Code: C24MDC205T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

**Course Objective:** This course introduces core concepts of Internet and web designing emphasizing on HTML& CSS.

**Unit I**

**Introduction to Internet:** Internet Evolution and Concept, Internet Vs Intranet, Growth of Internet, Internet Service Provider (ISP) & its Function, Connectivity- Dialup, Leased line; URL, Protocols.

**E-MAIL:** Email Basics, Address, Features, Sending & Receiving Email, Email Protocols, Lables in Email, Email services providers, Internet chatting - Voice chat, Text chat.

**World Wide Web (www):** History of WWW, Web Browser, Webserver, Search Engines, working of Search Engine, Web Protocols (HTTP, FTP, SNMP etc.), TCP/IP layer with protocols.

**Web Designing:** Steps for developing a Website; contents selection; Webpage, Home page; Domain Names; website publishing.

**Unit II**

**HTML:** Concepts of Hypertext, Versions of HTML, Elements of HTML, Syntax, Tags & Attributes, Head & Body Sections, Inserting Texts, Images, Hyperlinks, Backgrounds and Color Controls, Different HTML Tags, Table Layout and Presentation, Creating Lists, Use of Font Size & Attributes, List Types and Its Tags, Use of Frames and Forms in Web Pages.

**Cascading Style sheets :** Introduction to CSS, External Style sheet, Internal style sheet, Inline style sheet, CSS Syntax-Selector, Property, Value, Overriding, Comments, color, background, Font, images.

**Text and Reference Books:**

1. Raj Kamal, Internet and Web Technologies, Tata McGraw- Hill, 2002.
2. Wendy Willard, HTML Beginners Guide, Tata McGraw- Hill, 2009.
3. Deitel and Goldberg, Internet and World Wide Web, How to Program, PHI, 2004.

**Course Outcomes**

*At the end of the course , the students would be able to :*

CO1: **Recall** the basic concepts of Internet and WWW.

CO2: **Explain** ISPs and different connection types for networking.

CO3: **Apply** basic web designing tool: HTML.

CO4: **Analyze** and discuss various components of a web page.

CO5: **Evaluate** and prepare a report describing or making recommendations for a website design.

CO6: **Design** a basic webpage having different elements of HTML& CSS.

**Mapping of COs with POs: (C24MDC205T)**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

## Internet and Web Design Lab (Semester-II)

**Paper Code: C24MDC205P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam. Time: 3 Hrs**

**External Marks : 15**

**Internal Marks : 10**

**Total Marks: 25**

**The following activities to be carried out/discuss in the Lab during the practical. List of Experiments:**

10. Use the HTML tags for Font features.
11. Create Ordered and Unordered List in Table.
12. Create a simple webpage using HTML.
13. Designing of registration form with table and use of hyperlink.
14. Design a page with frames to include Images and Videos.
15. Add a cascading style sheet for designing the web page.
16. Use user defined function to get array of values and sort them in ascending order on web page
17. Demonstrate Request and Response object using HTML Form.
18. Register your website domain with DNS Provider.

**Note: In addition to above experiments, the teacher concerned may add more experiments based on theory syllabus**

### Course Outcome

*At the end of the course, the students would be able to :*

CO1. **Develop** Different Web pages using appropriate syntax and semantics. CO2.

**Analyze and debug** webpage and fix errors effectively.

CO3. **Evaluate** the impact of different coding practices on the performance and readability of HTML tags. CO4.

**Design and execute** programs inserting image, videos etc in webpage.

CO5. **Create** lab assignment record that includes problem definitions, solutions, results, and conclusions. CO6.

**Demonstrate** ethical practices while creating website projects individually or in groups.

### Mapping of COs with POs: (C24MDC205P)

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |
| CO6      |     |     |     |     |     |     |     |     |

S=Strong, M=Medium, W=Weak

**Computer Science**  
**Data Base Management System (Semester III)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS301T**  
**45 Hrs (3Hrs /Week)**  
**Credits: 3**  
**Exam Time: 2.5 Hrs**

**External Marks: 50**  
**Internal Marks: 20**  
**Total Marks: 70**

**Note:** The syllabus is divided into four units. For the end semester examination, nine questions are to be set by the examiner. Question number one is compulsory and contains five short answer questions covering entire syllabus. Rest eight more questions (each question of at least two parts) will be set by giving two questions from each of the unit of the syllabus. A candidate is required to attempt five questions in all by selecting one question from each of unit in addition to compulsory Question No.1. All questions will carry equal marks.

**Course Objective:** This course provides foundational knowledge in Data Base Management System. It covers data models and database languages, and a survey of implementation techniques applied in modern DBMS. It also provides practical skills of conceptual/logical database design and general familiarity with the problems and issues of database management. It develops skills that are appropriate for Database Administrators, Database Application Developers, Database Specialists, and DBMS developers.

**UNIT – I**

**Basic Introduction:** Data, Information, Records, Files and Database. Characteristics of Database Management System. DBMS over File Processing System. Advantages and Disadvantages of DBMS. Database Users and various types of DBMS users. Database Administrator (DBA) and responsibilities of DBA. Schema and Instance. Views of Database. Physical and Logical Data Independence. Database Languages. DBMS Architecture: Three Schema Database Architecture.

**UNIT-II**

**Data Models:** Hierarchical, Network and Relational Data Models.

**Entity-Relationship Model:** Entity, Entity Sets, and Entity Type, Attributes: Type of Attributes, **Relationships**-Relationship set, Degree of Relationship, Cardinality Ratio. Participation Constraints. **ER Diagram:** Symbolic Notations for Designing ER Diagram,

**UNIT – III**

**Relational Model:** Relational model concepts (Domain, Attribute, Tuple, Relations, Characteristics of a relation), Keys: Super Key, Candidate Key, Primary Key, Foreign Key. Constraints- Key constraints, Domain constraints, Referential integrity constraints; **Relational algebra :** Basic operations like Select, Project, Union, Intersection, Difference, Projection, Selection, Join.

**UNIT - IV**

**Relational Database design:** functional dependencies, Normal forms (1 NF, 2 NF, 3 NF and BCNF). Decomposition, types of decomposition, properties of decomposition.

**SQL:** Introduction, Data Types; DDL-Create, Alter and Drop table Commands. DML- SELECT/ FROM/WHERE, INSERT INTO/ VALUES, UPDATE /SET/ WHERE/ORDER BY/HAVING, DELETE, Commands.

**Suggested Readings:**

1. Elmasri & Navathe: Fundamentals of Database systems, 3rd Edition, Addison Wesley, New Delhi.
2. Ivan Bayross : SQL, PL/SQL-The Program Language of ORACLE, BPB Publication, New Delhi.
3. Korth & Silberschatz : Database System Concept, 4th Edition, McGraw Hill International Edition.
4. C. J. Date : An Introduction to Data bases Systems 7th Edition, Addison Wesley, New Delhi.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Identify:** Learn the basic concepts of Data Base Management System.

**CO2: Understand:** Understand the architecture of DBMS, and different data models, and various keys.

**CO3: Apply:** Design relational database system.

**CO4: Analyze and compare:** Design and execute queries using SQL.

**Mapping of CO-PO**

**C24COS301T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels:-None,1:Low,2:Medium,3:High

**Computer Science**  
**DBMS LAB**  
**(SemesterIII)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS301P**  
**30 Hrs (2Hrs /Week)**  
**Credits: 1**  
**Exam Time:3 Hrs**

**External Marks: 20**  
**Internal Mark: 10**  
**Total Marks: 30**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Principal of the college.

**Course Objective:** This course Understand basic concept of SQL and database concepts. Analyze the real-life problem and execute DDL, DML and DCL commands to solve the problem. It increases proficiency in database design and query using SQL.

**List of Laboratory Assignments:**

1. Creation of database having different fields and data types.
2. Adding various constraints using DDL commands
3. Alter the schema of the existing database
4. Delete the schema of the database
5. Add records in the database using DML command
6. SQL query for various views of the database.
7. Update and delete existing records in the database using DML command
8. Using SQL queries for various aggregate function
9. Using SQL queries Ordering and grouping of records on the database
10. Using SQL queries for logical operations on relational database

Students are given ten or more laboratory assignments with soft and hard deadlines. The lab assignments are evenly spread over the semester. Every student is required to prepare a file of laboratory assignments done.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Identify:** identify the various SQL commands.

**CO2: Understand:** Understand the data types, and various constraint, and nature of SQL commands.

**CO3: Apply:** Create a Data base and design various queries for the data base.

**CO4: Analyze and compare:** Enforce integrity constraints on a database using SQL commands

**Mapping of CO-PO**

**C24COS301P**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels:-None, 1:Low, 2:Medium, 3:High

**Computer Science UG Programs (B.Sc./B.A.)**  
**(Semester-III)**  
**IT & E-Commerce Lab**  
**Minor Course (MIC)**

**Paper Code: C24MIC302P**  
**30 Hrs (2 Hrs /Week)**  
**Credits: 1**  
**Exam.Time: 3 Hrs**

**External Marks: 20**  
**Internal Marks: 10**  
**Total Marks: 30**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objective:** The course aims to provide students with hands-on experience in networking and e-commerce technologies by enabling them to: design and simulate network topologies and understand DNS resolution mechanisms, explore, and compare various e-commerce models and platforms, analyze real-world e-commerce security issues, develop practical skills in mobile payment platforms and digital signatures for secure online transactions.

**List of Laboratory Assignments:**

1. Create and identify different network topologies using network simulation tools.
2. Practical on resolving domain names to IP addresses and analyzing how DNS works.
3. Design diagrams or mock-ups of B2B, B2C, C2C, and C2B e-commerce models.
4. Explore and compare e-commerce portals like Amazon, Flipkart, etc. and study their user interfaces.
5. Simulate a mobile banking transaction or use a mobile payment platform (e.g. Paytm, BHIM, and Google Pay).
6. Practical on creating and verifying digital signature.
7. Analyze a simple case study related to the IT Act 2000 and its applications in e-commerce security.
8. Create an E-commerce Web site using HTML/WORD PRESS. (Take your own concepts to develop site.)

**Note:** In addition to the above experiments, the teacher may add more programs on the behalf of the theory syllabus.

Students are given seven or more laboratory assignments with soft and hard deadlines. The lab assignments are evenly spread over the semester. Every student is required to prepare a file of laboratory experiments done.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Identify:** Learn how to implement various network concepts, e-commerce models and secure digital transaction mechanism.

**CO2: Understand:** Make the students familiar with various E-Commerce platforms, mobile banking interfaces and sites.

**CO3: Apply:** Learn the students how to deal with network simulation tools, various payment platforms and designing secure e-commerce portals.

**Mapping of CO-PO**  
**C24MIC302P**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science UG Programs (B.Sc./B.A.)  
IT & E-Commerce (Semester-III)  
Minor Course (MIC)**

**Paper Code: C24MIC302T**  
**45 Hrs (3 Hrs /Week)**  
**Credits: 3**  
**Exam. Time: 2.5 Hrs**

**External Marks: 50**  
**Internal Marks: 20**  
**Total Marks: 70**

**Note:** The syllabus is divided into four units. For the end semester examination, nine questions are to be set by the examiner. Question number one is compulsory and contains five short answer questions covering entire syllabus. Rest eight more questions (each question of at least two parts) will be set by giving two questions from each of the unit of the syllabus. A candidate is required to attempt five questions in all by selecting one question from each of unit in addition to compulsory Question No.1. All questions will carry equal marks.

**Course Objective:** The course aims to provide a foundational understanding of the Internet and its applications, focusing on e-commerce models, technologies, and real-world applications. It equips students with knowledge of networking, online payment systems, cryptography, digital signatures, and mobile commerce. Additionally, the course emphasizes risk management, cybersecurity, data privacy laws, and fraud prevention to prepare students for effectively managing and securing e-commerce platforms and transactions in diverse industries.

**Unit I**

Introduction to the Internet: Networking, Network Topologies, Types of Networks, Network Devices: Nodes and Hosts, TCP/IP, IP Address, Web Browsers and Web Servers, URL, Domain Names, WWW, Search Engines, Internet vs. Intranet vs. Extranet, Network Devices: Routers, Switches, Hubs, Modems, and their roles, Uses of Computer Networks.

**Unit II**

Introduction to E-commerce, E-commerce Models: B2B, B2C, C2C, C2B. Applications of E-commerce: Service Industry, Retail Sector, Financial Services, Travel & Tourism. Future of E-commerce, Online Shopping: Web Portals. Mobile commerce: Internet Services through Mobile, Mobile Banking, WAP & WML, Mobile Information Devices, POS.

**Unit III**

Online Payment Mechanism, Electronic Payment System: Legal Issues & Digital Currency - E-Cash & E-Cheque - Electronic Fund Transfer (EFT) - Advantages and Risks - Digital Token-Based E-Payment System - Smart Cards. Payment Gateways, Risk Management options for E-Payment Systems, Cryptography, Authentication, Data Encryption, Decryption, Public Key, Private Key, Digital Signature, E-check Certification, Digital Certification.

**Unit IV**

Threats in E-commerce, Fraud Prevention, E-commerce Data Protection: PCI Compliance and Data Privacy Laws, Security of Client & Service Provider, Security Issues over the Web, Cyber Law-IT Act 2000.

**Text and Reference Books:**

1. Kenneth C. Laudon, E-Commerce: Business, Technology, Society, 4th Edition, Pearson
2. Rayudu- C.S - "E-commerce E-business"- Himalaya Publishing House Mumbai.
3. E-Commerce & Mobile Commerce Technologies: Pandey, Saurabh Shukla, S. Chand.
4. E-Commerce: An Indian Perspective: P.T. Joseph, S.J, PHI
5. Electronic Commerce: A Managerial Perspective, Turban, E. et al., Prentice Hall-2008.

**Course Outcomes: After completing this Course, the learner will be able to:**

**Course Outcomes:**

**CO1: Identify:** Key networking components, e-commerce models, payment mechanisms, and security challenges in the digital ecosystem.

**CO2: Understand:** The working principles of the Internet, web technologies, and the role of cryptography, public/private keys, and digital signatures in e-commerce security.

**CO3: Apply:** Networking and e-commerce concepts to design and develop secure online platforms and integrate payment gateways effectively.

**CO4: Analyze:** Risks associated with e-commerce systems, cybersecurity threats, fraud cases, and legal compliance requirements under IT laws.

**CO5: Compare:** Different e-commerce models (B2B, B2C, C2C, C2B), their applications, and technologies used in mobile commerce versus traditional e-commerce systems.

**Mapping of CO-PO C24MIC302T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**C Programming (Semester-III)**  
**Multi Disciplinary Course (MDC)**

**Paper Code: C24MDC305T**  
**30 Hrs (2 Hrs /Week)**  
**Credits:2**  
**Exam Time: 2 Hrs**

**External Marks: 35**  
**Internal Marks: 15**  
**Total Marks: 50**

**Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory, consisting of five short questions covering the entire syllabus, each carrying three marks. In addition to these, four more questions (each question may have two parts) will be set, comprising two questions from each unit. The student is required to attempt three questions in all, selecting one question from each unit, each carrying 10 marks, in addition to the compulsory Question Number 1.

**Course Objective:** This course provides foundational knowledge in problem-solving using the C programming language. It covers C programming essentials such as data types, operators, control structures, arrays, functions, strings, pointers, and user-defined data types like structures and unions. The course emphasizes practical programming skills and problem-solving techniques.

**Unit I**

**Overview of C:** Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant, Formatted input/output function

**Operators & Expression:** Arithmetic, Relational, Logical, Bitwise, Increment and decrement operators, Assignment Operator, Conditional Operators and Special Operators, Arithmetic Expressions, Evaluation of Arithmetic Expression, Operator Precedence and Associativity,

**Decision making** with if statement, if-else statement, nested if statement, else-if ladder, Switch and Break statement, **Looping Statements:** for, while, and do-while loop, jumps in loops.

**Unit II**

**Arrays:** Declaration and Initialization of One Dimensional arrays, Declaration and Initialization of two Dimensional Arrays, Declaration and Initialization of String Variable, String Handling Functions: String Length, Copy, Compare, Concatenate, Search for a Substring etc.

**Functions:** definition, prototype, function call, passing arguments to a function: call by value; call by reference. **Structure and**

**Union:** Structure definition, declaring structure variables, accessing structure members, Union definition, Difference between Structure and Union.

**Text and Reference Books:**

1. Gottfried, Byron S., Programming with C, Tata McGraw Hill.
2. Balagurusamy, E., Programming in ANSI C, Tata McGraw Hill.
3. Yashwant Kanetker, Let us C, BPB.
4. Rajaraman, V. , Computer Programming in C, PHI.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Identify:** Learn the basics of C Language

**CO2: Understand:** Understand data types and input/output statements, different types of operators, their hierarchies

**CO3: Apply:** Implement programs using arrays and strings.

**CO4: Analyze and compare:** Get familiar with advanced concepts like structures, union etc. in C language.

**Mapping of CO-PO**

**C24MDC305T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels:-None, 1:Low, 2:Medium, 3:High

**Computer Science**  
**C Programming Lab (Semester-III)**  
**Multi Disciplinary Course (MDC)**

**Paper Code: C24MDC305P**  
**30Hrs (2Hrs /Week)**  
**Credits:1**  
**Exam Time:3 Hrs**

**External Marks: 15**  
**Internal Marks:10**  
**Total Marks:25**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Principal of the college.

**Course Objective:** This practical lab course focuses on fundamental programming skills using C language, with an emphasis on problem-solving techniques. Students will complete a series of laboratory assignments that cover various topics such as basic arithmetic operations, control structures, array manipulation, and matrix operations. Assignments are designed to enhance practical coding skills and prepare students for more advanced programming tasks.

**List of Laboratory Assignments:**

1. To read radius of a circle and to find area and circumference of a circle.
2. To read three numbers and find the greatest out of three numbers.
3. To find the roots of quadratic equation.
4. To check whether the number is prime or not.
5. To find the factorial of a number.
6. To find the sum of the digits of a number, reverse the number, and also check the number is palindrome or not.
7. To read percentage of marks and to display appropriate message.
8. To read marks scored by n students and find the average of marks.
9. To check whether a given number is present in one dimensional integer Array.
10. To perform addition, multiplication of Matrices.

Students are given ten or more laboratory assignments with soft and hard deadlines. The lab assignments are evenly spread over the semester. Every student is required to prepare a file of laboratory assignment done.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Identify:** Learn how to implement c program in a programming language.

**CO2: Understand:** Make the students familiar with various data types, operators.

**CO3: Apply:** Learn how to deal with control statement, arrays.

**CO4: Analyze and compare:** Compare various conditional statement and loops

**Mapping of CO-PO**

**C24MDC305P**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels:-None, 1:Low, 2:Medium, 3:High

**Computer Science**  
**Data Analysis Using Excel**  
**Skill Enhancement Course (SEC)**

**Paper Code: C24SEC303T**

**30 Hrs. (2 Hrs/week)**

**Credit: 2**

**Exam. Time: 2 Hrs**

**External Marks: 35**

**Internal Marks: 15**

**Total Marks: 50**

**Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory, consisting of five short questions covering the entire syllabus, each carrying three marks. In addition to these, four more questions (each question may have two parts) will be set, comprising two questions from each unit. The student is required to attempt three questions in all, selecting one question from each unit, each carrying 10 marks, in addition to the compulsory Question Number 1.

**About the Course:** This course provides a comprehensive introduction to mastering spreadsheet functions.

**Unit I**

**Introduction to Excel :** About Excel , Uses of Excel, Spreadsheet window pane, Ribbon, Home Tab – Cut, Copy, Paste, Font, Alignment, data types, conditional formatting, insert cell, delete cell, format cell, fill, clear, find and replace, Page Layout Tab- Theme group, Page setup group, Formula Bar.

**Creating Formulas :** Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum, Create and run a macro.

**Unit II**

**Spreadsheet Chart :** Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table

**Data Handling and Analysis:** Data Sorting, Filter, Advance Filter, data table, text to columns, remove duplicates, Data validation, consolidate, Data Outline : Group, Ungroup and Subtotal, VLook function.

**Text and Reference Books:**

- Microsoft Office- Complete Reference, BPB Publication
- Kevin Wilson, Essential Office 2016
- Michael Alexander and Richard Kusleika, Excel 2019 Bible
- Greg Harvey, Excel 2019 All-in-One For Dummies

**Course Outcome:**

*By the end of the course a student is able to:*

CO1: **Recall** Excel features, understanding spreadsheet components. (LOTS: Level 1 - Remember)

CO2: **Explain** Excel structure, Columns, Rows, Cells, and basic navigation. (LOTS: Level 2 - Understand)

CO3: **Apply** formatting tools for Columns, Rows, Cells, and data manipulation. (LOTS: Level 3 - Apply)

CO4: **Analyze** Excel formula functions, charting options, and data analysis tools. (HOTS: Level 4 - Analyze)

CO6: **Develop** Excel proficiency for advanced data manipulation and analysis skills. (HOTS: Level 5 - Create)

**Mapping of COs with POs : C24SEC303P:**

| <b>Outcomes</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| C01             |     |     |     |     |     |     |     |     |
| C02             |     |     |     |     |     |     |     |     |
| C03             |     |     |     |     |     |     |     |     |
| C04             |     |     |     |     |     |     |     |     |
| C05             |     |     |     |     |     |     |     |     |

S=Strong, M= Medium, W=Weak

**Computer Science**  
**Data Analysis Using Excel Lab**  
**Skill Enhancement Course (SEC)**

**Paper Code: C24SEC303P**

**30 Hrs. (2 Hrs/week)**

**Credit: 1**

**Exam. Time: 3 Hrs**

**External Marks: 15**

**Internal Marks: 10**

**Total Marks: 25**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objective:** The course aims to equip students with practical skills to perform data analysis using Microsoft Excel. It focuses on data organization, use of formulas and functions, data visualization through charts, and basic statistical analysis tools. Students will gain hands-on experience in analyzing datasets and drawing meaningful insights for informed decision-making.

**The following activities will be carried out/ discussed in the lab during the semester.**

**List of experiments:**

1. Insert Rows and Columns in specific positions.
2. Working of different tools in format menu. (write any three tools).
3. Make use of different mathematical formulas such as =SUM, =COUNT, =AVERAGE, =MIN, =MAX.
4. Create employees salary sheet of a company with allowances and calculate gross salary.
5. Create students Marks sheet with Five subjects ;
  - a. Apply total and percentage of marks using Formulas.
  - b. Find maximum and minimum marks in a marksheet.
6. Create a chart showing the marks of a student in different subjects.
7. Create a worksheet with sorting of data based on specific condition.
8. Explore VLook function.

**Note: In addition to above experiments, the teacher may add more experiments based on theory syllabus.**

**Course outcomes:**

At the end of the course, the student would be able to:

CO1. **Develop** basic Excel programs using MS Excel. (LOTS: Level 3: Apply)

CO2. **Demonstrate** programs to identify formulas. (LOTS: Level 4: Analyse)

CO3. **Evaluate** the impact of different functionalities of available menus . (HOTS: Level 5: Evaluate)

CO4. **Develop** programs involving Work on mathematical functions.. (HOTS: Level 6: Create)

CO5. **Create** lab assignment record that includes problem definitions, solutions, results, and conclusions. (HOTS: Level 6: Create)

**Mapping of COs with POs : C24SEC303P:**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| C01      |     |     |     |     |     |     |     |     |
| C02      |     |     |     |     |     |     |     |     |
| C03      |     |     |     |     |     |     |     |     |
| C04      |     |     |     |     |     |     |     |     |
| C05      |     |     |     |     |     |     |     |     |

S=Strong, M= Medium, W=Weak

**Computer Science**  
**Computer Networks (Semester-IV)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS401T**  
**45 Hrs (3 Hrs /Week)**  
**Credits: 3**  
**Exam. Time: 2.5 Hrs**

**External Marks : 50**  
**Internal Marks : 20**  
**Total Marks: 70**

**Note:** The syllabus is divided into four units. For the end semester examination, nine questions are to be set by the examiner. Question number one is compulsory and contains five short answer questions covering entire syllabus. Rest eight more questions (each question of at least two parts) will be set by giving two questions from each of the unit of the syllabus. A candidate is required to attempt five questions in all by selecting one question from each of unit in addition to compulsory Question No.1. All questions will carry equal marks.

**Course Objective:** This course provides a comprehensive overview of data communication and computer networks. It covers key algorithms for data routing, forwarding, and switching across network nodes. Emphasizing the layered architecture, it enhances understanding of structured network communication.

**Unit I**

Data communication: Components, Data representation and Data flow; Network: Uses, Topologies, Network Services, OSI and TCP/IP Reference Models; Network categories: LAN, MAN, WAN; Guided Transmission Media, Wireless Transmission Media, Networking Devices: Hubs, Repeaters, Bridges, Modems, Switches, Routers, and Gateways

**Unit II**

Data Link Layer-design issues, Framing & Error Handling: Framing Protocols, Error detection and correction mechanisms; Switching Techniques: Circuit Switching, Packet Switching, Message Switching Flow Control Protocols: Stop-and-wait, Sliding Window protocols: Go-back-N and Selective Repeat;

**Unit III**

Multiple Access Communication: Random Access-ALOHA, Slotted-ALOHA, CSMA, CSMA-CD. Routing algorithms: optimality principle, shortest path, flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Congestion control algorithms, Internetworking: IPV4 and IPV6, IP Addressing, ARP, RARP, ICMP.

**Unit IV**

Transport Layer: Transport layer Services: Addressing, Multiplexing, Flow control, Internet Transport Protocols: UDP, TCP, TCP Segment, TCP Connection.

Application Layer: Introduction to DNS, FTP, TELNET, HTTP, SMTP, Electronic Mail, WWW.

**Text and Reference Books:**

1. Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson publications, 2010.
2. Forouzan, Data Communication and networking ,5th Edition, Tata McGrawHill, 2012.
3. William Stalling, Data & Computer Communication 6th edition, LPE Pearson Education, 2013.
4. Todd Lammle, CCNA Study Guide, 6th Edition, 2013.
5. RFCs and Internet Drafts available from Internet Engineering Task Force.

**Course Outcomes: After completing this Course, the learner will be able to:**

- CO1. **Outline** various models, topologies and devices of Computer Networks. (LOTS: Level 1: Remember)
- CO2. **Explain** the functions of various layers in Network Reference Model. (LOTS: Level 2: Understand)
- CO3. **Apply** different network concepts in various network communication protocols. (LOTS: Level 3: Apply)
- CO4. **Analyse** performance of various protocols in different scenarios. (HOTS: Level 4: Analyse)
- CO5. **Design** network for an organisation. (HOTS: Level 6: Create)

**Mapping of CO-**

**PO C24COS401T**

| <b>Outcomes</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1             |     |     |     |     |     |     |     |     |
| CO2             |     |     |     |     |     |     |     |     |
| CO3             |     |     |     |     |     |     |     |     |
| CO4             |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

## Computer Networks Lab

**Paper Code: C24COS401P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam.Time: 3 Hrs**

**External Marks: 20**

**Internal Marks: 10**

**Total Marks: 30**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objective:** The Computer Network Lab aims to provide hands-on experience in understanding network fundamentals, protocols, and data transmission techniques. Students will implement routing algorithms, configure networks, and analyze performance using simulation tools like Cisco Packet Tracer. The lab enhances problem-solving skills in network configuration, troubleshooting, and security measures.

### List of Laboratory Assignments:

1. Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of Network Devices in Detail.
3. Study of network IP
4. Connect the computers in Local Area Network
5. Connectivity troubleshooting using PING, IPCONFIG commands
6. Study of basic network command and Network configuration commands.
7. Performing an Initial Switch Configuration
8. Configure a network topology using Packet Tracer software.
9. Configure a network using Distance Vector Routing Protocol.
10. Configure a network using Link State Vector Routing Protocol.

### Course Outcomes: After completing this Course, the learner will be able to:

CO1. **Demonstrate** various network topologies and networking devices.(LOTS: Level: 3: Apply)

CO2. **Justify** a particular routing protocol for any network.(HOTS: Level: 5: Evaluate)

CO3. **Construct** a network and implement various network protocols.(HOTS: Level: 6: Create)

CO4. **Devise** solutions for various routing and switching problems. (HOTS: Level: 6:Create)

CO5. **Create lab** records for the solutions of the assignments. (HOTS: Level: 6: Create)

### Mapping of CO-PO

**C24COS401P**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

## R Programming Lab

**Paper Code: C24VOC402P**

**60 Hrs (4 Hrs /Week)**

**Credits: 2**

**Exam Time: 3 Hrs**

**External Marks: 35**

**Internal Marks: 15**

**Total Marks: 50**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objective:** This practical lab course focuses on fundamental programming skills using R language, with an emphasis on data analytics techniques. Students will complete a series of laboratory assignments that cover various topics such as creating and manipulating objects, functions and loops, graphs and charts. Assignments are designed to enhance practical coding skills and prepare students for more statistics concepts for data exploration.

### List of Laboratory Assignments:

11. Download and install R-programming environment and install packages using install. Packages () command in R.
12. Learn all the basics of R-Programming (Data types, Variables, Operators etc.)
13. Implement different data structures in R (Vectors, Lists, and Data Frames).
14. Learn the basics of functions in R and implement with examples.
15. Write R program to demonstrate the matrix addition, subtraction and multiplication.
16. Implement data frames in R. Write a program to join columns and rows in a data frame.
17. Create a list containing a vector, a matrix and a list and give names to the elements in the list. Access the first and second element of the list.
18. Implement R-Loops with different examples.
19. Create a script file to compute Sum, Range, Mean and Standard Deviation of the numeric variable in BOSTON dataset.
20. Create bar charts and histograms using R.

Students are given ten or more laboratory assignments with soft and hard deadlines. The lab assignments are evenly spread over the semester. Every student is required to prepare a file of laboratory experiments done.

### Course Outcomes: After completing this Course, the learner will be able to:

**CO1: Identify:** Learn different R data types for developing programs.

**CO2: Understand:** Show the installation of R Programming Environment.

**CO3: Apply:** Make use of different R Data Structures.

**CO4: Design:** Develop programming logic using R packages.

### Mapping of CO-PO C24VOC402P

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Basics of Programming Using R (Semester-IV)**  
**Minor Course / Vocational Course**

**Paper Code: C24VOC402T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks: 35**

**Internal Marks: 15**

**Total Marks: 50**

**Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory, consisting of five short questions covering the entire syllabus, each carrying three marks. In addition to these, four more questions (each question may have two parts) will be set, comprising two questions from each unit. The student is required to attempt three questions in all, selecting one question from each unit, each carrying 10 marks, in addition to the compulsory Question Number 1.

**Course Objective:** This course provides foundational knowledge in R language and data analysis using the R programming language. It includes working with data in various ways with the help of programming in R. Students will learn about R's environment and programming essentials such as factors, arrays and matrices, data frames, functions and I/O in R. With this course students learn about how to visualize data in R.

**Unit I**

**About R's Environment:** Basics of R and RStudio, Setting Variables, Knowing about objects in R, Creating sequences in R, Operators in R, Packages in R, Creating script files in R.

**Vectors in R:** Type of vectors, Accessing and manipulating vectors, Basic arithmetic operations on numeric vectors, Finding descriptive summary like mean, median, mod, range, quartiles, standard deviation etc. of numeric vectors, Comparing vectors, sorting vectors, Character vectors and operations on character vectors.

**Factors in R:** What are factors in R? Useful operations on factors,

**Arrays and Matrices in R:** Arrays in R, Creating, accessing and manipulating matrices, Naming the dimensions of matrices, Arithmetic operations on matrices, Concatenating matrices, various operations on matrices.

**Unit II**

**Data Frames:** Creating and accessing data frames, Finding and assigning column and row names to data frames, Binding data frames, various operations on data frames.

**Lists:** Creating a List, Useful Operations on Lists.

**Control Structures:** If, If-else, If-else if-else, and switch statements, Loops in R, Break and next statements.

**Functions in R:** Defining functions, Calling functions, Scope of variables in functions, Returning values from functions

**Input Output in R:** Reading and writing txt and CSV files in R.

**Visualizing Data in R:** Creating bar chart, histograms, polygons and boxplots.

**Text and Reference Books:**

1. Venables W. N., Smith D. M. and the R Core Team, "An Introduction to R, 2016.
2. Teetor Paul, R Cookbook, O'Reilly Media, 2011.
3. Chang Winston, R Graphics Cookbook, O'Reilly, 2012.
4. Ratnoo Saroj Dahiya, Ratnoo Himmat Singh, Essentials of R for Data Analytics, Wiley, 2021.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Define** the data analytics terminology and concepts related to R programming.

**CO2: Describe** the operations on data stored in vectors, matrices and data frames.

**CO3: Apply** the required operations to manipulate data stored in various R objects.

**CO4: Compare** various data objects and their related operations in R.

**CO5: Create** appropriate plots for data visualization.

**Mapping of CO-PO C24VOC402T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Internet Ethics**  
**(Semester-IV) Value Added Course (VAC)**

**Paper Code: C24VAC313T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory, consisting of five short questions covering the entire syllabus, each carrying three marks. In addition to these, four more questions (each question may have two parts) will be set, comprising two questions from each unit. The student is required to attempt three questions in all, selecting one question from each unit, each carrying 10 marks, in addition to the compulsory Question Number 1.

**Course Objective:** This course covers Internet Ethics and Cybersecurity, focusing on ethical principles, digital citizenship, and emerging challenges. It explores cyber threats, legal frameworks, and issues like privacy, AI ethics, and cybercrimes. Students will develop ethical awareness and analyse security concerns in the digital world.

**Unit I**

**Foundations of Internet Ethics:** Basics of Internet Ethics-definition, scope, and historical evolution, Core Ethical Principles-Respect, responsibility, fairness, and transparency; Digital Citizenship; Ethical Challenges in Digital world- Privacy and surveillance, Intellectual Property and Copyright, Cybersecurity and Hacking, Cyberbullying; Emerging Issues in Internet Ethics- Artificial Intelligence in decision making, Digital Divide and accessibility, Environmental impact of the Internet.

**Unit II**

**Cyber Security:** Concept of cyber security, Issues and challenges of cyber security; Cyber crimes- Classification of cyber crimes, Emerging cyber threats- Financial frauds, malware and ransomware attacks;

**Legal perspective of Cyber crime :** IT Act 2000, cyber offences under the IT act, Personal Data Protection Bill, Cyber Appellate Tribunal, Process for filing complaints and appeals.

**Text and Reference Books:**

1. Tiji Thomas, Stephen James, Dr. Terry Jacob Mathew, "Informatics and Cyber Ethics", Prakash Publication
2. Craig B, "Cyber Law: The Law of the Internet and Information Technology". Pearson Education
3. Vakul Sharma, "Handbook of Cyber Laws" Macmillan India Ltd, Second Edition, PHI, 2003

**Course Outcomes: After completing this Course, the learner will be able to:**

CO1: **Recall** fundamental concepts of Internet ethics (LOTS: Level 1 - Remember)

CO2: **Understand** ethical challenges in the digital world, such as privacy, intellectual property, cybersecurity, and cyberbullying. (LOTS: Level 2 - Understand)

CO3: **Apply** ethical principles in digital citizenship and evaluate emerging (LOTS: Level 3 - Apply)

CO4: **Analyse** cyber threats, security concerns, and legal frameworks. (HOTS: Level 4 - Analyse)

**Mapping of CO-PO C24VAC313T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Operating System (Semester-V)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS501T**

**45 Hrs (3Hrs/Week)**

**Credits: 3**

**Exam Time: 2.5 Hrs**

**External Marks: 50**

**Internal Marks: 20**

**Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

**Course Objectives:** This course introduces the fundamental concepts of operating systems, including their functions, structures, and types. It covers key topics such as process management, CPU scheduling, synchronization, memory management, and file system implementation. Students will learn to analyze and apply various algorithms and techniques used in operating systems.

**Unit I**

Introductory Concepts: Operating System, Functions and Characteristics, Historical Evolution of Operating Systems, Types of Operating System: Real-time, Multiprogramming, Multiprocessing, Batch processing. Operating System Services, System Calls, System Programs, Operating System Structure.

Process Management: Process Concepts, Operations on Processes, Process States, and Process Control Block. Inter- Process Communication.

**Unit II**

CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling, Algorithm Evaluation.

Process Synchronization: Critical Section Problem, Semaphores, Classical Problem of Synchronization, Monitors.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.

**Unit III**

Memory Management Background, Logical versus Physical Address Space, Swapping, Contiguous Memory Allocation, External and Internal Fragmentation, Paging and Segmentation;

Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing.

**Unit IV**

File System Implementation: File, File Attributes, File Operations, Types of Files, File System Structure, File Access Methods, Directory Structures, File Allocation Methods, and Free Space Management.

Disk Scheduling algorithm-FCFS, SSTF, Scan, C-Scan, Look, C-Look. Disk Management.

**Text and Reference Books:**

1. Silberschatz A., Galvin P. B. and Gagne G., Operating System Concepts, John Wiley & Sons.
2. Godbole, A. S., Operating Systems, Tata McGraw-Hill Publishing Company, New Delhi.
3. Deitel, H. M., Operating Systems, Addison-Wesley Publishing Company, New York.
4. Tanenbaum, A. S., Operating System-Design and Implementation, Prentice Hall of India, NewDelhi.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Identify:** Learn the basic concepts of operating systems and their services along with management.

**CO2: Understand:** Understand the concept of process scheduling and acquire knowledge of process synchronization.

**CO3: Apply:** learn methods of memory management and virtual memory concepts.

**CO4: Analyze and compare:** learn to work with directory structure and security aspects.

**Mapping of CO-PO: C24COS501T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels:-None, 1:Low, 2:Medium, 3:High

**Computer Science**  
**Operating System Lab (Semester-V)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS501P**

**30 Hrs (2Hrs/Week)**

**Credits: 1**

**Exam Time: 3 Hrs**

**External Marks: 20**

**Internal Marks: 10**

**Total Marks: 30**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objectives:** This practical lab course is designed to provide students with hands-on experience in operating system functionalities and scheduling algorithms. Through a series of laboratory assignments, students will engage in tasks such as implementing various scheduling algorithms and performing file operations using C programming. The course aims to bridge theoretical knowledge with practical skills, enabling students to understand and apply operating system services and scheduling techniques effectively.

**List of Laboratory Assignments:**

1. Write a program to print file details including owner access permissions, and file access time, where file name is given as argument.
2. Write a program to copy files using system calls.
3. Write a program to implement the FCFS scheduling algorithm.
4. Write a program to implement the Round Robin scheduling algorithm.
5. Write a program to implement the SJF scheduling algorithm.
6. Write a program to implement a non-preemptive priority-based scheduling algorithm
7. Write a program to implement preemptive priority-based scheduling algorithm.
8. Write a program to implement “Paging”, the memory management techniques
9. Write a program to implement the FCFS Page Replacement algorithm.
10. Write a program to calculate the sum of numbers using the thread library.

Students are given ten or more laboratory assignments with soft and hard deadlines. The lab assignments are evenly spread over the semester. Every student is required to prepare a file of laboratory experiments done.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Identify:** Learn the operating systems services along with management. **CO2:**

**Understand:** Learn how to implement scheduling algorithm in c program. **CO3:**

**Apply:** Make the students familiar with various algorithm burst time.

**CO4: Analyze and compare:** Learn the students how to calculate execution time of different scheduling and compare them.

**Mapping CO-PO : C24COS501P**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels:-None, 1:Low, 2:Medium, 3:High

**Computer Science**  
**Programming in Python (Semester-V)**  
**Minor/Vocational Course (VOC)**

**Paper Code: C24MIC502T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. I. All questions will carry equal marks.

**Course Objective:** The objective of this course is to introduce students to the fundamental concepts of programming using Python. The course aims to develop logical thinking and problem-solving skills through the use of control structures, functions, and data structures.

**UNIT I**

**Introduction to Python:** Python Interpreter, Variable, identifiers and literal, Tokens, keywords, Data Types, Arithmetic operators, Relational operators, Logical operators, Bitwise operators, Assignment operators, Membership operators, Identity operators. Operators precedence. Comment, Indentation, Need for indentation  
**Built-in Functions:** input, print, type, round, min and max, pow, help. Type Conversion, Random Number Generation. Mathematical Functions, Assert Statement. **Control Statements:** if, for, while, break, continue & pass. **Functions:** Definition, Call, Arguments – types (Required, optional, default), Global and local Variables, Recursion.

**UNIT II**

**Strings:** String as a compound data type. String operations- Concatenation, Repetition, Membership operation, Slicing operation. String methods-count, find, rfind, capitalize, title, lower, upper, swapcase, islower, isupper, istitle, replace, isalpha, isdigit, isalnum. String Processing examples. **Lists:** List operations-multiplication, concatenation, length, indexing, slicing, min, max, sum, membership operator; List functions-append, extend, remove, pop, count, index, insert, sort, reverse. **Tuple, Set, Dictionary:** Introduction, operations, methods & built-in functions, mutability, manipulation and traversal.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Define** basic Python concepts including data types, control structures, functions, and OOP.

**CO2: Describe** data structures, file handling, exception handling, and modular programming in Python.

**CO3: Apply** Python concepts to develop solutions and simple applications.

**CO4: Compare** procedural and OOP approaches and choose suitable data structures.

**CO5: Create** structured and efficient Python programs using appropriate logic and classes.

**Mapping of CO-PO C24COS601T**

| <b>Outcomes</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1             |     |     |     |     |     |     |     |     |
| CO2             |     |     |     |     |     |     |     |     |
| CO3             |     |     |     |     |     |     |     |     |
| CO4             |     |     |     |     |     |     |     |     |
| CO5             |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Programming in Python Lab (Semester-V)**  
**Minor/Vocational Course (VOC)**

**Paper Code: C24MIC502P**

**60 Hrs (4 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objective:** This practical lab course focuses on fundamental programming skills using Python language, with an emphasis on data analytics techniques. Students will complete a series of laboratory assignments that cover various topics such as creating and manipulating objects, functions and loops, graphs and charts. Assignments are designed to enhance practical coding skills and prepare students for more statistics concepts for data exploration.

**The following activities will be carried out/ discussed in the lab during the semester.**

**List of experiments:**

9. Write a Program to convert decimal number into binary, octal and hexadecimal number system using built-in functions.
10. Write a program to find the H.C.F of two input numbers using function.
11. Write a program to slice lists.
12. Write a program to change or add elements to a list.
13. Write a program to display calendar of given month of the year.
14. Write a program to compute factorial of a number using recursion.
15. Write a program to reverse the string using recursion.
16. Write a program to create copy of list using recursion.
17. Write a program to sum all the items in a list.
18. Write a program to find common items from two lists.

**Note: In addition to above experiments, the teacher may add more experiments based on theory syllabus.**

**Course Outcomes: After completing this Course, the learner will be able to:**

CO1: **Identify** and use Python data types, operators, and built-in functions to perform number system conversions and basic computations.

CO2: **Understand** the use of Python lists and list operations such as slicing, modification, copying, and aggregation of elements.

CO3: **Apply** functions and recursion techniques to solve computational problems such as factorial calculation, string reversal, and list manipulation.

CO4: **Develop** Python programs to solve basic problem-solving tasks such as calendar generation, mathematical operations, and processing data from lists.

**Mapping of CO-PO C24COS601P**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Programming in Python (Semester-VI)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS601T**

**45 Hrs (3 Hrs /Week)**

**Credits: 3**

**Exam. Time: 2.5 Hrs**

**External Marks: 50**

**Internal Marks: 20**

**Total Marks: 70**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory, consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to compulsory Question No.1. All questions carry equal marks.

**Course Objective:** The objective of this course is to introduce students to the fundamental concepts of programming using Python. The course aims to develop logical thinking and problem-solving skills through the use of control structures, functions, and data structures. It also focuses on understanding object-oriented programming concepts and enabling students to design simple, efficient programs for real-world applications.

**UNIT - I**

**Introduction to Python:** History and Features of Python Programming, Python Interpreter. Variable, identifiers and literal. Token, keywords. Data Types. Arithmetic operators, Relational operators, Logical operators, Bitwise operators, Assignment operators, Membership operators, Identity operators. Operator precedence. Comment, Indentation, Need for indentation

**Built-in Functions:** input, eval, composition, print, type, round, min and max, pow. Type Conversion, Random Number Generation. Mathematical Functions. Getting help on a function, Assert Statement.

**UNIT - II**

**Control Statements:** if Conditional Statement, for and while Statements. break, continue and pass statements.

**Functions:** Function Definition and Call, Function Arguments-Variable Function Arguments, Default Arguments, Keyword Arguments, Arbitrary Arguments. Command Line Arguments. Global and local Variables. Accessing local variable outside the scope, Using Global and Local variables in same code, Using Global variable and Local variable with same name.

**UNIT - III**

**Strings:** String as a compound data type. String operations- Concatenation, Repetition, Membership operation, Slicing operation. String methods-count, find, rfind, capitalize, title, lower, upper, swapcase, islower, isupper, istitle, replace, isalpha, isdigit, isalnum. String Processing examples.

**Lists:** List operations-multiplication, concatenation, length, indexing, slicing, min, max, sum, membership operator; List functions-append, extend, remove, pop, count, index, insert, sort, reverse.

**Recursion:** Recursive solutions for problems on Numbers, String and list.

**UNIT - IV**

**Object Oriented Programming:** Introduction to Classes, Method, Class object, Instance object, Method object. Class as abstract data type, Data Class. Access attributes using functions-getattr, hasattr, setattr, delattr. Built-In Class Attributes of Class object(\_\_dict\_\_, \_\_doc\_\_, \_\_name\_\_, module\_\_).

**Graphics:** Screen Objects- Point and line, box, polygon, circle, arc. Screen Object Methods move\_to(), move\_by(), rotate\_by(), Text(). Sound-Sound(), play\_sound(), stop\_sound().

**Suggested Readings:**

1. Sheetal Taneja and Naveen Kumar, "Python Programming A modular Approach", Pearson
2. Charles R. Severance, "Python for Everybody", Shroff Publishers.
3. Yashavant Kanetkar, "Let Us Python", BPB
4. Mark Lutz, "Learning Python", O'Reilly Publishers
5. Martin Brown, "Python-The complete reference", Mc Graw hill Publishing.
6. Mike McGraw, "Python in easy steps", Mc Graw hill Publishing

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1: Define** basic Python concepts including data types, control structures, functions, and OOP.

**CO2: Describe** data structures, file handling, exception handling, and modular programming in Python.

**CO3: Apply** Python concepts to develop solutions and simple applications.

**CO4: Compare** procedural and OOP approaches and choose suitable data structures.

**CO5: Create** structured and efficient Python programs using appropriate logic and classes.

**Mapping of CO-PO C24COS601T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |
| CO5      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Programming in Python Lab (Semester-VI)**  
**Discipline Specific Course (DSC)**

**Paper Code: C24COS601P**

**30 Hrs (2 Hrs /Week)**

**Credits: 1**

**Exam Time: 3 Hrs**

**External Marks: 20**

**Internal Marks: 10**

**Total Marks: 30**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objective:** This practical lab course focuses on fundamental programming skills using Python language, with an emphasis on data analytics techniques. Students will complete a series of laboratory assignments that cover various topics such as creating and manipulating objects, functions and loops, graphs and charts.

**List of Laboratory Assignments:**

1. Write a Program to convert decimal number into binary, octal and hexadecimal number system using built-in functions.
2. Write a program to find the H.C.F of two input numbers using function.
3. Write a program to slice lists.
4. Write a program to change or add elements to a list.
5. Write a program to display calendar of given month of the year.
6. Write a program to compute factorial of a number using recursion.
7. Write a program to reverse the string using recursion.
8. Write a program to create copy of list using recursion.
9. Write a program to sum all the items in a list.
10. Write a program to find common items from two lists.
11. Write a program to design a calculator.
12. Create a Student Class with attributes (name, roll no, marks), add methods to display and calculate grade
13. Write a program for the following Basic Screen Objects
  - i Create a point object and move it using move\_to() and move\_by().
  - ii Draw a line between two points and rotate the line using rotate\_by().
  - iii Create a box (rectangle) and move the box across the screen.
  - iv Draw a triangle/pentagon using polygon and rotate polygon using rotate\_by().
  - v Draw a circle and move it diagonally using move\_by().
  - vi Draw an arc and rotate arc gradually.

**Course Outcomes: After completing this Course, the learner will be able to:**

**CO1:** Identify basic Python syntax, data types, operators, and control structures.

**CO2:** Understand functions, file handling, exception handling, and OOP concepts.

**CO3:** Apply Python techniques to solve computational and real-world problems.

**CO4:** Design simple applications using Python libraries and OOP principles.

**Mapping of CO-PO C24COS601P**

| <b>Outcomes</b> | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1             |     |     |     |     |     |     |     |     |
| CO2             |     |     |     |     |     |     |     |     |
| CO3             |     |     |     |     |     |     |     |     |
| CO4             |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Data Analytics (Semester-VI)**  
**Minor Course**

**Paper Code: C24MIC602T**

**60 Hrs (4 Hrs/Week)**

**Credits: 4**

**Exam Time: 3 Hrs**

**External Marks: 70**

**Internal Marks: 30**

**Total Marks: 100**

**Note:** The examiner is required to set nine questions in all. The first question will be compulsory, consisting of seven short questions covering the entire syllabus, consisting of 2 marks each. In addition to this, eight more questions (each question may be 2-3 parts) will be set, consisting of two questions from each unit. The student/candidate is required to attempt five questions in all, selecting one from each unit consisting of 14 marks each in addition to the compulsory Question No. 1. All questions carry equal marks.

**Course Objectives:** The objective of this course is to provide students with a foundational understanding of data analytics concepts, tools, and techniques used in modern decision-making. The course aims to develop skills in data preprocessing, data mining, predictive modelling, and interpretation of analytical results. Students will gain knowledge of business intelligence, data warehousing, and big data technologies. The course also intends to enable learners to apply analytical methods to solve real-world problems effectively and ethically.

**Unit 1**

**Data Analytics:** Introduction to Data Analytics, Business Intelligence (BI), Role of BI, Decision types, BI tools, BI applications.

**Data Warehousing:** Introduction to Data warehousing (DW), DW components, DW types, design consideration for DW, DW development approaches: Top-down, bottom-up, hybrid, federated; DW architecture.

**Data Mining:** Introduction to Data mining, Data cleaning and preparation, outputs of Data Mining, evaluation of data mining, Data Mining Techniques: Classification, Regression, Clustering, Association Rule Mining; Data Mining Applications.

**Unit II**

**Decision Tree:** Introduction to Decision Tree, Decision tree problem, Decision tree construction, Splitting Criteria- Gini index, Information gain, Entropy, Decision tree algorithms.

**Regression:** Introduction, Types of Regression: Linear, Polynomial, Ridge and Logistic Regression, Advantages and disadvantages of regression models.

**Artificial Neural Networks:** Introduction, business applications of ANN, Design principles of ANN, Representation of a neural network, Neural network architectures, Developing an ANN model, Advantages and disadvantages of ANN.

**Unit III**

**Cluster Analysis:** Introduction, Applications of cluster analysis, Definition and representation of clusters, Clustering techniques, K-means algorithm for clustering, Selecting the number of clusters.

**Association Rule Mining:** Introduction, Business applications of association rules, Representing association rules, Algorithms for association rule mining, Apriori algorithm, Generating association rules.

**Web Mining:** Introduction, Web content mining, Web usage mining, Web structure mining, Web mining algorithms, Data mining vs Web mining.

**Unit IV**

**Naive Bayes Classifiers:** Introduction, Bayes Theorem, Types of Naive bayes models, Text classification example.

**Support Vector Machine:** Introduction, SVM Model, The kernel method.

**Big Data:** Introduction, Defining big data, 5 V's Big data, How Big data works, Big data technologies, Real-world applications of big data.

**Text and Reference Books:**

1. Data Analytics by Anil Maheshwari, Mc Graw Hill Education, 2023.
2. Data Analytics for Beginners, Robert J. Woz, CreateSpace Independent Pub, October 2017.
3. Data Mining: Concepts and Techniques [3rd ed.]–Jiawei Han, Micheline Kamber & Jian Pei, Morgan Kaufmann Series.
4. MOOCs / E-Learning Resources.

**Course Outcomes: After successful completion of the course, students will be able to:**

**CO1: Understand** the fundamental concepts of Data Analytics

**CO2: Apply** the predictive modelling techniques such as Decision Trees, Regression models, and Artificial Neural Networks to analyze and solve structured data problems.

**CO3: Analyze** and implement pattern discovery techniques including Clustering, Association Rule Mining, and Web Mining for extracting meaningful insights from data.

**CO4: Implement** advanced classification techniques such as Naïve Bayes and Support Vector Machines, and explain the concepts and applications of Big Data technologies in real-world scenarios.

**Mapping of CO-PO : C24MIC602T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Cloud Computing (Semester-VI)**  
**Value Added Course (VAC)**

**Paper Code: C24VAC601T**

**30 Hrs (2 Hrs /Week)**

**Credits: 2**

**Exam. Time: 2 Hrs**

**External Marks : 35**

**Internal Marks : 15**

**Total Marks: 50**

**Note:** The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. I. All questions will carry equal marks..

**Course Objective:** The objective of this course is to provide students with fundamental knowledge of cloud computing concepts, service models (SaaS, PaaS, IaaS), and cloud architecture. It aims to develop understanding of different types of cloud deployment models and migration strategies. The course also intends to familiarize students with practical applications and contemporary cloud platforms used in industry.

**Unit I**

**Foundations of Cloud Computing:** Cloud Computing: Evolution of computing paradigms including Client-Server Computing, Peer-to-Peer Computing, Distributed and Collaborative Computing. Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self service. Cloud Service Models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS): definition, characteristics and benefits. Introduction to Cloud Storage and Data Management.

**Unit II**

**Cloud Platform Architecture :** Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms. Cloud Migration strategies and basic migration models. Cloud Security fundamentals including data security, privacy, identity and access management, backup and disaster recovery. Cloud networking basics and cost optimization concepts. Introduction to VMWare Simulator— Basics of VMWare, advantages of VMware virtualization, creating virtual machines.

**Text and Reference Books:**

4. Toby Velte, Anthony Velte, “Cloud Computing: A Practical Approach”, McGraw-Hill Education, 2017.
5. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, “Mastering Cloud Computing” McGrawHill Education, 1st Edition, 2017
6. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2nd Edition, 2009.
7. Google Cloud Teaching Resources – LMS [for practical component]

**Course Outcomes: After completing this Course, the learner will be able to:**

- **CO1: Remember** and recall fundamental concepts of cloud computing, including service models, deployment models, and basic cloud architecture.
- **CO2: Understand** the working principles, characteristics, advantages, limitations, and security aspects of cloud computing in modern IT environments.
- **CO3: Apply** cloud service models and basic migration strategies to real-world business and academic scenarios.
- **CO4: Analyse** cloud architecture, security challenges, cost factors, and deployment strategies to evaluate

suitable cloud solutions.

**Mapping of CO-PO C24VAC601T**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1      |     |     |     |     |     |     |     |     |
| CO2      |     |     |     |     |     |     |     |     |
| CO3      |     |     |     |     |     |     |     |     |
| CO4      |     |     |     |     |     |     |     |     |

\*Attainment Levels: - None, 1: Low, 2: Medium, 3: High

**Computer Science**  
**Cloud Computing Lab (Semester-VI)**  
**Value Added Course (VAC)**

**Paper Code: C24VAC601P**  
**60 Hrs. (4 Hrs/week)**  
**Credit: 2**  
**Exam. Time: 3 Hrs**

**External Marks: 35**  
**Internal Marks: 15**  
**Total Marks: 50**

**Note:** An internal practical examination is conducted by the Course coordinator. The end semester practical examination is conducted jointly by external and internal examiners. External examiner is appointed by the COE of the university from the panel of examiners approved by BOSR of the Department of Computer Science and Engineering, GJUS&T Hisar and the internal examiner is appointed by the Chairperson of the Department.

**Course Objectives:** The objective of this course is to provide practical knowledge of cloud computing concepts, service models (IaaS, PaaS, SaaS), and hands-on experience with major cloud platforms like AWS, Azure, and GCP.

**The following activities will be carried out/ discussed in the lab during the semester.**

**List of experiments:**

1. Study and comparison of major cloud service providers and preparation of a comparative report of services offered by Amazon Web Services, Google Cloud Platform, and Microsoft Azure.
2. Creation of a virtual machine (VM) on any cloud platform (AWS/Azure/GCP) and configuration of basic settings such as CPU, memory, and storage.
3. Installation and configuration of a web server (Apache/Nginx) on a cloud-based virtual machine and hosting of a simple HTML webpage.
4. Demonstration of cloud storage services by uploading, sharing, and managing files using cloud storage platforms.
5. Implementation of Infrastructure as a Service (IaaS) by launching and managing compute instances.
6. Demonstration of Platform as a Service (PaaS) by deploying a simple application (e.g., Python/Node.js app) on a cloud platform.
7. Study and basic implementation of Software as a Service (SaaS) tools for collaboration such as email, shared documents, and calendar management.
8. Backup and recovery demonstration using cloud storage snapshots or backup services.

**Note: In addition to above experiments, the teacher may add more experiments based on theory syllabus.**  
**At the end of the course, the student would be able to:**

CO1. **Develop** basic cloud-based applications using appropriate cloud service models.

CO2. **Demonstrate** configuration and management of virtual machines, storage, and networking services in a cloud environment.

CO3. **Evaluate** different cloud deployment models and service providers.

CO4. **Develop** cloud-based solutions incorporating security mechanisms, backup strategies.

CO5. **Create** lab assignment record that includes problem statements, configuration steps, outputs.

**Mapping of COs with POs :**

| Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|
| C01      |     |     |     |     |     |     |     |     |
| C02      |     |     |     |     |     |     |     |     |
| C03      |     |     |     |     |     |     |     |     |
| C04      |     |     |     |     |     |     |     |     |
| C05      |     |     |     |     |     |     |     |     |

S=Strong, M= Medium, W=Weak