JSS MAHAVIDYAPEETHA
JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
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Model Curriculum Structures for Bachelor of Computer Applications (BCA)Programme Model Syllabus for I to IV Semesters and Elective Courses As per Modified CBCS Scheme

2024-25 & 2025-26 on words

{BoS Meeting Held on 26 - 07 - 2025}

DEPARTMENT OF COMPUTER SCIENCE

The objectives of the BCA Program

1. The primary objective of this program is to provide a foundation of computing principles and business practices for effectively using/managing information systems and enterprise software

2. It helps students analyze the requirements for system development and exposes students to business software and information systems

3. This course provides students with options to specialize in legacy application software, system software or mobile applications

4. To produce outstanding IT professionals who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves

5. To provide opportunity for the study of modern methods of information processing and its applications.

6. To develop among students the programming techniques and the problem- solving skills through programming

7. To prepare students who wish to go on to further studies in computer science and related subjects.

8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

Program Outcomes: BCA (3 Years) Degree

1. **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity

2. **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.

3. **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems and acquiring a minimum knowledge on statistics and optimization problems. Establishing excellent skills in applying various design strategies for solving complex problems.

4. **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.

5. **Application Systems Knowledge**: Possessing a sound knowledge on computer application software and ability to design and develop app for applicative problems.

6. **Modern Tool Usage:** Identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.

7. **Communication:** Must have a reasonably good communication knowledge both in oral and writing.

8. **Project Management:** Practicing of existing projects and becoming independent to launch own project by identifying a gap in solutions.

9. **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

10. **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.

11. **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.

Program Structures for the Under-Graduate Program Bachelor of Computer Applications (BCA)						
Semester	**Coerces**	**Type**	**Credits**	**L: T: P**	**Marks**	
I	Major 1to 3	Theory	9	3: 0: 0	**300**	
	Major 1 to 3	Practical	6	0: 0: 2	**150**	
	Language 1	Theory	3	3: 0: 0	**100**	
	Language 2	Theory	3	3: 0: 0	**100**	
	Constitutional Values	Theory	2	2: 0: 0	**50**	
II	Major 1to 3	Theory	9	3: 0: 0	**300**	
	Major 1 to 3	Practical	6	0: 0: 2	**150**	
	Language 1	Theory	3	3: 0: 0	**100**	
	Language 2	Theory	3	3: 0: 0	**100**	
	Constitutional Values	Theory	2	2: 0: 0	**50**	
III	Major 1to 3	Theory	9	3: 0: 0	**300**	
	Major 1 to 3	Practical	6	0: 0: 2	**150**	
	Language 1	Theory	3	3: 0: 0	**100**	
	Language 2	Theory	3	3: 0: 0	**100**	
	Elective 1	Theory	3	3: 0: 0	**100**	
	Elective 2	Theory	3	3: 0: 0	**100**	
IV	Major 1to 3	Theory	9	3: 0: 0	**300**	
	Major 1 to 3	Practical	6	0: 0: 2	**150**	
	Language 1	Theory	3	3: 0: 0	**100**	
	Language 2	Theory	3	3: 0: 0	**100**	
	Elective 3	Theory	3	3: 0: 0	**100**	
	Compulsory Paper	Practical/Skill	2	2: 0: 0	**50**	

Modified CBCS Syllabus – BCA for 2024-25 onwards

Year	Sem	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th. IA		Pr. IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
I	I	**GCA 101** (Theory)	Digital Computer Organization	3	0	0	3	0	0	10	10	-	-	80	-	3 Hours	100
		GCA 102 (Practical)	Office Automation and HTML	0	0	4	0	0	2	-	-	05	05	-	40	3 Hours	50
		GCA 103 (Theory)	Problem Solving using C++	3	0	0	3	0	0	10	10	-	-	80	-	3 Hours	100
		GCA 104 (Practical)	C++ Programming	0	0	4	0	0	2	-	-	05	05	-	40	3 Hours	50
		GCA 105 (Theory)	Mathematical and Statistical Computing	3	0	0	3	0	0	10	10	-	-	80	-	3 Hours	100
		GCA 106 (Practical)	Mathematical and Statistical Computing using R	0	0	4	0	0	2	-	-	05	05	-	40	3 Hours	50
	II	**GCA 201** (Theory)	Data Structures	3	0	0	3	0	0	10	10	-	-	80	-	3 Hours	100
		GCA 202 (Practical)	Data Structures using C++	0	0	4	0	0	2	-	-	05	05	-	40	3 Hours	50
		GCA 203 (Theory)	Object Oriented Programming with Java	3	0	0	3	0	0	10	10	-	-	80	-	3 Hours	100
		GCA 204 (Practical)	Programming with Java	0	0	4	0	0	2	-	-	05	05	-	40	3 Hours	50
		GCA 205 (Theory)	Operating Systems	3	0	0	3	0	0	10	10	-	-	80	-	3 Hours	100
		GCA 206 (Practical)	Shell Programming	0	0	4	0	0	2	-	-	05	05	-	40	3 Hours	50

Year	Sem	Course Code	Title	Hours / Week			Credits			Maximum Marks						Exam Duration	Total Marks
										Th. IA		Pr. IA		Exam			
				L	T	P	L	T	P	C1	C2	C1	C2	Th.	Pr.		
II	III	**GCA 301** (Theory)	C#.NET Programming	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 302 (Practical)	C#.NET Programming Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**05**	**05**	**-**	**40**	**3 Hours**	**50**
		GCA 303 (Theory)	Data Base Management System	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 404 (Practical)	DBMS Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**05**	**05**	**-**	**40**	**3 Hours**	**50**
		GCA 505 (Theory)	Web Technologies	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 306 (Practical)	Web Technologies Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**05**	**05**	**-**	**40**	**3 Hours**	**50**
		GCA 307X	**Elective 1**	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 308X	**Elective 2**	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
	IV	**GCA 401** (Theory)	Computer Networks	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 402 (Practical)	Networking Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**05**	**05**	**-**	**40**	**3 Hours**	**50**
		GCA 403 (Theory)	Python Programming	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 404 (Practical)	Python Programming Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**05**	**05**	**-**	**40**	**3 Hours**	**50**
		GCA 405 (Theory)	PHP & MySQL	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 406 (Practical)	PHP & MySQL Lab	**0**	**0**	**4**	**0**	**0**	**2**	**-**	**-**	**05**	**05**	**-**	**40**	**3 Hours**	**50**
		GCA 407X	**Elective 3**	**3**	**0**	**0**	**3**	**0**	**0**	**10**	**10**	**-**	**-**	**80**	**-**	**3 Hours**	**100**
		GCA 408X	Digital Marketing /other	**2**	**0**	**0**	**2**	**0**	**0**	**05**	**05**	**-**	**-**	**40**	-	**2:30 Hours**	**50**

Elective 1	1. Cyber Security	2. Software Engineering	3. System Software
Elective 2	1. Cloud Computing	2. Digital Image Processing	3. E-Commerce and E-Governance
Elective 3	1. Fundamentals of Data Science	2. Internet of Things	3. Software Testing

Modified CBCS Course Content for BCA, Semesters I and II Semesters

Semester: I

Course Code: GCA101	**Course Title:** Digital Computer Organization
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

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

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

Unit – 1 Course Contents	Hours
Fundamentals of Computers: Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computer, Types of Computer, Basic Organization of A Digital Computer. **Input / Output Organization:** Peripheral Devices, Input–Output Interface. **Memory Organization:** Computer Memory System Overview - Characteristics and Types of Memory System. **Types Of Software**: System Software, Application Software and Utility Software; **Computer Languages:** Machine Level, Assembly Level & High-Level Languages, **Language Translators:** Assembler, Interpreter and Compiler.	**11**
Unit-2	
Number Systems: Introduction, Decimal, Binary, Octal and Hexadecimal. Inter-Conversions, Addition, Subtraction, Multiplication and Division in the Binary Number System. 1's and 2's Complement Method in the Binary Number System. Subtraction Using 1's and 2's Complement, Weighted Number System, Binary Coded Decimal (BCD), and Addition of BCD Numbers. Non-Weighted Number System, Applications, Excess-3, Gray Code Conversions, Gray and Binary Codes.	**11**

Unit-3	
Boolean Algebra: Basic Laws, Demorgan's Theorem, Duality Theorem, Sum of Product Method, and Products of Sum Method. Karnaugh Map (Up to 4 Variables, Don't Care Condition). **Fundamentals Of Gates:** Basic Gates, Derived Gates, and Universal Gates (Design).	**11**
Unit-4	
Combinational And Sequential Logic Circuits: Half Adder, Full Adder, Half Subtractor and Full Subtractor. **Flip-Flops**: SR, JK, Master-Slave JK, T Flip-Flops, Decoders - 3 To 8 Lines, Encoders Octal to Binary. **Multiplexer:** 4 To 1 Line, Counters-3 Bits Binary Ripple Counter, 3 Shift Registers-Serial-In-Parallel-Out, Parallel-In-Serial-Out.	**11**

Reference:

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

Course Code: GCA102	**Course Title:** Office Automation and HTML
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

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

1. Confidently work on Office Automation software such as Word Processing, Spreadsheet, and PowerPoint.
2. Understand the basics of web programming and create simple web pages using HTML**.**

Laboratory Program List

Part A:

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

ITEM	MONTHLY SALES (in Thousands)
Cotton	2,750
Wool	3,100
Yarn	2,975
Jute	2,100
Fiber	3,010

5. Using a spreadsheet, write the steps and execute the following: Roll No, Student Name, Marks 1, Marks 2, Marks 3, Total Percentage, Result
   i. Create appropriate records
   ii. Calculate the total and marks using the formula.
   iii. Update the result column using the IF function. (Result: Distinction, First Class, Second Class, Pass, Fail).

6. Using PowerPoint with suitable examples, write steps and execute the following:
   i. Create presentation slides with Titles, subtitles and Charts, choosing different slide layouts.
   ii. Use Design templates for background.
   iii. Format the slide design.
7. Using PowerPoint, create the presentation for
   i. "Components of PC" using organization chart.
   ii. Use different views such as slide view, slide sorter view and slide show view.
8. Using PowerPoint, create a presentation to demonstrate
   i. Insert Images, Shapes.
   ii. Charts for tabulated data
9. Using PowerPoint, create a presentation to demonstrate Transitions, animations, and slideshow effects.

Part B:

1. Design a page with a suitable background and text colour with the title "My First Web Page" using all the Font tag attributes.
2. Write an HTML code to design a page containing some text in a paragraph by giving a suitable heading style
3. Write an HTML program for the demonstration of Lists.
4. Unordered List
5. Ordered List
6. Write an HTML program for demonstrating Hyperlinks.
   a. avigation from one page to another.
   b. Navigation within the page.
7. Write an HTML program for a timetable using tables.
8. Write an HTML program to develop a static Registration Form.
9. Write an HTML program to develop a static Login Page.
10. Write an HTML code to create a web page with a pink background and display a moving message in red.
11. Write an HTML program to develop a static Web Page for a Shopping Cart.
12. Write an HTML program to develop a simple calculator.

Course Code: GCA103	**Course Title:** Problem Solving using C++
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

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

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

Unit – 1 Course Contents	Hours
Introduction to Programming: Program development life cycle, Introduction to Procedure Oriented Programming and Object-Oriented Programming (OOP) paradigms, basic concepts of OOP, benefits and applications of OOP. **Introduction to C++:** Overview of C++, Structure of C++ Program, Input-Output statements, Keywords, Identifiers, Constants, Variables, Data types, Operators, Types of Operators, Expressions, Precedence of Operators, Type Conversion, Storage classes.	**11**
Unit-2	
Control statements: Selection And Iteration Statements, Loop Control Statements. **Modular Programming:** Functions and Its Types, Recursion, Functions with Default Arguments, Inline Functions, Function Overloading, Call by Value and Reference, Math Library Functions.	**11**
Unit-3	
Derived Data Types: Arrays, Array Types, Strings, String Manipulation Functions, Pointers, Pointer Arithmetic. **Managing Console, I/O Operations:** C++ Stream, C++ Stream Classes, Unformatted I/O Operations, Formatted Console I/O Operations, Managing Output with Manipulators. **User Defined Data Type:** Class Definition, Instance Variables, Member Methods, Accessing Members, Access specifiers, this pointer, Friend Function, Constructors, Types of Constructors, Destructor.	**11**

Unit-4	
Polymorphism: Operator Overloading, Rules for Operator Overloading, Overloading Unary and Binary Operators. **Inheritance:** Inheritance, Types of Inheritance, Virtual Functions and Abstract Classes. **File Handling:** Introduction To Files and File Handling, File Opening Modes, Classes for File Stream Operations, and File I/O Operations (Opening, Reading, Writing, Appending and Closing).	**11**

Reference Books:

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

Course Code: GCA104	**Course Title:** C++ Programming
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

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

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

Laboratory Program List

Part -A

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

Part-B

9. Program to demonstrate call by value and call by reference.
10. Program to generate the factorial of a given number using recursion.
11. Program to create a Class for representing student details with appropriate member functions to accept and display the details.
12. Program to demonstrate function overloading.
13. Program to demonstrate the friend function.
14. Program for single inheritance.
15. Program to demonstrate multilevel inheritance.
16. Program to demonstrate operator overloading.
17. Program to demonstrate the usage of default and parameterized constructors.
18. Program to read and display the contents of a text file.

Course Code: GCA105	**Course Title:** Mathematical and Statistical Computing
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

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

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

Unit – 1 Course Contents	Hours
Mathematical Logic Introduction: Statements Connectives - Negation, Conjunction, Disjunction- Statement Formulas and Truth Tables- Conditional and Hours Bi Conditional Statements- Tautology, Contradiction. **Set Theory:** Sets And Subsets, Set Operations and The Laws of Set Theory, Counting and Venn Diagrams.	**11**
Unit-2	
Cartesian Products and Relations, Properties of Relations. **Computer Recognition**: Relation Matrices and Directed Graphs, Equivalence Relations and Partitions. **Functions**: One-to-One, Onto Functions, Function Composition, and Inverse Functions.	**11**
Unit-3	
Statistical Methods: Introduction, Definitions, Classifications, Frequency Distribution, Mean - Arithmetic Mean for Grouped and Ungrouped Data. **Median**: Meaning, Calculations of Median for Ungrouped. **Mode:** Meaning, Calculations of Mode for Discrete Series and Continuous Series.	**11**

Unit-4	
Standard Deviation: Meaning, Standard Deviation for Actual Mean Method, Assumed Mean Method, and Step Deviation Method Using Discrete Series and Continuous Series. **Coefficient of Variation:** Meaning and Problems. **Correlation:** Meaning, Types, Rank Correlations and Problems. **Simple Linear Regression**: Meaning, Properties of Regression Coefficients.	**11**

Reference Books:

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

Course Code: GCA106	**Course Title:** Mathematical and Statistical Computing Using R
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

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

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

Laboratory Program List

Part A

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

Part B

1. Write an R Program to Calculate central tendency (mean, median, mode).
2. Write an R Program to Calculate standard deviation and variance for discrete & continuous series.
3. Write an R Program to Calculate the coefficient of variance for discrete & continuous series.
4. Write an R Program to Calculate simple Linear Algebra Operations.
5. Write an R Program to Calculate the arithmetic mean for grouped and ungrouped data.
6. Write an R Program to Calculate cumulative sums, and products, minima, maxima.
7. Write an R Program to Calculate frequency distribution for discrete & continuous series.
8. Write an R Program to Calculate Simple Linear Regression.

Semester II

Course Code: GCA201	**Course Title:** Data Structures
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

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

1. Understand the basics of Data Structures.
2. Identify the appropriate data structures and algorithms for solving real-world problems.
3. Understand the practical applications of Tree and Graphs.
4. Understand the fundamentals of sorting and searching algorithms.

Unit – 1 Course Contents	Hours
Introduction: Data Structure Definition, Basic Terminology and Concepts, Importance of Data Structures in Programming. Classification of Data Structures. Primitive Data Structures, Non-Primitive Data Structures. **Stack:** Definition, Memory Representation, Algorithms for Stack Operations (Push, Pop), Applications of Stack.	**11**
Unit-2	
Queue: Definition, Memory Representation, Linear Queue, Circular Queue, Enqueue, Dequeue. Applications of Queue. **Linked Lists**: Definition, Types. **Singly Linked List:** Implementation, Insertion [At the Beginning], Deletion [At the End]. **Doubly Linked List:** Memory Representation of Singly Linked List and Doubly Linked Lists. Applications of Linked List.	**11**
Unit-3	
Tree: Definition, Memory Representation Using Array and Linked List. **Binary Tree:** Definition, Traversal Algorithms [Pre-Order, In-Order, Post-Order], Construction of Tree from In-Order and Pre-Order, In-Order and Post-Order. **Binary Search Trees:** Insertion of a Node, Deletion of A Node. **Advanced Tree Structures AVL And B-Trees:** Definition and Applications.	**11**

Unit-4	
Graph: Definition, Memory Representation of Graph. Adjacency Matrix, Adjacency List. Graph Traversal Algorithms: Breadth-First Search (BFS), Depth-First Search (DFS). **Sorting Techniques:** Bubble Sort, Selection Sort [Algorithm, Time & Space Complexity]. **Searching Techniques:** Linear And Binary Search [Algorithm, Time & Space Complexity]. **Heap:** Heap Operations and Applications.	**11**

Reference Books:

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

Course Code: GCA202	**Course Title:** Data Structures using C++
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

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

1. Implement data structures using C++.
2. Demonstrate searching and sorting techniques using C++.
3. Demonstrate advanced programming skills through C++ programming language.

Laboratory Program List

Part A:

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

Part B:

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

Course Code: GCA203	**Course Title:** Object-Oriented Programming with Java
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

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

1. Understand the Java programming fundamentals.
2. Describe with examples of basic Java OOP concepts.
3. Understand the Java Interfaces and Packages.
4. Deliberate the Details of Multithreading, Exception Handling & File Handling
5. Design GUI applications using tools like AWT.

Course Contents:

Unit – 1 Course Contents	Hours
Fundamentals of Object-oriented Programming: Object-oriented Paradigm, Basic Principles of Object-oriented Programming, Advantages of Object-Oriented Programming, Applications of Object-Oriented Programming. **Introduction to Java Language:** Java History, Features, Overview, Difference between C, C+ + and Java, Java Environment- JDK, JVM, JRE and API, Java Program Structure, Java Tokens, Implementing a Java Program, Command Line Arguments. **Java Programming Fundamentals:** Data types, Variables & Constants, Keywords & Naming Conventions, Type Casting, Operators and Expressions, Control Structures, Jumping Statements.	**11**
Unit-2	
Classes & Objects: Basics of Objects and Classes, Constructors, Access Modifiers, Method Overloading, Overloading Constructors, Static members, this keyword. **Arrays**: One-dimensional Arrays, Two-dimensional Arrays, Array of Objects. **Strings**: String Handling functions.	**11**
Unit-3	
Multithreading in Java: Concepts of Thread, Thread Life Cycle, Creating Threads & Implementing Runnable Interface, Thread Synchronization & Thread Priority. **Exception Handling:** Concepts of Exception, Different Types of Exceptions, Creating User-Defined Exceptions Using Try-Catch-Finally-Throw Blocks, Nested Try, Catch, Throw, and Throws Blocks.	**11**

Unit-4	
File Handling: I/O Handling, I/O Streams, Types of Files, Byte Stream, Binary I/O Classes & Their Hierarchy, FileInputStream & FileOutputStream Classes, Object I/O Classes. **Event Handling & GUI programming:** Event Handling, Event Types, Event Handling Mechanism, Keyboard & Mouse Handling, Introduction to AWT & GUI basics, AWT hierarchy of classes, AWT controls – Frames, Panels, Layout managers & other controls of AWT.	**11**

Reference Books:

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

Course Code: GCA204	**Course Title:** Programming with Java
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

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

1. Implement simple programs using Java Fundamental concepts.
2. Identify classes, objects, members of a class, and the relationships among them needed for finding the solution to specific problems using Objected Oriented Programming concepts of Java.
3. Design & Develop simple GUI programs using the AWT GUI tool.

Laboratory Program List

Part A:

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

Part B:

1. Program to generate negative array size exception
2. Program to generate NullPointer Exception.
3. Program that reads two integer numbers for the variables a and b. The program should catch NumberFormatException & display the error message.
4. Program to create AWT window with 4 buttons M/A/E/Close. Display M for Good Morning, A for Afternoon, E for Evening, and Close button to exit the window.
5. Program to demonstrate the various mouse handling events.
6. Program to read and write Binary I/O files.
7. Program to create a window with three buttons father, mother, and close. Display the respective details of the father and mother as name, age and designation using AWT controls.
8. Program to create menu bar and pull-down menus.

Course Code: GCA205	**Course Title:** Operating Systems
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

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

1. Understand the fundamentals of the operating system.
2. Describe the concepts of process, process management, CPU Scheduling, process synchronization, Deadlocks, memory management, and Virtual Memory management.
3. Illustrate the file system and structure.
4. Understand the UNIX OS, Shell Programming, Conditional Control Structures in Shell Programming.

Course Contents:

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

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

Reference Books:

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

Course Code: GCA206	**Course Title:** Shell Programming
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

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

1. Develop skills in shell scripting to perform simple operations and solve problems.
2. Perform file manipulation using shell scripts.
3. Understand and implement shell scripts for system information.

Laboratory Program List

Part A:

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

Part B:

1. Write a shell script to search for a particular element from an array of elements.
2. Write a shell script to calculate the TA, HRA, and DA of an employee.
3. Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions.
4. Develop an interactive script that asks for a word and a file name and then tells how many times that word occurred in the file.
5. Write a shell script to extract a substring from a given string.
6. Perform the following operations
    a) Concatenate 2 strings
    b) Rename a file
    c) Delete a file
    d) Copy the file

7. Write a shell script to display the
   a) Version of the shell
   b) The user information
   c) Login date and time
   d) List of processes running on the system
   e) User home directory
12. Write a C program to display the PID of the parent and the PID of a child process.
13. Write a shell script that takes two filenames as arguments. It should check whether the contents of two files are the same or not; if they are the same, then the second file should be deleted.
14. Assume a file with the given information
15. First Name Middle Name Age

    ---------- ---------- ------
16. Write a shell script to

a. Sort the first name in alphabetical order
b. Sort the age in terms of ascending order
c. Sort the age in terms of descending order
d. Sort the middle name in alphabetical order

Semester: III

Course Code: GCA301	**Course Title: C# and .NET Programming**
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Understand C# basics, syntax, control statements, arrays, and strings.
CO2: Apply OOP concepts like classes, inheritance, and interfaces.
CO3: Use delegates, events, and file I/O in C#.
CO4: Build GUI apps using Windows Forms and ADO.NET.

Course Contents	Hours
Unit 1	
Introduction: Overview of OOP, Introduction to C # - Characteristics, application, origins of the .NET technology, the .NET framework, C# program structure, command line argument, math function, Literals, variable in C#: Declaration, initialization, constant variables, scope of variables, boxing and unboxing, Operators, expression in C#, Decision making and looping statements in C#, **Methods in C#:** declaring methods, methods parameters: output, ref, val, params, **Arrays:** Declaration, initialization, variable-size arrays, array class, array list class, **String handling:** introduction, string library functions.	11
Unit-2	
OOPS with C#: Introduction to Classes & Objects, **Constructor:** Introduction & Types, Destructor, **Inheritance & types:** single level inheritance, multilevel inheritance, hierarchical inheritance, containment inheritance, defining a subclass, visibility control, **polymorphism:** definition, method overloading, method overriding, **operator overloading:** definition, overloadable operators, overloading unary and binary operator, **Data Abstraction:** hiding methods, abstract classes, abstract methods, sealed classes, sealed methods, **Interfaces:** Multiple Inheritance: defining an interface, extending an interface, implementing interface, abstract class and interface.	11
Unit-3	
Delegates and Events: Definition, delegate declaration, delegate methods, delegates instantiation, delegate invocation, multicast delegates, events. **Managing Console I/O operations:** console class, console input, console output, formatted output, numeric formatting, standard numeric format, custom numeric format. **File handling:** I/O Classes: write files, read files, File streams: file stream classes, File modes, operations on files	11

Unit-4	
Introducing windows forms: A tale of three GUI namespaces, Anatomy of a Form, Component class, control class. **Programming with Windows Forms controls:** Working with button types, check boxes, labels, Radio buttons, track bar, Progress bar, Group boxes, list boxes, calendar control, assigning tooltips for controls. **Data access with ADO.NET:** Introduction, two faces of ADO.NET, role of ADO.NET data providers, building a simple test database, selecting a data provider, working with the connected layer of ADO.NET & OleDb Data reader, inserting, updating and deleting records using OleDb command.	11

Text Books:

1.Programming in C#, E. Balagurusamy,4th or 5th Edition, McGraw Hill Education.

2. C# 9.0 and .NET 5 – Modern Cross-Platform Development, Mark J. Price,6th Edition, Packt Publishing.

Reference:

1.Pro C# 8 with .NET Core 3, Andrew Troelsen and Philip Japikse, Apress Publications.

2.Head First C#, Andrew Stellman and Jennifer Greene, O'Reilly Media.

3.The Complete Reference C#, Herbert Schildt, McGraw Hill Education.

Course Code: GCA302	**Course Title: C # .NET Programming Lab**
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Demonstrate C# basics using methods, arrays, and strings.
CO2: Apply OOP concepts like inheritance and overloading in C#.
CO3: Implement delegates, events, and file handling in C#.
CO4: Design Windows Forms and connect databases using ADO.NET.

Laboratory Program List

PART -A

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

PART-B

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

Evaluation Scheme for Lab Examination

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

Course Code: GCA303	**Course Title: Database Management System**
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Understand basic concepts of databases, data models, and ER diagrams.
CO2: Apply relational algebra and SQL to query and manipulate data.
CO3: Analyze database normalization to improve design and remove anomalies.
CO4: Evaluate transaction management and database security features.

Content	Hours
Unit-1	
Introduction to Databases: Definition of Data, Database, and DBMS, Overview of Database, Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators. **Data Models:** Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS. **Database Design**: Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK, Entity-Relationship (ER) Model, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema.	11
Unit-2	
Relational Algebra: Introduction to Relational Algebra, **Operations:** Selection, Projection, Set Operations, Join Operations, Division. **Structured Query Language (SQL):** SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count ()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses (Group By, Having, Order by, top/limit).	11
Unit-3	
SQL Joins and Views: Inner Join, Natural Join, Full Outer Join, Left Outer Join, right outer Join, Equi Join, Definition of View, creating a View, Managing Views (Listing, Updating, Deleting). **Normalization**: Anomalies in relational database design. Functional dependencies - Axioms. Decomposition, Transitive Dependency. **Data Normalization:** First normal form, Second normal form, Third normal form. Boyce-Codd normal form.	11

Unit-4	
Query Processing Transaction Management: Introduction Transaction Processing, Single user & multiuser systems. **Transactions**: read & write operations. **Need of concurrency control:** The lost update problem, Dirty read problem. Types of failures. Transaction states. Desirable properties (ACID properties) of Transactions. Storage of Database, File Operations, Database Security.	11

Reference Books:

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7thEdition, Pearson.

Reference Books:

1. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
2. Introduction to Database System, C J Date, Pearson, 1999.
3. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S. Sudarshan, 6th Edition, McGraw Hill,
4. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3rd Edition, McGraw Hill.

Course Code: GCA304	**Course Title: DBMS Lab**
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Execute single-line SQL queries and apply group functions effectively.
CO2: Perform database operations using DDL, DML, DCL, and TCL commands.
CO3: Implement advanced SQL concepts like nested queries and join operations.
CO4: Create views and apply table-level locking mechanisms for data control.

Laboratory Program List

Part A:

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

Table: Student

Name	Reg. No	Class	Major
Smith	17	1	CS
Brown	8	2	CS

Table: Course

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

Table: Section

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

Table: Grade Report

Reg. No	Section Identifier	Grade
17	112	B
17	119	C

8	85	A
8	92	A
8	102	B
8	135	A

Queries

1. Create a Table Using the create statement.
2. Insert rows into individual Tables using the insert statement.
3. Alter the table section, add a new field section and update the records
4. Delete brown's grade report.
5. Drop the table section.

Activity 2: (Select clause, Arithmetic Operators)
Database: Employee
Create the following tables and insert tuples with suitable constraints.

Table: EMPLOYEE

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

Table: EMPSALARY

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

Queries

1. Display FIRSTNAME, LASTNAME, ADDRESS, and CITY of all employees living in PARIS
2. Display the content of the employee table in descending order of FIRSTNAME
3. Select FIRSTNAME and SALARY of salesmen
4. Display the FIRSTNAME, LASTNAME, and TOTAL SALARY of all employees where TOTAL SALARY = SALARY + BENEFITS
5. Count the number of distinct DESIGNATIONs from EMPSALARY
6. List the employees whose names have exactly 6 characters
7. Add a new column PHONE_NO to the EMPLOYEE table and update the records 8. List employee names who have joined before 15-Jun-08 and after 16-Jun-07
8. Generate salary slip with Name, Salary, Benefits, HRA=50%, DA=30%, PF=12%, and calculate gross salary. Order by gross salary in descending order.

Activity 3: (Logical, Relational Operators)
Database: Library
Create the following tables and insert tuples with suitable constraints.
Table: Books

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

Table: Issued

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

Queries

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

Activity 4: (Date Functions)
Database: Lab
Create the following table and insert tuples with suitable constraints.

Table: Equipment Details

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

Queries

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

Part B:

Activity 5: (Numeric, character functions).

Use Functions for the following.

1. Find the mod of 165,16.
2. Find the Square Root of 5000.
3. Truncate the value 128.3285 to 2 and -1 decimal places
4. Round the value 92.7683 to 2 and -1 decimal places.
5. Convert the string 'Department' to uppercase and lowercase.
6. Display your address, convert the first character of each word to uppercase, and the rest are in lowercase.
7. Combine your first name and last name under the title Full name.
    A) Take a string maximum length of 15 display your name to the left. The remaining space should be filled with '*'.
    B) Take a string maximum length of 20 display your name to the right. The remaining space should be filled with '#'.
8. Find the length of the string 'JSS College, Mysore'.
9. Display substring 'BASE' from 'DATABASE'.
10. Display the position of the first occurrence of the character 'o' in Position and Length.
11. Replace the string Database with Data type.
12. Display the ASCII value of ' ' (Space).
13. Display the Character equivalent of 42.

Activity 6: Database: subject

Create the following table and insert tuples with suitable constraints.

Table: Physics

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

Table: Computer Science

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

Queries

1. Select all students from Physics and Computer Science.
2. Select a student common to Physics and Computer Science.
3. Display all student details who are studying in the second year.
4. Display students who are studying both Physics and Computer Science in the second year.
5. Display the students studying only Physics.
6. Display the students studying only Computer Science.
7. Select all students having a PMCs combination.
8. Select all students having a BCA combination.
9. Select all students studying in the third year.
10. Rename the table Computer Science to CS.

Activity 7: (views)
Database: Railway Reservation System.
Create the following table and insert tuples with suitable constraints.

Table: Train Details

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

Table: Availability

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

Queries

1. Create a view **sleeper** to display train number, start place, destination, which have sleeper class and perform the following:
    a. Insert new record.
    b. Update destination = ' Manglore' where train no = ' RJD16'.
    c. Delete a record which has train no = 'KKE55'
2. Create a view **detail** to display train number, train name, and class.

3. Create a view **total_seats** to display train number, start place, use the COUNT function on No_of_seats, group by start place and perform the following:
    a. Insert new record.
    b. Update start place='Hubli' where train no='JNS8'.
    c. Delete the last row of the view.
4. Rename view **sleeper** to **class**.
5. Delete view **details**.

Activity 8: (group by, having clause)
Database: Bank system
Create the following table and insert tuples with suitable constraints.

Table: Account

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

Table: Branch

Branch_ID	Branch_Name	Branch_City
SB001	Malleshwaram	Bangalore
SB002	MG Road	Bangalore
SB003	MG Road	Mysore
SB004	Jayanagar	Mysore

Table: Depositor

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

Table: Loan

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

Queries

1. Display the total number of accounts present in each branch.
2. Display the total loan amount in each branch.
3. Display the total deposited amount in each branch in descending order.
4. Display the maximum and minimum loan amounts present in each city.

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

Evaluation Scheme for Lab Examination

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

Course Code: GCA305	**Course Title: Web Technologies**
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Understand Internet basics, WWW, and HTML5 structure.
CO2: Design responsive web pages using HTML forms and CSS.
CO3: Write JavaScript code using variables, functions, and control structures.
CO4: Use JavaScript objects, arrays, events, and DOM manipulation.

Course Contents	Hours
Unit-1	
Foundations of Internet and World Wide Web: Introduction to the Internet, Internet Protocol Addresses, Domain Names, the World Wide Web, Web Browsers, Web Servers, Web Server Operation, General Server Characteristics, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol: -The Request Phase, The Response Phase, Security issues in WWW. **Introduction to HTML5:** Introduction, HTML Basics, Standard structure, HTML Elements, HTML Attributes, HTML Headings, HTML Paragraphs Text Formatting, Hyperlink and Images, Preserving White Space, Lists and Tables, HTML Block and Inline Elements, HTML Div Element, Horizontal Rules, Character Entities.	11
Unit-2	
HTML Form: Working with Form elements, Form attributes, and working with I Frames. Building a Responsive Webpage. **Cascading Style Sheets:** Introduction, CSS Syntax, CSS Comments, Applying Styles to HTML Elements, Style specification formats, Selector forms, CSS Margins, CSS Padding, CSS Height, and Width, **CSS Text:** Text Alignment, Text Decoration, Text Transformation, Text Spacing, Text Shadow, Font properties, List properties, The box model, CSS links, CSS List, CSS Position, CSS Z index	11
Unit-3	
Advanced CSS: CSS Rounded Corners, CSS Shadow Effects, CSS Text Effects, CSS 2D Transforms, CSS 3D Transforms, CSS Transitions, CSS Animations, CSS Masking. **Introduction to JavaScript:** Overview of JavaScript, General Syntactic Characteristics, Advantages of JavaScript, variables, Comments, data types, constants, Screen Output & Keyboard Input, Operators, Type Conversion, Flow Controls: conditional statements, looping statements, jumping statements. **Functions:** Function Basic, function parameters, Function Invocation, Return statement, Global and local variables.	11

Unit-4	
Object and Class: Definition of class, class syntax, class methods, and constructor. Definition of object, object creation, object properties, built-in objects: **Arrays and strings:** Definition of array, creation of array, Types of arrays, Accessing Array Elements, Array Properties and Methods, **Strings:** Definition, Creation of string, String Methods, Element Access in JavaScript. **Events and Event Handling:** Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Text Box and Password Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Slow Movement of Elements, **The Navigator Object**, **Basics of Pattern Matching using RegExp.**	11

Textbooks:

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

References book:

1. Thomas A. Powell: HTML & CSS: The Complete Reference, Fifth Edition.

Course Code: GCA306	**Course Title: Web Technologies Lab**
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

CO1:: Create web pages using HTML tags, tables, lists, and forms.
CO2:: Style web pages using inline, internal, and external CSS.
CO3:: Use JavaScript for interactivity, validation, and event handling.
CO4:: Build JavaScript programs for clocks, calculators, and animations.

Laboratory Program List

PART A

1. Develop and demonstrate an HTML page containing basic text formatting tags, hyperlinks, and images.
2. Develop and demonstrate an HTML page containing III Sem BCA / III Sem B.Sc. [P.M. Cs] Course timetable using table tag and its properties such as rowspan, colspan, etc.
3. Develop an HTML Page containing college Course Details using ordered and unordered lists
4. Design and develop a Student Application Form using HTML Form Elements
5. Design and develop an HTML web page with appropriate tags to show the usage of
    a. External level style specification.
    b. Document-level style specification.
    c. Inline level CSS style specification.
6. Write an HTML program to create a div and apply the following CSS properties to the created div
    a. Margin
    b. Padding
    c. Border Box shadow.
7. Write an HTML program to create a circle and create an animation of the circle bouncing for 10 seconds
8. Write an HTML Program to Design Your College Name using the following CSS Properties
    a. CSS Rounded Corners.
    b. CSS Shadow Effects.
    c. CSS Text Effects.

PART B

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

Evaluation Scheme for Lab Examination

Assessment Criteria Marks		Marks
Writing	One Program from Part A	15
	One Program from Part B	15
Execution	Any one of the Written Program	5
Viva Voce based on Web Technologies		5
Total		**40**

Semester: III

Course Code: GCA307 **(Elective)**	**Course Title: Cyber Security**
Course Credits: 03(3-0-0)	**Hours/Week:** 03
Total Contact Hours:44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Describe cyberspace, internet infrastructure, and Cybersecurity concepts.
CO2: Identify types of cybercrimes and understand related cyber laws.
CO3: Analyze social media risks, privacy issues, and legal aspects.
CO4: Use Cybersecurity tools and apply best practices for protection.

Course Content	Hours
Unit 1	
Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	11
Unit-2	
Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	11
Unit 3	
Social Media Overview and Security: Introduction to Social Networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, best practices for the use of social media, Case studies.	11
Unit 4	
Cyber Security Tools and Technologies: Introduction to antivirus, firewalls, intrusion detection and prevention systems (IDS/IPS), encryption tools, VPNs, and authentication mechanisms. **Cyber Hygiene:** Importance of strong passwords, regular updates, backups, and secure browsing habits. **Network Security Fundamentals:** Basics of securing wired and wireless networks, secure configurations, and network monitoring.	11

Text Books:

1. **Cyber Crime Impact in the New Millennium**, by R. C Mishra , Auther Press. Edition 2010.
2. **Cyber Security:** Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sunit Belapure and Nina Godbole,Wiley India Pvt. Ltd.

References Books:

1. **Compilers: Principles, Techniques, and Tools** by Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, 2nd Edition, Pearson, 2007.
2. **Security in the Digital Age:** Social Media Security Threats and Vulnerabilities by Henry A.
3. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001).
4. **Fundamentals of Network Security** by E. Maiwald, McGraw Hill.
5. **Cyber Laws: Intellectual Property & E-Commerce Security** by Kumar K, Dominant Publishers.

Semester: III

Course Code: GCA308 **(Elective)**	**Course Title: Software Engineering**
Course Credits: 03(3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44 Hours	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Explain software engineering concepts, process models, and agile practices.
CO2: Apply techniques to gather and manage software requirements.
CO3: Model systems using UML diagrams and system modelling techniques.
CO4: Design software architecture using patterns and UML notations.

Course Content	Hours
Unit 1	
Overview: Introduction; Software Engineering Ethics; Software Process Models; Process Activities; Coping with Change; Agile Software Development: Agile Methods; Plan-Driven and Agile Development.	11
Unit 2	
Requirements Engineering: Functional and Non-Functional Requirements; Software Requirements Document; Requirements Specification; Requirements Engineering Processes; Requirements Elicitation and Analysis; Requirements Validation; Requirements Management.	11
Unit 3	
System Modeling: Context Models; Interaction Models- Use Case Modelling, Sequence Diagrams; Structural Models- Class Diagrams, Generalization, Aggregation, Behavioral Models- Data-Driven Modelling, Event-Driven Modelling; Model-Driven Engineering.	11
Unit 4	
Architectural Design: Architectural Design Decisions; Architectural Views; Architectural Patterns- Layered Architecture, Repository Architecture, Client–Server Architecture, Pipe and Filter Architecture. **Design And Implementation:** Object-Oriented Design Using The UML- System Context and Interactions, Architectural Design, Object Class Identification, Design Models, Interface Specification; Design Patterns; Implementation Issues.	11

Text Books:

1. Software Engineering by Ian Sommerville, Pearson publications;10th Edition, 2015.
2. A Concise Introduction to Software Engineering, Pankaj Jalote, 2nd Edition, Springer Cham, 2025.

Reference:

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023.
2. Software Engineering A Practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

Semester: III

Course Code: GCA309 **(Elective)**	**Course Title: System Software**
Course Credits: 03(3-0-0)	**Hours/Week:** 03
Total Contact Hours:44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):
CO1: Understand system software, SIC/SIC-XE, CISC and RISC.
CO2: Explain assembler functions and features.
CO3: Describe loader and linker operations.
CO4: Identify functions of DBMS, editors, and debuggers.

Course Content	Hours
Unit 1	
System software: Introduction, System Software and Machine Architecture, The Simplified Instructional Computer (SIC)- SIC Machine Architecture, SIC / XE Machine Architecture, SIC programming examples, Traditional (CISC) Machines and RISC Machines- Introduction, Differences.	11
Unit 2	
Assemblers: Basic Assembler Functions- A Simple SIC Assembler, Assembler Algorithm and Data Structures, **Machine Dependent Assembler Features**- Instruction Formats and Addressing Modes, Program Relocation, Machine Independent **Assembler Features**- Literals, Symbol Defining Statements, Expressions, Program Blocks, Control Sections and Program Linking.	11
Unit 3	
Loaders and Linkers: Basic Loader Functions- Design of an Absolute Loader, Machine Dependent Loader Features, Relocation, Program Linking, **Machine Independent Loader Features**- Automatic Library Search, Loader Options, **Loader Design Options**- Linkage Editors, Dynamic Linking, Bootstrap Loaders	11
Unit 4	
Other System Software: Database Management Systems- Basic Concepts of a DBMS, Levels of Data Description, Use of a DBMS, **Text Editors**- Overview of the Editing Process, User Interface, Editor Structure, Interactive Debugging Systems- Debugging Functions and Capabilities, Relationship with Other Parts of the System, User Interface Criteria.	11

Text Books:

1. **System Software-** An Introduction to Systems Programming, 3rd Edition, Leland L. Beck, D Manjula, Pearson Education.
2. **Systems Programming,** John J Donovon, McGraw Hill Education.

Reference Books:

1. **Compilers: Principles, Techniques, and Tools** by Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, 2nd Edition, Pearson, 2007.
2. **Lex & Yacc** by Doug Brown, John Levine, and Tony Mason, O'Reilly Media, October 2012.

Semester: III

Course Code: GCA310 **(Elective)**	**Course Title: Cloud Computing**
Course Credits: 03(3-0-0)	**Hours/Week:** 03
Total Contact Hours:44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Understand cloud computing concepts, architecture, benefits, and challenges.
CO2: Explain cloud service models (IaaS, PaaS, SaaS) and their providers.
CO3: Describe deployment models, virtualization types, and hypervisors.
CO4: Explore cloud storage, databases, networking, and DevOps practices.

Course Content	Hours
Unit 1	
Introduction to Cloud Computing: Definition and Characteristics of Cloud Computing, History and Evolution of Cloud Computing, Cloud Computing Architecture, Benefits and Challenges of Cloud Computing.	11
Unit 2	
Cloud Service Models: Infrastructure as a Service (IaaS), **Key Providers**: AWS EC2, Google Compute Engine, Azure VMs, Platform as a Service (PaaS), Key Providers: AWS Elastic Beanstalk, Google App Engine, Azure App Services, Software as a Service (SaaS), Examples: Google Workspace, Microsoft Office 365.	11
Unit 3	
Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Concept of Virtualization, **Types of Virtualizations**: Server, Network, Storage, **Hypervisors**: VMware, Hyper-V, KVM.	11
Unit 4	
Cloud Storage and Databases: Storage Solutions, S3, Azure Blob Storage, Google Cloud Storage, Database Services AS AWS RDS, Azure SQL Database, Google Cloud SQL, NoSQL Databases as DynamoDB, Azure Cosmos DB, Google Cloud Firestore. **Cloud Networking:** Networking Basics in the Cloud, Virtual Private Cloud (VPC), Load Balancing and Auto Scaling, Content Delivery Networks (CDN). **Introduction to DevOps in the Cloud:** DevOps Principles and Practices, CI/CD Pipelines, Infrastructure as Code (IaC).	11

Text Books:

1. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, PHI.

Reference Books:

1. AWS Documentation, Azure Documentation, Google Cloud Documentation, **Tools:** AWS Free Tier, Azure Free Account, Google Cloud Free Tier.

Semester: III

Course Code: GCA311 **(Elective)**	**Course Title: Digital Image Processing**
Course Credits: 03(3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):
CO1: Understand the fundamentals of digital and color image processing.
CO2: Apply spatial and frequency domain techniques for image enhancement.
CO3: Implement image restoration using filtering and degradation models.
CO4: Perform image segmentation, morphological operations, and compression techniques.

Course Content	Hours
Unit 1	
Digital Image Processing: Definition, History, Applications Of DIP, Fundamental Steps in Digital Image Processing, Components of An Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Simple Image Formation, Image Sampling and Quantization, Representing Digital Pixels, Image Quality. **Introduction to Color Image:** Color Fundamentals, RGB And HSI Models, Pseudo Color Image Processing.	11
Unit 2	
Image Enhancement in Spatial Domain: Introduction to Image Enhancement, Basic Grey Level Transforms, Histogram, Histogram-Processing Equalization, Matching & Colour Histogram, Enhancement Using Arithmetic/Logic Operations, Spatial Filtering, Smoothing Spatial Filtering, Sharpening Spatial Filtering. **Image Transform**: Fourier Transform, SHFT, DFT, FFT, DCT, Hadamard Transform, Wavelets transform (CWT, DWT), KLT, SVD, Applications.	11
Unit 3	
Image Enhancement in the Frequency Domain: Smoothing the Frequency Domain Filtering, Sharpening Frequency Domain Filtering. **Image Restoration**: Model For Image Degradation/Restoration Process, Noise Model, Mean Filtering And Filtering, Estimating Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener Filter), Colour Image Smoothening, Sharpening.	11
Unit 4	
Segmentation & Morphological operations: Segmentation and Threshold Function, Different Algorithms in Thresholding, Line Detection, Edge Detection, Edge Linking By Graph Search Method, Hough Transform, Region-Based Segmentation, Matching, Color Segmentation, Morphological-Dilation And Erosion, Opening And Closing, Hit/Miss Transforms, Representation Boundary Descriptors, Regional Descriptors. **Image Compression:** Need For Image Compression, Huffman, Run-Length Encoding, Shift Codes, Vector Quantization, Transform Coding, JPEG Standard, MPEG.	

Textbooks:

1. Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.
2. K. Jain "Fundamentals of Digital Image Processing", Prentice-Hall, 2002.

Reference:

1. R. C. Gonzalez, R. E. Wood, "Digital image processing using MATLAB", Pearson Education, 2004.
2. M. Sonka, V. Hlavac, R. Boyle," Image processing analysis and machine vision" Chapman & Hall, 1998.
3. Digital Image Processing- S. Jayaraman, S. Esakkirajan,T. Veerakumar, Tata McGraw Hill 2014.

Semester: III

Course Code: GCA312 **(Elective)**	**Course Title: E-commerce and E-Governance**
Course Credits: 03(3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1:: Understand the fundamentals, models, and infrastructure of E-commerce.
CO2:: Analyze e-commerce strategies, marketing, and real-world applications.
CO3:: Explain E-Governance models, technologies, and service frameworks.
CO4:: Evaluate challenges, innovations, and future trends in E-Governance.

Course Contents	Hours
Unit-1	
Introduction to E-commerce: Fundamentals of E-commerce, E-commerce Business Models, E-commerce Infrastructure, E-commerce Security and Payment Systems	11
Unit-2	
E-commerce Strategies and Applications: E-commerce Marketing and 11 Advertising, Supply Chain Management in E-commerce, Emerging Trends in E-commerce, Case Studies and Practical Applications.	11
Unit-3	
Introduction to E-Governance: Fundamentals of E-Governance, E-Governance Models and Frameworks, Technology and Infrastructure for E-Governance, E-Governance Services and Applications.	11
Unit-4	
Challenges and Future Trends in E-Governance: Challenges in E-Governance, E-Governance in Developing Countries, Emerging Technologies in E-Governance, Future Directions and Innovations.	11

Textbooks:

1. "E-Commerce 2020: Business, Technology, and Society" by Kenneth C. Laudon and Carol Guercio Traver, Pearson.
2. "Electronic Commerce 2018: A Managerial and Social Networks Perspective" by Efraim Turban, Jon Outland, David King, Jae Lee, Ting-Peng Liang, and Deborrah C. Turban, Springer.

Reference Books:

1. "E-Government: Information, Technology, and Transformation" by Hans J. Scholl, Routledge.
2. "E-Governance: Managing or Governing?" by Jeremy Millard, Routledge.
3. "Public Information Technology and E-Governance: Managing the Virtual State" by G. David Garson, Jones & Bartlett Learning.

Semester: IV

Course Code: GCA 401	**Course Title: Computer Networks**
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Explain digital data transmission between computers.
CO2: Apply data communication and network types in real life.
CO3: Compare layers in networking models.
CO4: Compare protocols in the OSI and TCP/IP models.

Course Contents	Hours
Unit 1	
Introduction: Characteristics- Delivery, Accuracy, Timeliness and Jitter. **Components: Message**, Sender, Receiver, Transmission medium and protocol, **Topology-**Mesh, Star, Tree, Bus, Ring and Hybrid Topologies. **Transmission modes:** Simplex, Half Duplex, Full Duplex. **Categories of networks** – LAN, WAN, MAN, The ISO/OSI reference model, The TCP/IP reference model. **Digital- to -Analog Conversion:** Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying.	11
Unit 2	
Analog- to -Analog Conversion: Amplitude Modulation, Frequency Modulation, Phase Modulation. **The Physical Layer:** Transmission Media – Twisted pair, coaxial cable, optical fibre, radio transmission, microwaves and infrared transmission, Switching – message switching, Multiplexing. Connecting Devices such as Repeater, Hub, Router, Bridge.	11
Unit 3	
The Data Link Layer: Data Link Layer design issues, Error detection – Single parity checking, Checksum, polynomial codes – CRC, Error correction- Hamming code, Elementary data link protocols, sliding window protocols **The Network Layer:** Network layer design issues, Routing algorithms – Dijkstra's shortest path routing. Flooding, Distance vector routing, Hierarchical routing, Link state routing, Congestion, control algorithms – Leaky bucket, token bucket algorithm, admission control, Hop by Hop choke packets.	11
Unit 4	
The Transport Layer and Application Layer: Elements of Transport service, Internet transport protocols (TCP & UDP), Application Layer DNS, Electronic Mailing- Introduction, SMTP, POP3, SNMP, FTP, TELNET and World Wide Web.	11

Text Books:

1. Data Communication & Networking, Behrouza A Forouzan, McGraw Hill.
2. Computer Networks, Andrew S. Tanenbaum, 5th Edition, Pearson Education

Reference Books:

1. Data and Computer Communications, William Stallings, 10th Edition, Pearson Education, 2017.
2. Data Communication and Computer Networks, Brijendra Singh, 3rd Edition, PHI.
3. Data Communication & Network, Dr. Prasad, Wiley Dreamtech.

Course Code: GCA 402	**Course Title: Computer Networks Lab**
Course Credits: 02	**Hours/Week: 04**
Total Contact Hours: 60	**Formative Assessment Marks: 10**
Exam Marks: 40	**Exam Duration: 03**

Course Outcomes (COs):

CO1: Identify and set up basic computer hardware, software, and network configurations.
CO2: Create and test wired network cables and connect networking devices.
CO3: Simulate and configure various network topologies using network simulators.
CO4: Analyze network protocols and services like FTP and wireless LAN through simulation.

Laboratory Program List

Part- A

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

Part-B

1. Implement connecting two nodes using the network simulator.
2. Implement connecting three nodes, considering one node as a central node, using the network simulator. Implement a network to connect three nodes, considering one node as a central node, using the network simulator
3. Implement a bus topology using the network simulator.
4. Implement a star topology using the network simulator.
5. Implement ring topology using the network simulator.
6. Demonstrate the use of a wireless LAN using a network simulator.
7. Implement FTP using TCP bulk transfer using the network simulator.
8. Implement connecting multiple routers and nodes and building a Hybrid topology network simulator.

Links for open-source simulation software:

NS3 software: https://www.nsnam.org/releases/ns-3-30/download/
Packet Tracer Software: https://www.netacad.com/courses/packet-tracer
GNS3 software: https://www.gns3.com/

Evaluation Scheme for Lab Examination

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

Semester: IV

Course Code: GCA 403	**Course Title: Python Programming**
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Demonstrate basic Python programs using control structures and arrays.
CO2: Use functions, strings, lists, and dictionaries in Python.
CO3: Apply OOP, file handling, and exception handling concepts.
CO4: Build GUI apps, work with databases, and visualize data using Python libraries.

Course Contents	Hours
Unit 1	
Introduction: Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program. Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples. **Python Conditional Statement:** Conditional Statements - if, if else, elif, if elif else, match case, looping Statements while loop, for loop Statement; break, continue statements, range () and exit () functions. **Arrays:** Definition, syntax, accessing the elements of an array, and array methods.	11
Unit 2	
Python Functions: Types of Functions; Defining Functions, Calling Functions, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions. **Strings:** Creating and Storing Strings; Accessing String Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods. **Lists:** Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists. **Dictionaries**: Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.	11
Unit 3	
Tuples and Sets: Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods. **File Handling**: File Types, Operations on Files– Opening and Closing files, Reading and Writing files: write( ) and write lines( ) methods, append() method, read( ) and read lines( ) methods, with keyword, Splitting words, Renaming and deleting files. **Object Oriented Programming:** Classes and Objects; Creating Classes and Objects; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Constructor, types of constructors, Inheritance - Single and Multiple Inheritance, Multilevel and Multipath Inheritance.	11

Unit 4	
GU Interface: The tkinter Module; Window and Widgets; Layout Management- pack, grid and place. **Python SQLite:** The SQLite3 module; SQLite Methods- connect, cursor, execute, close; Connect to Database; Create Table; Operations on Tables- Insert, Select, Update. Delete and Drop Records. **Data Analysis:** NumPy - Introduction to NumPy, Array Creation using NumPy, Operations on Arrays; Pandas- Introduction to Pandas, Series and Data Frames, Creating Data Frames from Excel Sheet and .csv file, Dictionary and Tuples. Operations on Data Frames. **Data Visualization:** Introduction to Data Visualization; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart, Histogram & Pie chart.	11

Textbooks

1. **Python Programming:** Using Problem Solving Approach by Reema Thareja, Oxford University Press, 2nd Edition, 2023.
2. **Learning Python** by Mark Lutz, O'Reilly Media, 5th Edition, 2013.

Reference books

1. **Python: The Complete Reference** by Martin C. Brown, McGraw-Hill Education, 2nd Edition, 2018.
2. **Python for Data Analysis by Wes McKinney,** O'Reilly Media, 3rd Edition, 2022.
3. **Head First Python by Paul Barry**, O'Reilly Media, 3rd Edition, 2023.
4. **Advance Core Python Programming,** Meenu Kohli, BPB Publications, 2021.

Course Code: GCA 404	**Course Title: Python Programming Lab**
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Apply basic Python syntax and logic.
CO2: Use data structures and functions effectively.
CO3: Build apps with Tkinter, SQLite, NumPy, Matplotlib, and Pandas.
CO4: Solve real-world problems using modular Python code.

Laboratory Program List

Part-A

1. Python script for checking the given year is leap year or not.
2. Python script to check if a number belongs to the Fibonacci Sequence
3. Python script to solve Quadratic Equations
4. Python script to display all numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.
5. Python script to display Multiplication Tables
6. Python script to create a calculator program
7. Explore string functions
8. Implementation of python script that takes a list of words and returns the length of the longest one.
9. Python script handles multiple errors with one except statement.
10. Python script to check whether password is valid or not.
    Conditions for a valid password are:
    - Should have at least one number.
    - Should have at least one uppercase and one lowercase character.
    - Should have at least one special symbol.
    - Should be between 6 to 20 characters long.

Part-B

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

Evaluation Scheme for Lab Examination

Assessment Criteria Marks		**Marks**
Writing	One Program from Part A	15
	One Program from Part B	15
Execution	Any one of the Written Program	5
Viva Voce based on Python Programming		5
Total		**40**

Semester: IV

Course Code: GCA 405	**Course Title: PHP & MySQL**
Course Credits: 03 (3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Understand PHP basics, syntax, variables, data types, and control structures.
CO2: Use arrays, functions, and strings to create dynamic PHP programs.
CO3: Apply object-oriented concepts and exception handling in PHP.
CO4: Build web applications using forms, sessions, and MySQL with PHP.

Course Contents	Hours
Unit 1	
Introduction to PHP: Introduction to PHP, History and Features of PHP, Installation & Configuration of PHP, Embedding PHP code in Your Web Pages, Understanding PHP, HTML and White Space, Comments in PHP, Sending Data to the Web Browser, Data types, Keywords, Variables, Constants in PHP, Expressions in PHP, Operators in PHP. **Conditional statements:** if, if-else, switch, The? Operator**, Looping statements:** while Loop, do-while Loop, for Loop, foreach loop, break, continue.	11
Unit 2	
Arrays in PHP: Definition, Creating, Accessing Array**, Types of Arrays:** Indexed, Associative arrays, Multidimensional arrays, Accessing Array, Manipulating Arrays, displaying array, Array Functions. **Using Functions in PHP:** Definition, Creating, invoking, user-defined functions, Formal parameters, actual parameters, Function and variable scope, Recursion, Library functions, Date and Time Functions. **Strings in PHP:** Definition, Creating, Declaring, formatting strings, String Functions.	11
Unit 3	
Object Oriented Concepts: Definition, Creation, Declaration, Accessing of Class & Object, Object properties, Object methods, **Constructor:** Definition, Types, Destructor, **Polymorphism:** Method Overloading, Property Overloading. Access Specifiers **Inheritance:** Definition, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Interfaces, Abstract Class, Overriding. **Exception Handling:** try, catch, multi try, multi catch, throw, finally.	11
Unit 4	
Form Handling: Creating an HTML Form, Handling HTML Form data in PHP. File Inclusion (Include ( ), Require ( )). **Session Handling:** Definition, session_start (), session_id (), session_destroy () session variables. **Database Handling Using PHP with MySQL:** Introduction to MySQL: Database terms, Data Types. **Accessing MySQL** –Using MySQL Client and Using phpMyAdmin, MySQL Commands, Using. PHP MySQL Functions, connecting to MySQL and selecting the Database, Executing Simple Queries, Retrieving Query Results, Counting Returned Records, Updating Records with PHP	11

Textbooks:

1. **PHP and MySQL Web Development**: Luke Welling, Laura Thomson, Addison-Wesley, 5th Edition, 2016.
2. **Learning PHP, MySQL & JavaScript:** Robin Nixon, O'Reilly Media, 6th Edition, 2021.

Reference Books:

1. Beginning PHP and MySQL: From Novice to Professional – W. Jason Gilmore, Apress, 4th Edition, 2010.

Course Code: GCA 405	**Course Title: PHP & MySQL Lab**
Course Credits: 02 (0-0-2)	**Hours/Week:** 04
Total Contact Hours: 60	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Implement syntax, control structures, and loop constructs to solve problems.
CO2: Apply arrays, functions, and string operations to build dynamic web features.
CO3: Implement object-oriented programming and exception handling in PHP.
CO4: Develop interactive web applications with form handling, sessions, and MySQL integration.

Laboratory Program List

Part-A

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

Part-B

1. Write a PHP script to demonstrate the use of constructors and destructors in a class.
2. Write a PHP script to demonstrate Multilevel Inheritance.
3. Write a PHP script to demonstrate exception handling by catching a divide-by-zero exception.
4. Write a PHP script to handle form data using the POST method.
5. Write a PHP script to demonstrate session handling by storing and displaying username and user role using session variables.
6. Write a PHP script to create a new database using MySQL and PHP.
7. Write a PHP script to create a table in a MySQL database & insert data using PHP.
8. Develop a PHP application to design a college admission form and store the submitted data into a MySQL database.

Evaluation Scheme for Lab Examination

Assessment Criteria Marks		**Marks**
Writing	One Program from Part A	15
	One Program from Part B	15
Execution	Any one of the Written Program	5
Viva Voce based on PHP & MySQL		5
Total		**40**

Semester: IV

Course Code: GCA 406 **(Elective)**	**Course Title: Fundamentals of Data Science**
Course Credits: 03(3-0-0)	**Hours/Week:** 03
Total Contact Hours: 44	**Formative Assessment Marks:** 20
Exam Marks: 80	**Exam Duration:** 03

Course Outcomes (COs):

CO1: Explain key concepts of data mining, KDD, and its real-world applications.
CO2: Apply data preprocessing and perform frequent pattern mining using Apriori and FPGrowth.
CO3: Implement and evaluate classification techniques and prediction models.
CO4: Apply clustering methods and evaluate clustering results.

Course Content	Hours
Unit 1	
Data Mining: Introduction, Data Mining Definitions, Steps in Knowledge Discovery in Databases (KDD), Kinds of Data That Can Be Mined in Data Mining, DM functionalities – kinds of patterns can be mined, KDD Vs Data Mining, DBMS Vs Data Mining, DM techniques, Problems, Issues and Challenges in DM, DM applications.	11
Unit 2	
Data Warehouse: Introduction, Definition, Data Warehousing: Three Tier Architecture, Multidimensional Data Model, Schemas for Multidimensional Data Models, OLAP Operations, **Data Cleaning:** Introduction, types of data cleaning tasks (handling missing values, handling noisy data), **Data Integration**: Introduction, Challenges, **Data reduction:** Introduction, Strategies, **Data Transformation:** Introduction, Strategies, Data Transformation by Normalization. **Mining Frequent Patterns:** Basic Concepts (Items, Itemset, Support, Confidence, Maximal Itemset, Closed Itemset), - Association Rule, Mining Association Rules, Frequent Item Set Mining Methods -A priori and Frequent Pattern Growth (FPGrowth) algorithms. Vertical Data Format in Frequent Itemset Mining.	11
Unit 3	
Classification: Basic Concepts, Issues, **Algorithms:** Decision Tree Induction, Attribute Selection Measures, Bayes Classification Methods, Rule-Based Classification, Lazy Learners (or Learning from your Neighbours), k Nearest Neighbour. Metrics for Evaluating Classifier Performance (Precision and Recall), Confusion Matrix.	11
Unit 4	
Clustering: Cluster Analysis, Partitioning Methods (K-Means, K-Medoids), Hierarchical Methods (Algorithmic methods, Probabilistic methods and Bayesian methods), Density-Based Methods (DBSCAN, DENCLUE), Grid-Based Methods (STING, CLIQUE), Dendrogram, Distance Measuring in Algorithmic Methods, Types of Linkage of clusters, Evaluation of Clustering.	11

Text Books:

1. Jiawei Han and Micheline Kamber – "Data Mining Concepts and Techniques" Second Edition, Morgan Kaufmann Publishers.

Reference:

1. Arun K Pujari – "Data Mining Techniques" 4th Edition, Universities Press
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2012.
3. K.P. Soman, Shyam Diwakar, V.Ajay: Insight into Data Mining – Theory and Practice, PHI

Semester: IV

Course Code: GCA 407 **(Elective)**	**Course Title: Internet of Things**
CourseCredits:03(3-0-0)	**Hours/Week:**03
TotalContactHours:44	**Formative Assessment Marks:** 20
ExamMarks:80	**ExamDuration:**03

Course Outcomes (COs):

CO1: Define key concepts, architecture, and challenges of IoT.
CO2: Explain the role of sensors, actuators, and communication in IoT networks.
CO3: Illustrate the use of IoT protocols and data analytics tools.
CO4: Apply IoT concepts to basic smart city use cases.

Course Content	Hours
Unit 1	
Introduction to IoT: Definition, IoT and Digitization, IoT impact, convergence of IT and OT, IoT Challenges, Comparing IoT Architectures, Core IoT Functional stack, IoT data management and compute stack.	11
Unit 2	
IoT Networks: Sensors, Actuators and smart objects, sensor networks, Communication Criteria, IoT Access Technologies, need for optimization, optimizing IP for IoT.	11
Unit 3	
Application Protocols: The transport Layer, IoT Application Transport Methods, Data Analytics for IoT, Machine Learning, Big Data Analytics tools and technology, network analytics.	11
Unit 4	
IoT in Industry: Smart and connected cities – IoT strategy for smarter cities, smart city IoT architecture, smart city security architecture, Smart city use-case examples.	11

Textbook:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 9789386873743)

Reference Books:

1 Raj Kamal, " Internet of Things: Architecture and Design", McGraw-Hill, 2nd edition June 2022.
2 Arsheep Bahga, Vijay Madisetti, Internet Of Things - A Hands-On Approach, Orient Blackswan Private Limited, 2015.

Semester: IV

Course Code: GCA 408 **(Elective)**	**Course Title: Software Testing**
CourseCredits:03(3-0-0)	**Hours/Week:**03
TotalContactHours:44	**Formative Assessment Marks:** 20
ExamMarks:80	**ExamDuration:**03

Course Outcomes (COs):

CO1: Understand the basics of software testing and test case design.
CO2: Apply decision table and data flow testing methods.
CO3: Analyze integration and system testing techniques.
CO4: Evaluate object-oriented and GUI testing approaches.

Course Content	Hours
Unit 1	
Basics of Software Testing and Examples: Basic definitions, Test cases, Insights from a Venn diagram, identifying test cases, Error and fault taxonomies, Levels of testing, Generalized pseudo code, The triangle problem, The Next Date function, The commission problem, The SATM (Simple Automatic Teller Machine) problem. **Decision Table-Based Testing:** Decision tables, Test cases for the triangle problem, Test cases for the Next Date function, Test cases for the commission problem.	11
Unit 2	
Data Flow Testing: Definition - Use testing, Slice-based testing, Guidelines and observations. **Life Cycle–Based Testing:** Traditional Waterfall Testing**,** Testing in Iterative Life Cycles**,** Agile Testing, **Model-Based Testing:** Testing Based on Models**,** Peterson's Lattice**,** Expressive Capabilities of Mainline Models**,** Modelling Issues**,** Making Appropriate Choices. **Integration Testing:** Introduction, Decomposition-based, call graph-based, Path-based integrations.	11
Unit 3	
System Testing: Definition, Possibilities, Basic concepts for requirements specification, Model-Based Threads, Use Case–Based Threads, ASF (Atomic System Functions). **Object-Oriented Testing:** Units for object-oriented testing, Implications of composition and encapsulation, inheritance, and polymorphism, Levels of object-oriented testing, GUI testing, Dataflow testing for object-oriented software. **Class Testing:** Methods as units, Classes as units.	11
Unit 4	
Object-Oriented Integration Testing: UML support for integration testing, MMpaths for object-oriented software, A framework for object-oriented dataflow integration testing. **Object-Oriented System Testing:** Currency converter UML description, UML-based system testing, State chart-based system testing. **GUI Testing:** The currency conversion program, Unit testing, Integration Testing and System testing for the currency conversion program, case study of windshield wiper.	11

Text Books:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications.

Reference Books:

1 Aditya P Mathur: Foundations of Software Testing, Pearson.
2 Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, 1st edition, John Wiley & Sons.
3 Srinivasan Desikan, Gopalaswamy Ramesh: Software Testing Principles and Practices.

Semester: IV

Course Code: GCA 409	**Course Title: Digital Marketing**
Course Credits: 02(2-0-0)	**Hours/Week:** 02
Total Contact Hours: 30	**Formative Assessment Marks:** 10
Exam Marks: 40	**Exam Duration:** 02:30

Course Outcomes (COs):

CO1: Describe the basics, evolution, and channels of digital marketing.
CO2: Apply social media and email marketing strategies effectively.
CO3: Create content and mobile marketing plans with analytics.

Course Content	Hours
Unit 1	
Introduction to Digital Marketing: Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digital marketing channels and platforms **Digital Marketing Strategy and Planning:** Developing a digital marketing strategy, setting goals and objectives, Budgeting, and resource allocation. Campaign planning and execution, Monitoring and adjusting digital marketing campaigns.	10
Unit 2	
Social Media Marketing: Overview of social media marketing, social media platforms and their features, creating and optimizing social media profiles, social media content strategy, social media advertising and analytics **Email Marketing:** Introduction to email marketing, building an email list, creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics.	10
Unit 3	
Content Marketing: Understanding content marketing, Content strategy and planning, Content creation and distribution, Content promotion and amplification, Content marketing metrics and analytics. **Mobile Marketing:** Mobile marketing overview, Mobile advertising strategies, Mobile app marketing, Location-based marketing, Mobile marketing analytics.	10

Text Books:

1 "Digital Marketing Strategy: An Integrated Approach to Online Marketing" by Simon Kingsnorth.
2 "Email Marketing Rules: How to Wear a White Hat, Shoot Straight, and Win Hearts" by Chad S. White.

Reference Books:

1 "Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses" by Joe Pulizzi.
2 "Mobile Marketing: How Mobile Technology is Revolutionizing Marketing, Communications and Advertising" by Daniel Rowles.
3 "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" by Avinash Kaushik.

Practical Evaluation [50 Marks]

- **Internal assessment: C1= 05 Marks, C2 =05 Marks [Total = 10 Marks]**
- **Semester End Practical Examination C3=40 marks**
- **Writing:** One program from both Part A and Part B (10 Marks each): **10 + 10 = 20 Marks**
- **Debug and Execution:** (05 Marks each) **05 + 05 = 10 Marks**
- **Record: 05 Marks**
- **Viva:** 05 **Marks**

Theory Evaluation [100 Marks]

CIE, SEE, and QP Pattern for Theory Courses:

- Total Lecture hours per paper: 44
- No. of Units 4 (11 Hours Each)
- Internal Assessment **C1 = 10 Marks, C2 = 10 Marks**
- Semester End Theory Exam **C3 = 80 Marks**

Question Paper Pattern

Instructions: Answer Part-A and Part-B:

Part-A

Answer any 10 out of 12 Questions (3 Questions drawn from each unit).
Each question carries 2 Marks. (10 X 2 =20) Q. No. 1 to Q. No. 12.

Part-B

Answer the following Questions.

13. a)

OR

b)

14. a)

OR

b)

15. a)

OR

b)

16. a)

OR

b)

Each main Question has with internal choice and carries 15 Marks. (4 X 15 =60)
(Each main question may split into sub-questions like (10 + 5, 8 +7, 5+5+5, …) and with a maximum of 3 sub-questions)

Scheme of question paper (2 Credits):

Maximum Marks – 40
Part A: Answer any 5 questions: (5x2=10 Marks)
Question No. 1 to 6
Part B: Answer the following questions: (10x3=30 Marks)
7. a) 7. b) or 7. c) 7. d)
8. a) 8. b) or 8. c) 8. d)
9. a) 9. b) or 9. c) 9. d)