First Year Revised NEP Syllabus: BCA for 2026-2027

Programme: BCA

Subject: Computer Applications

Semester	Course Code	Title	Theory/Practical	Credit L: T:P	Hours / Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIE		SEE		
						C1	C2	C3		
I	HRA210	Digital Computer Organization	**Theory**	**3:0:0**	**3**	**10**	**10**	**80**	**100**	**3**
	HRA210P	Office Automation and HTML	**Practical**	**0:0:2**	**4**	**05**	**05**	**40**	**50**	**3**
	HRA220	Problem Solving using C++	**Theory**	**3:0:0**	**3**	**10**	**10**	**80**	**100**	**3**
	HRA220P	C++ Programming	**Practical**	**0:0:2**	**4**	**05**	**05**	**40**	**50**	**3**
	HRA230	Mathematical and Statistical Computing	**Theory**	**3:0:0**	**3**	**10**	**10**	**80**	**100**	**3**
	HRA230P	Mathematical and Statistical Computing using R	**Practical**	**0:0:2**	**4**	**05**	**05**	**40**	**50**	**3**

****Total Credits (Theory and Practical): (09+06=15)**

Semester	Course Code	Title	Theory/Practical	Credit L: T:P	Hours / Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIE		SEE		
						C1	C2	C3		
II	HRB210	Data Structures	**Theory**	**3:0:0**	**3**	**10**	**10**	**80**	**100**	**3**
	HRB210P	Data Structures using C++	**Practical**	**0:0:2**	**4**	**05**	**05**	**40**	**50**	**3**
	HRB220	Object Oriented Programming with Java	**Theory**	**3:0:0**	**3**	**10**	**10**	**80**	**100**	**3**
	HRB220P	Programming with Java	**Practical**	**0:0:2**	**4**	**05**	**05**	**40**	**50**	**3**
	HRB230P	Operating systems	**Theory**	**3:0:0**	**3**	**10**	**10**	**80**	**100**	**3**
	HRB230P	Shell Programming	**Practical**	**0:0:2**	**4**	**05**	**05**	**40**	**50**	**3**

****Total Credits (Theory and Practical): (09+06=15)**

Programme Name: BCA	**Semester: I**
Course Title: Digital Computer Organization	
Course Code: HRA 210	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand the digital computer system including classification of computers, anatomy of Computer, input /output devices ad memory organization of computer.
CO 2	Illustrate the types of Software, Computer languages and Translator programs.
CO 3	Apply Boolean algebra to simplify logical expressions and solve problems using Karnaugh maps and other minimization techniques.
CO4	Design and analyze combinational and sequential logic circuits, including adders, subtractors, flip-flops, encoders, decoders, multiplexers, and counters.
CO5	Perform conversions between decimal, binary, octal, and hexadecimal number systems and carry out arithmetic operations in binary.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**2**	**1**	**1**	**2**	–	–	–	**1**	–
CO2	**3**	**2**	**2**	**1**	**2**	**1**	–	–	**1**	**1**
CO3	**3**	**3**	**2**	–	**2**	–	–	–	**1**	–
CO4	**3**	**3**	**3**	–	**2**	**1**	–	–	**1**	–
CO5	**3**	**3**	**2**	–	**1**	–	–	–	**1**	–

Course Content	**Hours**
Unit 1:	
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:** Computers 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 Binary Number System. 1's and 2's Complement Method in Binary Number System. Subtraction Using 1's and 2's Compliment, Weighted Number System, Binary Coded Decimal (BCD), Addition of BCD Numbers. Non-Weighted Number System, Applications, Excess-3, Gray Code Conversions, Gray and Binary Codes.	11
Unit 3:	
Boolean Algebra: Basic Laws, Demorgan's Theorem, Duality Theorem, Sum of Product Method And Products Of Sum Method. Karnaugh Map (Upto 4 Variables, Don't Care Condition). **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

Text Books/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 (Elseviers)

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: I**
Course Title: Office Automation and HTML	
Course Code: HRA 210P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Confidently work on Office Automation software such as word processor, spreadsheet an power Point.
CO 2	Understand the Web Programming basics and create simple web pages using HTML

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	1	2	1	3	2	1	–	2	2
CO2	3	2	3	–	3	2	1	–	2	2

List of Practical Experiments

Part A

1. Using Word processor with suitable examples, write the steps and execute the following with respect to table handling
    - Creating a table (At least 4 Columns and 6 Rows). Entering appropriate data into the table. Sort the table, Apply the formulas on table numeric values.
2. Using Word processor write the steps and execute for creating “Mail Merge” document for “FORMLETTERS”.
3. Using spread sheet, with suitable example, write steps and create worksheet called “Employee” and calculate the following using formulas
   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)
   vi. Calculate Deductions (10% of Total Salary).
   vii. Calculate Net Salary (Total Salary – Deductions).
4. Using spread sheet draw X-Y Line Chart and Bar Charts based on the following worksheet data and write the steps
   ITEM MONTHLY SALES (in Thousands)
   Cotton 2,750, Wool 3,100, Yarn 2,975, Jute 2,100, Fiber 3,010

5. Using spread sheet write the steps and execute the following: Roll,No, StudName, Marks1, Marks2, Mark3 ,Total Percentage, Result

i. Create appropriate records
ii. Calculate total and marks using formula.
iii. Update result column using IF function. (Result: Distinction, First Class, Second Class, Pass, Fail).

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

Part - B

10. Design a page having suitable background colour and text colour with title "My First Web Page" using all the attributes of the Font tag.
11. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style
12. Write a HTML program for the demonstration of Lists.
    i) Unordered List
    ii) Ordered List
13. Write a HTML program for demonstrating Hyperlinks.
    i. Navigation from one page to another.
    ii. Navigation within the page.
14. Write a HTML program for time-table using tables.
15. Write a HTML program to develop a static Registration Form.
16. Write a HTML program to develop a static Login Page.
17. Write a HTML code to create a web page with pink color background and display moving message in red color.
18. Write a HTML program to develop a static Web Page for Shopping Cart.
19. Write a HTML program to develop simple calculator.

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: I**
Course Title: Problem Solving using C++	
Course Code: HRA 220	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Understand the fundamental concepts and benefits of Object-Oriented Programming (OOP) and how it differs from Procedure-Oriented Programming paradigms.
CO2	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.
CO3	Describe the control structures, functions, and different parameter passing methods and write programs to solve problems.
CO4	Demonstrate the concepts of classes and objects, access specifiers, constructors, Destructors and OOP features like polymorphism, inheritance with the help of programs.

CO-PO Mapping Matrix

COs \ Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**2**	–	**2**	**1**	–	–	**2**	**1**
CO2	**3**	**3**	**3**	**1**	**3**	**1**	–	–	**2**	**2**
CO3	**3**	**3**	**3**	–	**2**	**1**	**1**	–	**2**	**2**
CO4	**3**	**3**	**3**	–	**3**	**1**	**1**	–	**2**	**2**

Course Content	**Hours**
Unit 1:	
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, and 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, File I/O Operations (Opening, Reading, Writing, Append And Closing).	11

Text 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 Balaguruswamy, Tata McGraw-Hill Publicationm 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.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: I**
Course Title: C++ Programming	
Course Code: HRA220P	**No of credits :02(0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Demonstrate fundamental C++ programming concepts by writing programs for simple problems.
CO 2	Utilize features of C++, such as recursion, function overloading, and friend functions, to enhance the functionality and efficiency of programs.
CO 3	Design and construct classes and objects in C++ to model real-world entities, demonstrate inheritance, operator overloading, constructors, and file handling operations.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	–	**2**	**1**	**1**	–	**2**	**2**
CO2	**3**	**3**	**3**	–	**3**	**1**	**1**	–	**2**	**2**
CO3	**3**	**3**	**3**	**1**	**3**	**1**	**1**	–	**2**	**2**

List of Practical Experiments:

Part -A

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

Part - B

1. Program to demonstrate call by value and call by reference.
2. Program to generate factorial of a given number using recursion.
3. Program to create a Class for representing student details with appropriate member functions to accept and display the details.
4. Program to demonstrate function overloading.
5. Program to demonstrate friend function.
6. Program for single inheritance.
7. Program to demonstrate multilevel inheritance.
11. Program to demonstrate operator overloading.
12. Program to demonstrate the usage of default and parameterized constructors.
13. Program to read and display the contents of a text file.

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: I**
Course Title: Mathematical and Statistical Computing	
Course Code: HRA230	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 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.
CO 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.
CO 3	Organize and interpret data using statistical methods, calculate measures of central tendency and dispersion, analyze correlation between variables, and perform linear regression analysis.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**2**	–	**1**	**1**	–	–	**2**	**1**
CO2	**3**	**3**	**2**	–	**2**	**1**	–	–	**2**	**1**
CO3	**3**	**3**	**2**	**1**	**2**	**2**	–	–	**2**	**1**

Course contents	**Hours**
Unit 1:	
R Programming: Introduction to R programming, Uses of R programming, Output functions - print () and cat () .Input functions - readline (), scan ().R data types – numeric, integers, complex, character, logical. R Operators – Arithmetic, Relational, Logical and Assignment operators .Decision Making Statement – if statement, if else statement, else if statement, nested if statement and switch statement. R loops – for loop, nested for loop, while loop. R data structures – vectors, list, matrices, array and data frame.	**11**
Unit 2:	
Mathematical Logic Introduction: Statements Connectives - Negation, Conjunction, Disjunction- Statement Formulas and Truth Tables- Conditional and Bi Conditional Statements- Tautology, Contradiction. **Set Theory:** Sets and Subsets, Set Operations and The Laws of Set Theory, Counting and Venn Diagrams.	**11**

Unit 3:	
Relations: Introduction, 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 4:	
Statistical methods: Introduction, Definitions, Classifications, Frequency Distribution, Mean - Arithmetic Mean for Ungrouped Data. Median: Meaning, Calculations of Median for Ungrouped data. Mode: Meaning, Calculations of Mode for Ungrouped data. Standard Deviation: Meaning, Standard Deviation for Ungrouped data. Coefficient of Variation: Meaning and Problems. Correlation: Meaning, Types, Rank Correlations and Problems on Rank Correlation. Simple Linear Regression: Meaning, Properties of Regression Coefficients	**11**

Text 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.)

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Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: I**
Course Title: Mathematical and Statistical Computing using R	
Course Code: HRA230P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Develop practical skills in implementing set operations and function operations using R programming.
CO 2	Implement logic gates using R and perform comprehensive statistical analysis including calculations of central tendency and conduct linear regression analysis.
CO 3	Compute Cartesian products and analyze relations for properties such as reflexivity, symmetry, and transitivity through R scripts.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**3**	–	**3**	**1**	**1**	–	**2**	**2**
CO2	**3**	**3**	**3**	**1**	**3**	**1**	**1**	–	**2**	**2**
CO3	**3**	**3**	**3**	–	**3**	**1**	**1**	–	**2**	**2**

List of Practical Experiments:

Part A

1. Write an R Program to implement operations of Set (Union, Intersection, Difference,
2. Write an R program to implement inverse function.
3. Write an R Program to implement one-to-one function.
4. Write an R Program to implement Cartesian Product of Two sets.
5. Write an R Program to check whether the given relation is Reflexive.
6. Write an R Program to check whether the given relation is Transitive.
7. Write an R Program to implement logic gates (NOT, AND, OR, XOR).
8. Write an R Program to check whether the given relation is Symmetric.
9. Write an R Program to calculate central tendency (mean, median, and mode).
10. Write an R Program to Calculate standard deviation and variance for discrete & continuous series.

Part B

11. Write an R Program to Calculate coefficient of variance for discrete & continuous series.
12. Write an R Program to calculate simple Linear Algebra Operations.
13. Write an R Program to Calculate arithmetic mean for grouped and ungrouped data.

14. Write an R Program to calculate cumulative sums, and products, minima, maxima.
15. Write an R Program to Calculate frequency distribution for discrete & continuous series.
16. Write an R Program to Calculate Simple Linear Regression.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: II**
Course Title: Data Structures	
Course Code: HRB210	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand the basics of Data Structures.
CO 2	Identify the appropriate data structures and algorithms for solving real world problems.
CO 3	Understand the practical applications of Tree and Graph.
CO4	Understand the fundamentals of sorting and searching algorithms.

CO-PO Mapping Matrix

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**–**	**1**	**–**	**–**	**–**	**1**	**–**
CO2	**2**	**3**	**3**	**–**	**2**	**–**	**–**	**–**	**2**	**1**
CO3	**2**	**3**	**2**	**–**	**3**	**–**	**–**	**–**	**2**	**1**
CO4	**2**	**3**	**3**	**–**	**2**	**–**	**–**	**–**	**2**	**1**

Course Content	**Hours**
Unit 1:	
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:	
Two-Dimensional Transformations: Coordinate and Geometric Transformations; Translation, Rotation, Scaling; Matrix representations and Homogeneous coordinates, Composite transformations, General Pivot Point rotation, General Fixed-Point Scaling, Shearing; Reflection; Reflection about an arbitrary line. 2-D Viewing: Viewing pipeline; Window, Viewport, Window-to-Viewport transformation; Zooming, panning; Pointing and Positioning techniques; Rubber band technique; Dragging. Clipping operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-Point Subdivision line clipping.	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 Sort [Algorithm, Time & Space Complexity]. **Heap:** Heap Operations and Applications.	11

Text 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.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

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Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: II**
Course Title: Course Title: Data Structures using C++	
Course Code: HRB210P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Implement data structures using C++.
CO 2	Demonstrate searching and sorting techniques using C++.
CO3	Demonstrate advanced programming skills through C++ programming language.

CO -PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	–	2	–	–	–	1	1
CO2	2	3	3	–	2	–	–	–	2	1
CO3	3	2	3	–	3	1	–	–	2	2

List of Practical Experiments

Part A

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

Part B:

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

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: II**
Course Title: Object Oriented Programming with Java	
Course Code: HRB220	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand the Java programming fundamentals.
CO 2	Describe with examples of basic Java OOP concepts.
CO 3	Understand the Java Interfaces and Packages.
CO4	Deliberate the Details of Multithreading, Exception Handling & File Handling
CO5	Design GUI applications using tools like AWT.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**2**	**2**	**–**	**2**	**–**	**–**	**–**	**1**	**–**
CO2	**3**	**2**	**3**	**–**	**2**	**–**	**–**	**–**	**1**	**1**
CO3	**2**	**2**	**3**	**–**	**3**	**–**	**–**	**–**	**2**	**1**
CO4	**2**	**3**	**3**	**–**	**3**	**–**	**–**	**–**	**2**	**2**
CO5	**2**	**2**	**3**	**–**	**3**	**1**	**–**	**–**	**2**	**2**

Content	**Hours**
Unit 1:	
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. **Inheritance**: Types of inheritance, method overriding in inheritance, Interface, abstract	11

class and methods, final keyword in inheritance **Arrays**: One dimensional Arrays, Two dimensional Arrays, Array of Objects. **Strings**: String Handling functions. **Multithreading in Java** :Concepts of Thread, Thread Life Cycle, Creating Threads & Implementing Runnable Interface, Thread Synchronization & Thread Priority.	
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 & Its 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

Text 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

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: II**
Course Title: Programming with Java	
Course Code: HRB220P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Implement simple programs using Java Fundamental concepts.
CO 2	Identify classes, objects, members of class and the relationships among them needed for finding the solution to specific problems using Objected Oriented Programming concepts of Java.
CO3	Design & Develop simple GUI programs using AWT GUI tool.

CO -PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	3	–	2	–	–	–	1	1
CO2	2	3	3	–	2	–	–	–	2	1
CO3	3	2	3	–	3	1	–	–	2	2

List of Practical Experiments

Part A

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

Part B:

1. Program to 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 file.
7. Program to create window with three buttons father, mother and close. Display the respective details of father and mother as name, age and designation using AWT controls.
8. Program to create menu bar and pull-down menus.

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: II**
Course Title: Operating System	
Course Code: HRB220	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand the fundamentals of the operating system.
CO 2	Describe the concepts of process, process management, CPU Scheduling, process synchronization, Dead locks, memory management and Virtual Memory management.
CO 3	Illustrate the file system and structure.
CO4	Understand the UNIX OS, Shell Programming, Conditional Control Structures in Shell Programming.

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**2**	**–**	**–**	**2**	**–**	**–**	**–**	**–**	**1**
CO2	**3**	**3**	**2**	**–**	**2**	**–**	**–**	**–**	**–**	**1**
CO3	**3**	**2**	**2**	**–**	**2**	**–**	**–**	**–**	**–**	**1**
CO4	**3**	**2**	**3**	**–**	**3**	**–**	**–**	**–**	**–**	**1**

Content	**Hours**
Unit 1:	
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, Interprocess 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, Directorystructure, File-System Structure, Allocation Methods- Contiguous Allocation, Linked Allocation and Indexed Allocation, FreeSpace 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

Text 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

Sumitabha Das: UNIX – Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: II**
Course Title: Shell Programming	
Course Code: HRB230P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Develop skill in shell scripting to perform simple operations and problems.
CO 2	Perform file manipulation using shell scripts.
CO3	Understand and implement shell scripts for system information.

CO -PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**3**	**–**	**2**	**–**	**–**	**–**	**–**	**1**
CO2	**3**	**3**	**3**	**–**	**3**	**–**	**–**	**–**	**–**	**1**
CO3	**3**	**2**	**3**	**–**	**3**	**–**	**–**	**–**	**–**	**1**

List of Practical Experiments

Part A

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

Part B:

1. Write a shell script to search for particular element from an array of elements.
2. Write a shell script to calculate the TA, HRA and DA of an employee.
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 file name and then tells how many times that word occurred in the file.

5. Write a shell script to extract a sub string from a given string.
6. Perform the following operations

   Concatenate 2 strings

   Rename a file

   Delete a file
   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 PID of parent and PID of child process.
13. Write a shell script that takes two filename as arguments. It should check whether the contents of two files are same or not, if they are same then second file should be deleted.
14. Assume a file with the given information

    First Name Middle Name Age

    ---------- ---------- ------
15. Write a shell script to

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

Evaluation Scheme for Practical Examination:

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

QP Pattern for Theory Courses (3 Credits):

Instructions: Answer Part-A, Part-B and Part-C:

Time: 3 Hours Max Marks:80

Part-A

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

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

1
2
3
4
5
6
7
8
9
10
11
12

Part-B

II Answer any 4 questions out of 6 questions **4X5=20**

(4Questions drawn from each unit and 2 questions from any unit)

13
14
15
16
17
18

Part-C

III Answer all the Questions. Each question carries 10 Marks. **4 X 10 =40**

(Each question with internal choice and with maximum of 2 sub questions)

19

20

21

22

Question paper pattern for Theory Courses (2 Credits):

Time: 2 Hours Max Marks: 40

Instructions: Answer Part-A and Part-B

Part-A

I. **Answer any 5 questions out of 6 Questions: 5x2=10**

Question No. 1 to 6

Part B

II Answer the following questions: 10x3=30

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)

Second Year Revised NEP Syllabus: BCA for 2026-2027

Programme: BCA

Subject: Computer Applications

Semester	Course Code	Title	Theory/Practical	Credit L: T:P	Hours / Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIE		SEE		
						C1	C2	C3		
III	HRC210	C#.NET Programming	Theory	3:0:0	03	10	10	80	100	3
	HRC210P	C#.NET Programming Lab	Practical	0:0:2	04	05	05	40	50	3
	HRC220	Data Base Management System	Theory	3:0:0	03	10	10	80	100	3
	HRC220P	DBMS Lab	Practical	0:0:2	04	05	05	40	50	3
	HRC230	Web Technologies	Theory	3:0:0	03	10	10	80	100	3
	HRC230P	Web Technologies Lab	Practical	0:0:2	04	05	05	40	50	3
	HRC240	1. Cyber Security 2. Software Engineering System Software	Theory (Elective 1)	2:0:0	02	05	05	40	50	2
	HRC250	1. Cloud Computing 2. Digital Image Processing E-Commerce and E- Governance	Theory (Elective 2)	2:0:0	02	05	05	40	50	2

****Total Credits (Theory and Practical): (13+06=19)**

Semester	Course Code	Title	Theory/Practical	Credit L: T:P	Hours / Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIE		SEE		
						C1	C2	C3		
IV	HRD210	Computer Networks	Theory	3:0:0	03	10	10	80	100	3
	HRD210P	Networking Lab	Practical	0:0:2	04	05	05	40	50	3
	HRD220	Python Programming	Theory	3:0:0	03	10	10	80	100	3
	HRD220P	Python Programming Lab	Practical	0:0:2	04	05	05	40	50	3
	HRD230	PHP & MySQL	Theory	3:0:0	03	10	10	80	100	3
	HRD230P	PHP & MySQL Lab	Practical	0:0:2	04	05	05	40	50	3
	HRD240	1. Fundamentals of Data Science 2. Internet of things Software Testing	Theory (Elective1)	2:0:0	02	05	05	40	50	2
	HRD250	Digital Marketing	Theory (Compulsory Paper)	0:0:2	02	05	05	40	50	3

****Total Credits (Theory and Practical): (11+08=19)**

Programme Name: BCA	**Semester: III**
Course Title: C#.NET Programming (Theory)	
Course Code: HRC210	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand C# basics, syntax, control statements, arrays, strings.
CO 2	Apply OOP concepts like inheritance and overloading in C#.
CO 3	Use delegates, events, and file I/O in C#.
CO4	Build GUI apps using Windows Forms and ADO.NET.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**2**	–	**2**	–	–	–	1	–
CO2	**3**	**3**	**3**	–	**2**	1	–	–	1	1
CO3	**3**	**2**	**3**	1	**3**	1	–	–	**2**	1
CO4	**3**	**3**	**3**	**3**	**3**	1	1	–	**2**	**2**

Course Content	**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	11

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.	
Unit-3	
Delegates and Events: Definition, delegate declaration, delegate methods, delegate's 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 **Managing Errors and Exceptions:** Introduction, what is Debugging, types of Errors, Exceptions, syntax of exception handling code, Multiple Catch statements, the exception hierarchy, Using Finally statement, Nested try Blocks, Throwing our own Exceptions.	11
Unit-4	
Introducing windows forms: A tale of three GUI namespaces, Anatomy of a Form, Component class and 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 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.

References:

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

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini

Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: III**
Course Title: C#.NET Programming Lab	
Course Code: HRC210P	**No of credits :02(0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Demonstrate C# basics using methods, arrays, and strings.
CO 2	Apply OOP concepts like inheritance and overloading in C#.
CO 3	Implement delegates, events, and file handling
CO4	Design Windows Forms and connect databases using ADO.NET.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**–**	**2**	**–**	**–**	**–**	**1**	**–**
CO2	**3**	**3**	**3**	**–**	**2**	**1**	**1**	**–**	**2**	**1**
CO3	**2**	**3**	**3**	**2**	**3**	**1**	**1**	**–**	**2**	**1**
CO4	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**

List of Practical Experiments:
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 Array List.
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.
9. Write a C# program to implement multicast delegate.
10. Write a C# program to implement an event handler.

11. Write a C# program to demonstrate the operations of numeric formatting types.
12. Write a C# program to write to and read from a text file.

Part - B

1. Design a window application to find the factorial of a number and check the number is prime number
2. Design a Windows Forms application that includes the following controls: image button (PictureBox).
3. Create a Windows Forms application that demonstrates the use of a track bar, progress bar, group boxes and button.
4. Create a Windows Forms application that includes a calendar control to allow the user to Select a date and display it on a label.
5. Design a calculator using windows application.
6. Design a window application that includes the following controls: Menustrip and Toolstrip.
7. Design a window application that includes the following controls: List box and Dropdown list.
8. Design a window application that includes the following controls: Checkbox, Radio button.
9. Design a window application to use a frame control to navigate to web pages.
10. Design a windows application to bind data to combo box.
11. Design a window application for multi tab control.
12. 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 DataGrid View.

Evaluation Scheme for Practical Examination:

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

Program Name: BCA	**Semester: III**
Course Title: Database Management System	
Course Code: HRC220	**No of credits:03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
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.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**3**	**2**	**–**	**–**	**–**	**1**	**–**
CO2	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**–**	**2**	**1**
CO3	**3**	**3**	**2**	**3**	**2**	**1**	**–**	**–**	**2**	**1**
CO4	**2**	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**2**	**1**

Course contents	**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 and 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:	
Transform and Conquer: Introduction, Heaps and Heap Sort Backtracking: Introduction, N-Queens problem (4 queens), Introduction to Dynamic Programming, need of dynamic programming, introduction to dynamic programming approaches	**11**

Text Books

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

2.Design and Analysis of Algorithms, P. H. Dave, H. B. Dave, 2nd edition, Pearson Education

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, Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3rd Edition, McGraw Hill

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini

Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Semester: III

Program Name: BCA	**Semester: III**
Course Title: DBMS Lab	
Course Code: HRC220P	**No of credits :02(0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Execute single-line SQL queries and apply group functions effectively.
CO 2	Perform database operations using DDL, DML, DCL, and TCL commands
CO 3	Implement advanced SQL concepts like nested queries and join operations.
CO4	Create views and apply table-level locking mechanisms for data control.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	3	3	2	1	–	–	1	–
CO2	3	3	3	3	3	1	1	1	2	1
CO3	3	3	3	3	3	1	1	–	2	1
CO4	2	3	3	3	2	1	1	2	2	1

List of Practical Experiments:

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 Table Using create statement.
2. Insert rows into individual Tables using insert statement.
3. Alter table section add 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	Losantivill e
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	DESIGNA TION
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
9. Generate salary slip with Name, Salary, Benefits, HRA=50%, DA=30%, PF=12%, and calculate gross salary. Order by gross salary in descending order.

Activity 3: (Logical, Relational Operators)

Database: Library

Create the following tables and insert tuples with suitable constraints.

Table: Books

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

Table: Issued

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

Queries

1. To show Book name, Author name and price of books of First Publ. publisher.
2. Display Book id, Book name and publisher of books having quantity more than 8 and price less than 500.
3. Select Book id, book name, author name of books which is published by other than ERP publishers and price between 300 to 700.
4. Generate a Bill with Book_id, Book_name, Publisher, Price, Quantity, 4% of VAT "Total".
5. Display book details with book id"s C0001, F0001, T0002, F0002 (Hint: use IN operator).
6. Display Book list other than, type Novel and Fiction.
7. Display book details with author name starts with letter "A".
8. Display book details with author name starts with letter "T" and ends with "S".
9. Select Book_Id, Book_Name, Author Name , Quantity Issued where Books.Books_Id = Issued.Book_Id.
10. List the book_name, Author_name, Price. In ascending order of Book_name and then on descending order of price

Activity 4: (Date Functions)

Database: Lab

Create Following table and insert tuples with suitable constraints.

Table: Equipment Details

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

Queries

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

Activity 5

Database: Games

Create the following tables and insert tuples with suitable constraints.

Table: GAMES

GCode	GameName	Number	PrizeMoney	Date
101	CaromBoard	2	5000	23-jan-2021
102	Badminton	2	12000	12-dec-2023
103	TableTennis	4	8000	14-feb-2024
104	Chess	2	9000	01-jan-2024
105	LawnTennis	4	25000	19-mar-2024

Table: PLAYER

PCode	Name	GCode
1	Arjun	101
2	Ravi	105
3	Jignesh	104
4	Nihir	103
5	Sohil	104
6	Bharat	104

1. To display the details of those games whose name starts from character ‘c’.
2. To display details of those games which are having PrizeMoney more than 8000.
3. To display the details of the game which is played in the month of January
4. To display the name of players who plays CaromBoard.
5. To display the name of the player in ascending order who play the games chess.
6. To display the details of the game which has maximum prize money

Activity 6:

Database: Employee

Create the following tables and insert tuples with suitable constraints.

Table: EMPLOYEE

W_ID	FIRSTNAME	LASTNAME	CITY
102	SAM	TONES	PARIS
105	SARAH	ACKERMAN	NEW YORK
144	MANILA	SENGUPTA	NEW DELHI
210	GEORGE	SMITH	HOWARD
255	MARY	JONES	HUSTON

300	ROBERT	SAMUEL	WASHINGTON
335	HENRY	WILLIAMS	BOSTON
400	RONNY	LEE	NEW YORK
451	PAT	THOMPSON	PARIS

Table: Desig

W_ID	SALARY	BENEFITS	DESIGNATION
102	75000	15000	MANAGER
105	85000	25000	DIRECTOR
144	70000	15000	MANAGER
210	75000	12500	MANAGER
255	50000	12000	CLERK
300	45000	10000	CLERK
335	40000	10000	CLERK
400	32000	7500	SALESMAN
451	28000	7500	SALESMAN

1. Display FirstName and City of Employee having salary between 50,000 and 90,000
2. Display details of Employees who are from "PARIS" city.
3. Increase the benefits of employee having W_ID = 210 by 500.
4. Count number of employees whose name starts from character 'S'.
5. Display maximum salary of desig
6. Display first name having designation as manager and employee w_id=design w_id
7. Display the number of distinct designation

PART – B

Activity 7: (Numeric, character functions).

Use Functions for the following.

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

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

Activity 8: Database: subject

Create the following table and insert tuples with suitable constraints.

Table: Physics

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

Table: Computer Science

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

Queries:

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

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

Activity 10:

Database: Books

Create the following tables and insert tuples with suitable constraints.

Table: BOOKS

Book_Id	Book_Name	Author_Name	Publishers	Price	Type	Quantity
C01	Fast Cook	Lata Kapoor	EPB	355	Cookery	5
F01	The Tears	William Hopkins	First	650	Fiction	20
T01	My C++	Brain & Brooke	FPB	350	Text	10
T02	C++ Brain	A.W.Rossaine	TDH	350	Text	15
F02	Thuderbolts	Anna Roberts	First	750	Fiction	50

Table: ISSUED

Book_Id	Quantity_Issued
T01	4
C01	5
F01	2
C01	6
T02	3

1. To list the names from books of Text type.
2. To display the names and price from books in ascending order of their price.
3. To increase the price of all books of EPB publishers by 50.
4. To display the Book Name, Quantity_Issued and Price for all books of EPB publishers.
5. To display maximum price from books.
6. To display the count of distinct publishers from books where price is greater than or equal to 400
7. To display book_name, author_name from books where publishers is first
8. To display minimum price from books where type is text

Activity 11:

Database: LAb

Create the following tables and insert tuples with suitable constraints.

ItemNo	ItemName	CostPerItem	Quantity	Dateofpurchase	Warranty	Operational
1	Computer	60000	9	21/5/2016	2	7
2	Printer	15000	3	21/5/2017	4	2
3	Scanner	18000	4	29/8/2016	3	1
4	Camera	21000	2	13/10/2017	1	1
5	Switch	8000	1	31/10/2018	2	1
6	UPS	5000	5	21/5/2017	1	4
7	Router	25000	2	11/1/2018	2	5

1. To display all the itemName whose name starts with “C”.
2. To select the ItemName,which are within the Warranty period till present date.
3. To list the ItemName in ascending order of the date of purchase where quantity is more than 3.
4. To display minimum of distinct quantity
5. To display maximum of warranty
6. To display sum of costperitem
7. To display sum of costperitem whose name starts with ‘S’ and Quantity >2
8. Update costperitem to 500 of the item which is purchased in the year 2017 and warranty>2

Activity 12: (views)

Database: Railway Reservation System.

Create the following table and insert tuples with suitable constraints.

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

Evaluation Scheme for Practical Examination:

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

Program Name: BCA	**Semester: III**
Course Title: Web Technologies	
Course Code: HRC230	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand Internet basics, WWW, and HTML5 structure.
CO 2	Design responsive web pages using HTML forms and CSS.
CO 3	Write JavaScript code using variables, functions, and control structures.
CO4	Use JavaScript objects, arrays, events, and DOM manipulation

CO-PO Mapping Matrix

Cos/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	1	–	2	–	–	–	1	–
CO2	3	3	3	–	3	2	1	–	2	1
CO3	3	3	3	–	3	1	1	–	2	1
CO4	2	3	3	1	3	2	1	1	2	2

Course Content	**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, Working with IFrames. Building Responsive Webpage. **Cascading Style Sheets:** Introduction, CSS Syntax, CSS Comments, Applying Styles to	11

HTML Elements, Style specification formats, Selector forms, CSS Margins, CSS Padding, CSS Height, 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	
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, constant, 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 Variable.	11
Unit 4:	
Object and Class: Definition of class, class syntax, class methods, 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.** **Mini project:** build a small interactive form or web page using HTML, CSS and JavaScript	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

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: III**
Course Title: Web Technologies Lab	
Course Code: HRC230P	**No of credits :02(0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Create web pages using HTML tags, tables, lists, and forms.
CO 2	Style web pages using inline, internal, and external CSS.
CO 3	Use JavaScript for interactivity, validation, and event handling.
CO 4	Build JavaScript programs for clocks, calculators, and animations.

CO -PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	–	–	2	–	–	1	1	–
CO2	2	3	–	–	–	–	–	3	1	–
CO3	2	3	–	–	1	1	–	3	1	–
CO4	2	2	2	–	3	–	–	2	2	1

List of Practical Experiments
Part A

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

8. Write an HTML program to create a circle and create an animation of bouncing of the circle for 10 sec
9. Write HTML Program to Design Your College Name using follow CSS Properties

    a. CSS Rounded Corners.
    b. CSS Shadow Effects.
    c. CSS Text Effects.

Part B

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

Evaluation Scheme for Practical Examination:

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

Program Name: BCA	**Semester: III**
Course Title: Cyber Security	
Course Code: HRC240(Elective 1)	**No of credits: 02 (2:0:0)**
Total Contact Hours: 30	**Duration of SEA/Exam: 02 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Describe cyberspace, internet infrastructure, and cyber security concepts
CO 2	Identify types of cybercrimes and understand related cyber laws.
CO 3	Analyze social media risks, privacy issues, and legal aspects.
CO4	Use cyber security tools and apply best practices for protection.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**–**	**–**	**2**	**–**	**–**	**1**	**1**	**–**
CO2	**2**	**3**	**–**	**–**	**–**	**–**	**–**	**3**	**1**	**–**
CO3	**2**	**3**	**–**	**–**	**1**	**2**	**–**	**3**	**1**	**–**
CO4	**2**	**2**	**2**	**–**	**3**	**–**	**–**	**2**	**2**	**1**

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.	10
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.	10
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. **Cyber Security Tools and Technologies:** Introduction to antivirus, firewalls. **Cyber Hygiene:** Importance of strong passwords, regular updates, backups, and secure browsing habits	10

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. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001).
3. Fundamentals of Network Security by E. Maiwald, McGraw Hill
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning/ Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**05**
Internal Assessment C2 (Seminar/Assignment/Quiz)	**05**
Total	**10**

Program Name: BCA	**Semester: III**
Course Title: Software Engineering	
Course Code: HRC240 (Elective 1)	**No of credits: 02 (2:0:0)**
Total Contact Hours: 30	**Duration of SEA/Exam: 02 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Explain software engineering concepts, process models, and agile practices.
CO 2	Apply techniques to gather and manage software requirements.
CO 3	Model systems using UML diagrams and system modeling techniques.
CO4	Design software architecture using patterns and UML notations.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	2	–	1	–	–	1	2	–
CO2	2	3	2	–	2	2	1	1	1	–
CO3	2	3	3	–	2	1	1	–	1	–
CO4	2	3	3	–	3	1	1	1	2	1

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

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.

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**05**
Internal Assessment C2 (Seminar/Assignment/Quiz)	**05**
Total	**10**

Programme Name: BCA	**Semester: III**
Course Title: System Software	
Course Code: HRC240 (Elective 1)	**No of credits: 02 (2:0:0)**
Total Contact Hours: 30	**Duration of SEA/Exam: 02 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand system software, SIC/SIC-XE, CISC and RISC.
CO 2	Explain assembler functions and features.
CO 3	Describe loader and linker operations.
CO4	Design and evaluate system software components

CO-PO Mapping

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	1	–	1	–	–	–	2	–
CO2	3	3	2	–	2	–	–	–	2	–
CO3	2	3	2	–	2	–	–	–	2	–
CO4	2	3	3	–	3	1	1	1	2	1

Course contents	**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.	10
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.	10
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	10

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:

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.

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**05**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**05**
Total	**10**

Programme Name: BCA	**Semester: III**
Course Title: Cloud Computing	
Course Code: HRC250 (Elective 2)	**No of credits: 02 (0:0:2)**
Total Contact Hours: 30	**Duration of SEA/Exam: 02 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand cloud computing concepts, architecture, benefits, and challenges.
CO 2	Understand cloud computing concepts, architecture, benefits, and challenges.
CO 3	Describe deployment models, virtualization types, and hypervisors
CO4	Explore cloud storage, databases, networking, and DevOps practices.

CO-PO Mapping

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	1	–	**2**	–	–	–	1	–
CO2	**3**	**2**	1	–	**2**	–	–	–	1	–
CO3	**3**	**2**	**2**	–	**3**	–	–	–	1	–
CO4	**3**	**2**	**3**	**2**	**3**	1	1	–	**2**	1

Content	**Hours**
Unit 1:	
Cloud Fundamentals and Service Models Introduction: Definition and Characteristics of Cloud Computing, History and Evolution, Cloud Computing Architecture, Benefits and Challenges. **Cloud Service Models:** Infrastructure as a Service (IaaS) with Key Providers (AWS EC2, Azure VMs), Platform as a Service (PaaS) with Key Providers (AWS Elastic Beanstalk, Google App Engine), Software as a Service (SaaS) with Examples (Google Workspace, Microsoft Office 365).	10
Unit 2:	
Deployment Models and Virtualization Cloud Deployment Models: Public, Private, Hybrid, and Community Cloud. **Concept of Virtualization:** Definition and Importance, Types of Virtualizations. **Hypervisors:** Role of the Hypervisor, Introduction to VMware, Hyper-V and KVM.	10
Unit 3:	
Cloud Infrastructure and DevOps Cloud Storage & Databases: Storage Solutions (S3, Azure Blob), Database Services (AWS RDS, Google Cloud SQL), Introduction to NoSQL (DynamoDB, Cosmos DB). **Cloud Networking:** VPC Basics, Load Balancing, Auto Scaling, and CDN. **Introduction to DevOps:** Principles, CI/CD Pipelines, and Infrastructure as Code (IaC)	10

Text Books

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

Reference:

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

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**05**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**05**
Total	**10**

Programme Name: BCA	**Semester: III**
Course Title: Digital Image Processing	
Course Code: HRC250 (Elective 2)	**No of credits: 02 (2:0:0)**
Total Contact Hours: 30	**Duration of SEA/Exam: 02 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand the fundamentals of digital and color image processing.
CO 2	Apply spatial and frequency domain techniques for image enhancement.
CO 3	Implement image restoration using filtering and degradation models.
CO4	Perform image segmentation, morphological operations, and compression techniques.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**–**	**1**	**–**	**–**	**–**	**2**	**–**
CO2	**3**	**3**	**2**	**–**	**3**	**–**	**–**	**–**	**2**	**–**
CO3	**2**	**3**	**3**	**–**	**3**	**–**	**–**	**–**	**2**	**1**
CO4	**2**	**3**	**3**	**–**	**3**	**1**	**1**	**–**	**2**	**1**

Course contents	**Hours**
Unit 1:	
Digital Image Processing: Definition, Applications Of DIP, Fundamental Steps In Digital Image Processing, Components of an Image Processing System, Elements Of Visual Perception, Image Sensing And Acquisition, Simple Image Formation, Image Sampling and Quantization, Representing Digital Pixels, Image Quality. **Introduction to Colour Image:** Colour Fundamentals, RGB And HSI Models, Pseudo Colour Image Processing.	10
Unit 2:	
Image Enhancement In Spatial Domain: Introduction to Image Enhancement, Basic Grey Level Transforms, Histogram, Histogram-Processing – Equalization and Matching, Enhancement Using Arithmetic/Logic Operations, Spatial Filtering, Smoothing Spatial Filtering, Sharpening Spatial Filtering. **Image Transform**: Fourier Transform, SHFT, DFT, FFT, DCT, Hadamard Transform, Wavelets transform (CWT, DWT), KLT, SVD, Applications	10

UNIT-3	
Image Enhancement in frequency domain: Smoothing Frequency Domain Filtering, Sharpening Frequency Domain Filtering. **Image Restoration**: Model For Image Degradation/Restoration Process, Noise Model, Mean Filtering, Estimating Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener Filter), Colour Image Smoothening, Sharpening.	10

Text Books

1. Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.
2. K. Jain "Fundamental 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.

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**05**
Internal Assessment C2 **(Seminar/Assignment/Quiz etc.)**	**05**
Total	**10**

Programme Name: BCA	**Semester: IV**
Course Title: Computer Networks	
Course Code: HRD210	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Explain digital data transmission between computers.
CO 2	Apply data communication and network types in real life.
CO 3	Compare layers in networking models.
CO4	Compare protocols in OSI and TCP/IP models.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**–**	**2**	**–**	**–**	**–**	**1**	**–**
CO2	**3**	**3**	**2**	**–**	**2**	**1**	**1**	**–**	**1**	**1**
CO3	**3**	**2**	**2**	**–**	**2**	**–**	**–**	**–**	**1**	**–**
CO4	**3**	**3**	**2**	**–**	**3**	**1**	**–**	**1**	**1**	**–**

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 fiber, 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 HTTPS, SMTP, POP3, SNMP, FTP, TELNET , Web Server 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:

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

Pedagogy:

Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self-Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz /mini project etc.)	**10**
Total	**20**

Programme Name: BCA	**Semester: IV**
Course Title: Computer Networks Lab	
Course Code: HRD210P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Identify and set up basic computer hardware, software, and network configurations.
CO 2	Create and test wired network cables and connect networking devices.
CO 3	Simulate and configure various network topologies using network simulators
CO4	Analyze network protocols and services like FTP and wireless LAN through simulation.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**2**	–	**3**	1	1	–	1	–
CO2	**2**	**3**	**3**	–	**3**	1	**2**	1	1	1
CO3	**3**	**3**	**3**	–	**3**	1	**2**	–	**2**	1
CO4	**3**	**3**	**2**	–	**3**	1	1	1	**2**	1

Laboratory Program List

Part- A

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

Part-B

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

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

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: IV**
Course Title: Python Programming	
Course Code: HRD220	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Demonstrate basic Python programs using control structures and arrays.
CO 2	Use functions, strings, lists, and dictionaries in Python.
CO 3	Apply OOP, file handling, and exception handling concepts.
CO4	Build GUI apps, work with databases, and visualize data using Python libraries.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**2**	–	**2**	–	–	–	1	–
CO2	**3**	**3**	**3**	–	**2**	1	–	–	1	1
CO3	**3**	**3**	**3**	1	**3**	1	–	–	**2**	1
CO4	**3**	**3**	**3**	**3**	**3**	1	1	–	**2**	**2**

Content	**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 arrays, 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 Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods. **Lists:** Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists. **Dictionaries**: Creating	11

Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.	
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 and scatter plot.	11

Text Books:

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

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning /

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: IV**
Course Title: Python Programming Lab	
Course Code: HRD220P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Apply basic Python syntax and logic.
CO 2	Use data structures and functions effectively.
CO 3	Build apps with Tkinter, SQLite, NumPy, Matplotlib, and Pandas.
CO4	Solve real-world problems using modular Python code.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**2**	–	**2**	–	–	–	1	–
CO2	**3**	**3**	**3**	–	**2**	1	–	–	1	1
CO3	**3**	**3**	**3**	**3**	**3**	1	1	–	**2**	**2**
CO4	**3**	**3**	**3**	1	**3**	1	**2**	1	**2**	**2**

Laboratory Program List

Part- A

1. Python script to calculate simple interest
2. Python script to check Armstrong number
3. Python script for checking the given year is leap year or not.
4. Python script to check if a number belongs to the Fibonacci Sequence
5. Python script to solve Quadratic Equations
6. Python script to display all numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.
7. Python script to display Multiplication Tables
8. Python script to create a calculator program
9. Explore string functions
10. Implementation of python script that takes a list of words and returns the length of the longest one.
11. Python script handle multiple errors with one except statement.
12. 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 multiply all numbers in the list
2. Implement linear search using python script
3. Implement python script to remove duplicates from a list.
4. Implement python script to find the repeated items of a tuple.
5. Implement python script to check whether a given key already exists or not in a dictionary.
6. Write a python script to implement method overloading.
7. Create SQLite Database and Perform Operations on Tables.
8. Create a GUI using Tkinter module.
9. Drawing Line chart and Bar chart using Matplotlib.
10. Drawing Histogram and Pie chart using Matplotlib.
11. Create Array using NumPy and Perform Operations on Array.
12. Create DataFrame from Excel sheet using Pandas and Perform Operations on DataFrames.

Evaluation Scheme for Practical Examination:

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

Program Name: BCA	**Semester: IV**
Course Title: PHP & MySQL	
Course Code: HRD230	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand PHP basics, syntax, variables, data types, and control structures.
CO 2	Use arrays, functions, and strings to create dynamic PHP programs.
CO 3	Apply object-oriented concepts and exception handling in PHP.
CO4	Build web applications using forms, sessions, and MySQL with PHP.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**2**	–	**2**	–	–	–	1	–
CO2	**3**	**3**	**3**	–	**2**	1	–	–	1	1
CO3	**3**	**3**	**3**	1	**3**	1	–	–	**2**	1
CO4	**3**	**3**	**3**	**3**	**3**	1	1	–	**2**	**2**

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 and **Types of Arrays:** Indexed, Associative arrays, Multidimensional arrays, Accessing Array, Manipulating Arrays, displaying array, Array Functions.	11

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.	
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 Specifies **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 HTML Form, Handling HTML Form data in PHP. File Inclusion (Include ( ), Require ( )). **CSS:** CSS Introduction, Tags, Syntax, Types of CSS and Selector Types. **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 php MyAdmin, MySQL Commands, Using. PHP MySQL Functions, connecting to MySQL and Selecting the Database, Executing Simple Queries, Retrieving Query Results, Counting Returned Records, Updating Records with PHP	11

Text Books:

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:

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

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Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: IV**
Course Title: PHP & MySQL Lab	
Course Code: HRD230P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Implement syntax, control structures, and loop constructs to solve problems.
CO 2	Apply arrays, functions, and string operations to build dynamic web features.
CO 3	Implement object-oriented programming and exception handling in PHP.
CO4	Develop interactive web applications with form handling, sessions, and MySQL integration.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**2**	–	**2**	–	–	–	1	–
CO2	**3**	**3**	**3**	–	**2**	1	1	–	1	1
CO3	**3**	**3**	**3**	1	**3**	1	–	–	**2**	1
CO4	**3**	**3**	**3**	**3**	**3**	1	**2**	–	**2**	**2**

List of Practical Experiments:

Part -A

1. Write a PHP script to find the Odd or Even Number.
2. Write a PHP script to find the maximum among three given numbers.
3. Write a PHP script to calculate the factorial of a given number.
4. Write a PHP script to Swap Two Numbers.
5. Write a PHP script to check whether a given number is a palindrome.
6. Write a PHP script to reverse a given number and compute the sum of its digits.
7. Write a PHP script to generate a Fibonacci series using a recursive function.
8. Write a PHP script to demonstrate at least seven string functions.
9. Write a PHP script to demonstrate the functionality of date and time functions in PHP.
10. 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 that receive string as a Form Input.
5. Write a PHP script to handle form data using the POST method.
6. Write a PHP script to handle form data using the GET method.
7. Write a PHP script to demonstrate session handling by storing and displaying username and user role using session variables.
8. Write a PHP script to create a new database using MySQL and PHP.
9. Write a PHP script to create a table in a MySQL database & insert data using PHP.
10. Develop a PHP application to design a college admission form and store the submitted data into a MySQL database.

Evaluation Scheme for Practical Examination:

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

Program Name: BCA	**Semester: IV**
Course Title: Fundamentals of Data Science	
Course Code: HRD240(Elective 1)	**No of credits: 02 (2:0:0)**
Total Contact Hours: 30	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Explain key concepts of data mining, KDD, and its real-world applications.
CO 2	Apply data preprocessing and perform frequent pattern mining using Apriori and FP- Growth.
CO 3	Implement and evaluate classification techniques and prediction models
CO4	Apply clustering methods and evaluate clustering results.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	1	**2**	**2**	–	–	–	1	–
CO2	**3**	**3**	**2**	**3**	**3**	1	–	–	**2**	1
CO3	**3**	**3**	**3**	**2**	**3**	1	1	–	**2**	**2**
CO4	**3**	**3**	**3**	**2**	**3**	1	1	–	**2**	**2**

Course Contents	**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, Relational Database ,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	11

(FPGrowth) algorithms. Vertical Data Format in Frequent Itemset Mining.	
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. Outlier Analysis, Statistical Distribution-Based Outlier Detection, Distance-Based Outlier Detection, Density-Based Local Outlier Detection.	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

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Formative Assessment for Theory	
Internal Assessment C1 (Test)	**05**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**05**
Total	**20**

Program Name: BCA	**Semester: IV**
Course Title: Internet of Things	
Course Code: HRD240 **(Elective 1)**	**No of credits: 02 (2:0:0)**
Total Contact Hours: 30	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Define key concepts, architecture, and challenges of IoT.
CO 2	Explain the role of sensors, actuators, and communication in IoT networks.
CO 3	Illustrate the use of IoT protocols and data analytics tools.
CO4	Apply IoT concepts to basic smart city use cases.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	1	–	**2**	–	–	–	1	–
CO2	**3**	**3**	**2**	–	**3**	1	–	–	1	1
CO3	**3**	**3**	**2**	**2**	**3**	1	1	–	**2**	1
CO4	**3**	**3**	**3**	**2**	**3**	1	**2**	1	**2**	**2**

Course Contents	**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.	10
Unit 2:	
IoT Networks: Sensors Actuators and smart objects, sensor networks, communication criteria, IoT Access Technologies, need for optimization, optimizing IP for IoT.	10
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. **IoT in Industry:** Smart and connected cities – IoT strategy for smarter cities, smart city IoT architecture.	10

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT

2. Fundamentals: Networking Technologies, Protocols, and Use Cases for the Inter 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.

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Formative Assessment for Theory	
Internal Assessment C1 (Test)	**05**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**05**
Total	**10**

Program Name: BCA	**Semester: IV**
Course Title: Software Testing	
Course Code: HRD240 (Elective 1)	**No of credits: 02 (2:0:0)**
Total Contact Hours: 30	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO 1	Understand basics of software testing and test case design.
CO 2	Apply decision table and data flow testing methods.
CO 3	Analyze integration and system testing techniques.
CO4	Evaluate object-oriented and GUI testing approaches.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**2**	–	**2**	–	–	–	1	–
CO2	**3**	**3**	**3**	–	**3**	1	–	–	**2**	1
CO3	**3**	**3**	**3**	–	**3**	1	1	1	**2**	**2**
CO4	**3**	**3**	**3**	–	**3**	1	1	1	**2**	**2**

Course Contents	**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.	10
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**,** Modeling Issues**,** Making Appropriate Choices. **Integration Testing:** Introduction, Decomposition-based, call graph- based, Path-based integrations.	10

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.	10

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.

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Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: IV**
Course Title: Digital Marketing	
Course Code: HRD240 (Elective 1)	**No of credits: 02 (0:0:2)**
Total Contact Hours: 30	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 02	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1 Identify and differentiate various digital marketing channels and tools.
CO2 Create and optimize social media profiles, content, and promotional campaigns.
CO3 Design marketing content for different platforms including email, social media, and mobile.
CO4 Analyze digital advertisements, campaigns, and metrics to evaluate effectiveness.
CO5 Develop and implement a digital marketing plan for real-world business scenarios.
CO6 Conduct surveys and research to understand digital tool adoption in small businesses.

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	–	1	**3**	2	1	2	1	**3**	1	1
CO2	2	**3**	–	2	**3**	**3**	2	**3**	2	**3**	2	2
CO3	2	**3**	–	2	**3**	2	**3**	**3**	2	**3**	2	2
CO4	2	**3**	2	**3**	**3**	**3**	2	2	2	**3**	2	2
CO5	**3**	**3**	2	**3**	**3**	**3**	**3**	**3**	2	**3**	**3**	**3**
CO6	2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	2	**3**	**3**	**3**

List of Practical experiments

Activity 1: Digital Marketing Channel Identification

I. List out at least 5 companies (example: Amazon, Flipkart, Myntra).
II. Identify what digital marketing channels they use:

a. Website
b. Social media
c. Email marketing
d. Mobile apps

Activity 2: Social Media Profile Creation

I. Create a sample business profile on any platform (Instagram/Facebook/LinkedIn).
II. Design:

a. Profile name
b. Logo

c. Bio
d. 3 promotional posts

Activity 3: Content Creation Activity

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

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

Activity 4: Digital Marketing Strategy Preparation

Prepare a digital marketing plan for:

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

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

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

Activity 6: Create the Digital Marketing Webpage
Activity 7: Digital Marketing Implementation in Business Scenario

Activity 8: Advertising through Google Ads

Activity 9: Creating Promotional banner through Canva
Activity 10: Digital Marketing Implementation in Business Scenario

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

Evaluation Scheme for Lab Examination

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

QP Pattern for Theory Courses (3 Credits):

Instructions: Answer Part-A, Part-B and Part-C:

Time: 3 Hours Max Marks:80

Part-A

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

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

1
2
3
4
5
6
7
8
9
10
11
12

Part-B

II Answer any 4 questions out of 6 questions 4X5=20

(4Questions drawn from each unit and 2 questions from any unit)

13
14
15
16
17
18

Part-C

III Answer all the Questions. Each question carries 10 Marks. 4 X 10 =40

(Each question with internal choice and with maximum of 2 sub questions)

19

20

21

22

Question paper pattern for Theory Courses (2 Credits):

Time: 2 Hours Max Marks:40

Instructions: Answer Part-A and Part-B

Part-A

I **Answer any 5 questions out of 6 Questions:** **5x2=10**

Question No. 1 to 6

Part B

II Answer the following questions: **10x3=30**

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)

Third Year Revised NEP Syllabus: BCA for 2026-2027

Programme: BCA

Subject: Computer Applications

Semester	Course Code	Title	Theory/Practical	Credit L: T:P	Hours / Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIE		SEE		
						C1	C2	C3		
V	HRE210	Network Security	Theory	3:0:0	3	10	10	80	100	3
	HRE210P	Network Security Lab	Practical	0:0:2	4	05	05	40	50	3
	HRE220	Design and Analysis of Algorithms	Theory	3:0:0	3	10	10	80	100	3
	HRE220P	Design and Analysis of Algorithms Lab	Practical	0:0:2	4	05	05	40	50	3
	HRE230	Computer Graphics & Multimedia	Theory	3:0:0	3	10	10	80	100	3
	HRE230P	Computer Graphics & Multimedia Lab	Practical	0:0:2	4	05	05	40	50	3
	HRE240	Block chain Technology	Theory	3:0:0	3	10	10	80	100	3
	HRE250	Enterprise Resource Planning	Theory	3:0:0	3	10	10	80	100	3
	HRE260	Fundamentals of Artificial Intelligence	Theory	3:0:0	3	10	10	80	100	3
	HRE260P	AI Tools and its applications	Practical (Compulsory Paper)	0:0:2	4	05	05	40	50	3

****Total Credits (Theory and Practical): (18+08=26)**

Semester	Course Code	Title	Theory/ Practical	Credit L: T:P	Hours / Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIE		SEE		
						C1	C2	C3		
VI	HRF210	Scientific Computing Techniques	Theory	3:0:0	3	10	10	80	100	3
	HRF210P	Scientific Computing Techniques Lab	Practical	0:0:2	4	05	05	40	50	3
	HRF220	Big Data Analytics	Theory	3:0:0	3	10	10	80	100	3
	HRF220P	Big Data Analytics Lab	Practical	0:0:2	4	05	05	40	50	3
	HRF230	Web Content Management System	Theory	3:0:0	3	10	10	80	100	3
	HRF230P	Web Based Mini Project	Practical	0:0:2	4	05	05	40	50	3
	HRF240	Software Project Management	Theory	3:0:0	3	10	10	80	100	3
	HRF250	Mobile Communication	Theory	3:0:0	3	10	10	80	100	3
	HRF260	Power BI	Practical (Compulsory Paper)	0:0:2	4	05	05	40	50	3

****Total Credits (Theory and Practical): (15+08=23)**

Programme Name: BCA	**Semester: V**
Course Title: Network Security (Theory)	
Course Code: HRE210	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:
CO1: Build foundational knowledge.
CO2: Focus on cryptography and secure communication.
CO3: Emphasize practical tools and mechanisms.
CO4: Introduce advanced, real-world applications and legal aspects

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**1**	**2**	**-**
CO2	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**2**	**2**	**-**
CO3	**2**	**3**	**3**	**-**	**3**	**-**	**1**	**2**	**2**	**-**
CO4	**2**	**2**	**2**	**-**	**2**	**1**	**1**	**3**	**3**	**1**

Course Content	**Hours**
Unit 1:	
Fundamentals of Network Security - Introduction to Information Security: CIA triad (Confidentiality, Integrity, Availability), Threats and Attacks: Malware, phishing, denial of service, man-in-the-middle, Security Services: Authentication, authorization, non-repudiation, Cryptography Basics: Symmetric vs. asymmetric encryption, hashing, digital signatures, Overview of Security Policies and Standards (ISO/IEC 27001, NIST).	11
Unit 2:	
Cryptography and Secure Communication - Symmetric Key Algorithms: DES, AES, Asymmetric Key Algorithms: RSA, Diffie-Hellman key exchange, Hash Functions: MD5, SHA family, Public Key Infrastructure (PKI) and Certificates, Secure Communication Protocols: SSL/TLS, HTTPS, IPSec, VPNs, Email Security: PGP, S/MIME.	11
Unit 3:	

Network Security Tools and Mechanisms - Firewalls: Types (packet filtering, proxy, stateful inspection), configuration basics, Intrusion Detection and Prevention Systems (IDS/IPS), Virtual Private Networks (VPNs) and tunneling protocols, Wireless Security: WEP, WPA, WPA2, WPA3, Security in Cloud and IoT environments, Case Studies: Real-world breaches and lessons learned.	11
Unit 4:	
Advanced Topics and Management - Security in Operating Systems and Applications, Incident Response and Disaster Recovery Planning, Security Auditing and Vulnerability Assessment, Ethical Hacking and Penetration Testing basics, Emerging Trends: Zero Trust Architecture, AI in Security, Blockchain for Security, Legal and Ethical Issues: Cyber laws in India, IT Act 2000, GDPR basics.	11

Text Books

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

Pedagogy: Lecture/ PPT/ Videos/ Animations/ Role Plays/ Think-Pair-Share/ Predict-Observe-Explain/ Demonstration/ Concept mapping/ Case Studies examples/ Tutorial/ Activity/ Flipped Classroom/ Jigsaw/ Field based Learning/ Project Based Learning/ Mini Projects/ Hobby Projects/ Forum Theatre/ Dance/ Problem Based Learning/ Game Based Learning/ Group Discussion/ Collaborative Learning/ Experiential Learning / Self Directed Learning etc.

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: V**
Course Title: Network Security Lab	
Course Code: HRE210P	**No of credits :02(0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Demonstrate the use of network security tools such as Wireshark and Nmap for monitoring and analyzing network traffic.
CO2	Implement basic cryptographic algorithms such as Caesar Cipher, Playfair Cipher, Hill Cipher, and RSA for secure communication.
CO3	Apply network security mechanisms including firewall configuration

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	2	2	3	-	3	1	1	1	2	-
CO2	3	2	3	-	2	-	-	1	2	-
CO3	2	3	3	-	3	-	1	2	2	-

List of Practical Experiments:

Part -A

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

Part - B

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

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: V**
Course Title: Design and Analysis of Algorithms	
Course Code: HRE220	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Understand fundamental concepts of algorithms and analyze their time and space complexity using asymptotic notations.
CO2	Apply brute force and divide-and-conquer techniques to solve searching and sorting problems.
CO3	Design solutions for optimization problems using greedy method and understand minimum spanning tree algorithms.
CO4	Know the concepts of backtracking and dynamic programming and apply them to solve computational problems.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**3**	**-**	**2**	**-**	**1**	**-**	**2**	**-**
CO4	**3**	**3**	**3**	**-**	**2**	**-**	**1**	**-**	**3**	**-**

Course contents	**Hours**
Unit 1:	
INTRODUCTION: Algorithm, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Worst-case, Best- case and Average-case efficiencies, Asymptotic Notation, Big oh notation, Omega notation, Theta notation. Mathematical analysis of non-recursive algorithms, mathematical analysis of recursive algorithms.	**11**
Unit 2:	
Brute Force and Exhaustive Search: Introduction to Brute Force approach, Selection Sort and Bubble Sort, Sequential search, Exhaustive Search- Travelling Salesman Problem and Knapsack Problem. Divide and Conquer: General method, Applications-Binary search, Quick sort, Merge sort	**11**
Unit 3:	

Greedy Method- Introduction to Greedy Method, Definition of Greedy algorithm, Characteristics of Greedy Strategy, General structure of greedy algorithms, Fractional Knapsack Problem, Job Sequencing with Deadlines, Minimum Spanning Tree- Prim's Algorithm, Kruskal's Algorithm.	**11**
Unit 4:	
Transform and Conquer: Introduction, Heaps and Heap Sort Backtracking: Introduction, N-Queens problem (4 queens), Introduction to Dynamic Programming, need of dynamic programming, introduction to dynamic programming approaches	**11**

Text Books

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

Pedagogy:

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: V**
Course Title: Design and Analysis of Algorithms Lab	
Course Code: HRE220P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Implement searching and sorting algorithms.
CO2	Analyze time and space complexity of algorithms.
CO3	Implement divide and conquer and greedy algorithms.
CO4	Apply algorithm design techniques to solve computational problems

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**3**	**-**	**2**	**-**	**1**	**-**	**2**	**-**
CO4	**3**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**3**	**-**

List of Practical Experiments:

1. Program to search an element by sequential search method and estimate the time and space complexity
2. Program to generate Fibonacci series without recursion and estimate the time and Space complexity
3. Program to search an element by binary search and estimate the time and space Complexity
4. Program to find factorial of a number using recursion and estimate the time and space complexity
5. Program to sort a list of N elements using Selection Sort Technique and estimate the time and space complexity
6. Write a program to find minimum and maximum value in an array using divide and Conquer
7. Program to solve the Travelling Salesman Problem using the brute-force approach and estimate the time and space complexity.
8. Program to perform Knapsack Problem using Branch and Bound and estimate the time and space complexity
9. Program to implement merge sort algorithm and estimate the time and space complexity
10. Program to generate N random numbers and sort them using quick sort.
11. Implementation of Fractional Knapsack Algorithm using Greedy Approach

12. Program to find the minimum cost spanning tree using prim's algorithm and estimate time space complexity
13. Program to find the minimum cost spanning tree using Kruskal's algorithm and estimate the time and space complexity.
14. Program that implements the backtracking technique to solve the 4-Queens problem and estimate the time and space complexity.

General instructions

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

Course Pedagogy:

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

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: V**
Course Title: Computer Graphics & Multimedia	
Course Code: HRE230	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Understand the fundamentals of computer graphics and multimedia
CO2	Apply different graphics algorithms for drawing and displaying graphical objects such as lines, circles and polygons
CO3	Implement geometric transformations such as translation, rotation, scaling, reflection, and shearing in computer graphic
CO4	Analyze multimedia elements such as text, images, audio, video, and animation used in multimedia applications
CO5	Use multimedia tools and software such as Adobe Photoshop, Blender, and Adobe Animate for creating multimedia content

CO-PO Mapping Matrix

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO4	**2**	**2**	**2**	**-**	**3**	**1**	**1**	**-**	**2**	**1**
CO5	**2**	**1**	**2**	**-**	**3**	**1**	**1**	**-**	**3**	**1**

Course Content	**Hours**
Unit 1:	
Computer graphics fundamentals – Introduction, Application Areas of Computer Graphics, Overview of Graphics Systems, Video-Display Devices, Raster-Scan Systems, Random Scan Systems, Graphics Monitors and Work Stations and Input Devices. Points and Lines - Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms, Scan Line Polygon Fill Algorithm, Boundary Fill and Flood-Fill Algorithms. Curve Representation: Parametric Curves, Parametric Representation of a Circle, Parametric representation of cubic curves, drawing Bezier curve	11

Unit 2: Two-Dimensional Transformations: Coordinate and Geometric Transformations; Translation, Rotation, Scaling; Matrix representations and Homogeneous coordinates, Composite transformations, General Pivot Point rotation, General Fixed-Point Scaling, Shearing; Reflection; Reflection about an arbitrary line. 2-D Viewing: Viewing pipeline; Window, Viewport, Window-to-Viewport transformation; Zooming, panning; Pointing and Positioning techniques; Rubber band technique; Dragging. Clipping operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-Point Subdivision line clipping.	11
Unit 3:	
3-D Graphics & Modeling: Visualization techniques for Realism; 3D Object Representation; Solid Model Representation Schemes; Euclidean Geometry methods: Regularized Boolean Set Operations, Primitive Instancing, Boundary Representations, Curved lines and surfaces, Sweep Representations, Spatial-Partitioning Representations - Octree representation, Constructive Solid Geometry; Procedural Methods: Fractals, Shape Grammars, Particle systems, Physically Based modeling, Visualization techniques; 3D transformations. Three-Dimensional Viewing: Viewing Pipeline; Parallel Projection: Orthographic and Oblique Projection.	11
Unit 4:	
Introduction to Animation: Fundamentals of Animation, Traditional Animation, Computer Animation, Types of computer Animation, Challenges and the future of computer animation Designing of Animation Sequences; Key-Frame Systems; Introduction to Photoshop: Drawing and Creating Design, Designing Pamphlets, Image Color Corrections, Morphing One Image with the Other Images, Doing B&W Photo to Color Designing & Crating Logos Working with Brush, Pen, Text Tools Blending Options Creating Text Effects Designing Layout for the Web Page Designing Web Banners and Buttons Doing Actions in Photoshop Doing Animation in Photoshop Creating Posters with Text Effects Creating the Out Line Designs Drawing the Basic Shapes with Pencil and Pen Designing the Frame Layouts for Photos.	11

Text Books

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

Course Pedagogy:

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: V**
Course Title: Course Title: Computer Graphics & Multimedia Lab	
Course Code: HRE230P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Implement basic computer graphics algorithms to draw lines, circles, and other graphical objects
CO2	Apply 2D transformations such as translation, rotation, scaling, reflection, and shearing to graphical object
CO3	Implement clipping and filling algorithms used in computer graphics application.
CO4	Create simple graphics programs to display shapes, patterns, and animations
CO5	Use multimedia tools such as Adobe Photoshop, Audacity, and Blender for editing images, audio, and animation

CO -PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**2**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO4	**2**	**2**	**3**	**-**	**3**	**1**	**1**	**-**	**2**	**1**
CO5	**2**	**1**	**2**	**-**	**3**	**1**	**1**	**-**	**3**	**1**

List of Practical Experiments
Part A

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

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

Part B

1. Create and edit images using image editing software such as Adobe Photoshop or GIMP.
2. Perform image enhancement operations such as cropping, resizing, brightness, and contrast adjustment.
3. Design a poster or banner using graphics tools.
4. Record and edit audio using software such as Audacity.
5. Perform audio operations such as noise reduction, trimming, mixing, and adding sound effects.
6. Create a short audio clip with background music and voice narration.
7. Create and edit videos using tools such as Adobe Premiere Pro or OpenShot Video Editor.
8. Create a short video presentation or advertisement

Course pedagogy:

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

Evaluation Scheme for Practical Examination:

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

Programme Name: BCA	**Semester: V**
Course Title: Blockchain Technology	
Course Code: HRE240	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Describe the fundamental concepts of blockchain technology including distributed ledger systems, block structure, hashing, and types of blockchain.
CO2	Demonstrate the role of cryptographic techniques such as hash functions, digital signatures, and public key cryptography in ensuring blockchain security.
CO3	Analyze the working of cryptocurrencies and Bitcoin including transaction processes, mining, and consensus mechanisms
CO4	Apply the concepts of smart contracts and blockchain platforms such as Ethereum and Hyperledger to understand real-world blockchain applications

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	2	1	-	2	-	-	-	2	-
CO2	3	3	2	-	2	-	-	1	2	-
CO3	3	3	2	-	2	-	-	1	2	1
CO4	3	2	3	-	3	1	1	1	3	1

Content	**Hours**
Unit 1:	
Introduction to Blockchain Technology - Evolution of Digital Systems, Introduction to Blockchain Technology, Distributed Systems and Distributed Ledger Technology (DLT), Blockchain Architecture and Components, Structure of Blocks, Hashing Concept, Chain Formation Process, Centralized vs Decentralized Systems, Types of Blockchains, Advantages of Blockchain, Limitations and Challenges	11
Unit 2:	
Cryptography in Blockchain - Introduction to Cryptography, Cryptographic Hash Functions, Digital Signatures, Public Key and Private Key Cryptography, Merkle Trees, Role of Cryptography in Blockchain, Wallets and Blockchain Addresses, Blockchain Security Concepts, Double Spending Problem, 51% Attack, Privacy and Security Issues.	11
Unit 3: **Cryptocurrencies and Bitcoin -** Introduction to Cryptocurrencies, History and Evolution of Bitcoin, Bitcoin Network Architecture, Bitcoin Transactions, Blockchain Transaction Lifecycle, Mining Process, Proof of Work Consensus Mechanism, Cryptocurrency Wallets, Cryptocurrency Exchanges, Advantages and Limitations of Bitcoin and Regulatory Issues in Cryptocurrency.	11

Unit 4:	
Smart Contracts and Blockchain Platforms - Introduction to Smart Contracts, Working of Smart Contracts, Features and Benefits of Smart Contracts, Introduction to Ethereum, Ethereum Architecture, Ethereum Virtual Machine (EVM), Gas and Transaction Fees, Blockchain Platforms Overview, Comparison of Ethereum, Hyperledger, and Binance Smart Chain, Use Cases of Smart Contracts.	11

Text Books

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

Course Pedagogy

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: V**
Course Title: Enterprise Resource Planning	
Course Code: HRE250	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Understand ERP Fundamentals
CO2	Integrate Related Technologies
CO3	Evaluate ERP Marketplace
CO4	Manage Implementation Lifecycle
CO5	Adapt to Emerging Trends

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**2**	**1**
CO2	**2**	**2**	**2**	**3**	**2**	**-**	**1**	**-**	**2**	**1**
CO3	**2**	**2**	**2**	**3**	**2**	**1**	**1**	**-**	**2**	**1**
CO4	**2**	**3**	**2**	**2**	**3**	**1**	**1**	**1**	**3**	**2**
CO5	**2**	**2**	**2**	**2**	**3**	**1**	**1**	**1**	**3**	**2**

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

Text Books:

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

Course pedagogy

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: V**
Course Title: Artificial Intelligence	
Course Code: HRE260	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Explain the basic concepts, history, scope, and applications of Artificial Intelligence
CO2	Describe intelligent agents, their structure, types, and apply basic AI problem- solving and search techniques
CO3	Understand Machine Learning fundamentals including supervised, unsupervised and Reinforcement learning concepts
CO4	Gain the knowledge of representation techniques, logic-based representation and Expert systems.
CO5	Demonstrate basic usage of AI tools for simple real-world applications

CO-PO Mapping

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**-**	**2**	**-**	**-**	**1**	**2**	**-**
CO2	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**2**	**-**
CO4	**3**	**2**	**2**	**-**	**2**	**1**	**-**	**1**	**2**	**-**
CO5	**2**	**2**	**3**	**-**	**3**	**1**	**1**	**1**	**3**	**1**

Course contents	**Hours**
Unit 1:	
Definition, Scope, and Importance of AI, History and Evolution of AI, Overview of AI system, AI Applications in Real-world: Healthcare, Education, Banking, etc. AI vs. Human Intelligence, Types of AI: Narrow AI, General AI. Ethics and Challenges in AI	11
Unit 2:	
Intelligent agents-definition and structure of intelligent agents, Types-simple, reflex, model based, goal based, utility based. Problem-Solving Techniques in AI, problem formulation, State Space Representation, Search techniques- Breadth-First Search, Depth-First Search, Informed Search: Best-First Search, A* Algorithm, Heuristics in AI, Constraint Satisfaction Problems	11
Unit 3:	
Machine Learning Overview, Types- Supervised, Unsupervised, reinforcement learning, Machine Learning concept- training, testing, validation, classification and clustering, Knowledge Representation in AI - Logic-Based Representation: Propositional and Predicate Logic, Rule-Based Systems and Expert System	11

Unit 4: Deep Learning: Concept of Deep Learning, Introduction to Neural Networks, Types of Deep Learning models, Deep leaning applications, AI Tools introduction: ChatGPT, DALL-E, Canva AI, Teachable Machine.	11

Text Books:

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: V**
Course Title: Course Title: AI Tools and its applications	
Course Code: HRE260P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Use AI tools to generate text, images, presentations and reports effectively
CO2	Apply AI tools for solving basic computational and programming problems.
CO3	Analyze data and generate meaningful insights using AI assistance.
CO4	Compare different AI tools and select appropriate tools for specific tasks.
CO5	Demonstrate the use of AI tools in academic work such as resume creation, translation and documentation

CO-PO Mapping

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**2**	**2**	**-**	**3**	**2**	**1**	**-**	**3**	**1**
CO2	**3**	**3**	**3**	**-**	**3**	**1**	**1**	**-**	**3**	**1**
CO3	**2**	**3**	**2**	**2**	**3**	**1**	**1**	**-**	**3**	**1**
CO4	**2**	**2**	**2**	**-**	**3**	**1**	**1**	**-**	**3**	**1**
CO5	**1**	**1**	**2**	**-**	**3**	**3**	**1**	**1**	**3**	**2**

List of Practical Experiments

Part A

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

Part B

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

Evaluation scheme for practical examination:

Assessment criteria		**Marks**
Writing	One program from part A	**15**
	One program from part B	**15**
Execution	Any one of the written problems	**5**
Viva voce		**5**
Total Marks		**40**

Programme Name: BCA	**Semester: VI**
Course Title: Scientific Computing Techniques	
Course Code:HRF210	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Explain the basic concepts, history, scope, and applications of Artificial Intelligence Understand the concepts of computer arithmetic including fixed-point and floating-point representation, normalization, and error analysis in numerical computations.
CO2	Apply iterative methods such as Bisection, Newton–Raphson, Regula Falsi, and Secant methods to find roots of polynomial equations
CO3	Solve ordinary differential equations and numerical integration problems using methods such as Euler's method, Runge–Kutta methods, Simpson's rule, and the Trapezoidal rule
CO4	Analyze and compute solutions of simultaneous linear equations using numerical techniques such as Gauss Elimination, Gauss–Jordan, LU Decomposition, and Gauss–Seidel methods.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO4	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**

Content	**Hours**
Unit 1:	
Computer Arithmetic**:** Need of Computer Oriented Numerical Analysis, Fixed and Floating-point representation of numbers, Normalization, arithmetic operations with normalization, consequences of normalized floating-point representation of numbers, Concept of Zero in floating point, Errors in computing, Measure of errors	11
Unit 2:	
Finding the roots of an equation**:** Iterative method: Introduction, types of equation Methods of solution, Beginning an iterative method, Bisection method, Newton Raphson method, Regula Falsi method, Secant method. Comparison of Iterative methods. (Problems only on polynomial equations)	11
Unit 3:	
Ordinary differential equations: Euler's method, Taylor series method, Runge Kutta II and IV order methods. Numerical Integration: Introduction, Simpson's 1/3 and 3/8 rule, Trapezoidal rule.	11
Unit 4:	

Solving simultaneous linear equations: Introduction, Gauss Elimination method, pivoting, ill-conditioned equations, Gauss Jordon method, LU Decomposition method and Gauss-Seidel iterative method. Comparison of direct and iterative methods.	11

Text Books

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

Course Pedagogy

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: VI**
Course Title: Course Title: Scientific Computing Techniques Lab	
Course Code: HRF210P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Implement numerical methods such as Bisection, Regula Falsi, and Newton–Raphson to determine the roots of algebraic equations using programming.
CO2	Apply numerical techniques like Euler's method and Runge–Kutta methods to solve ordinary differential equations computationally.
CO3	Develop programs to solve systems of simultaneous linear equations using methods like Gauss Elimination, Gauss–Jordan, and Gauss–Seidel
CO4	Compute numerical integration using methods such as Trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO4	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**

List of Practical Experiments:

PART-A

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

PART-B

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

Evaluation scheme for practical examination:

Assessment criteria		**Marks**
Writing	One program from part A	**15**
	One program from part B	**15**
Execution	Any one of the written problems	**5**
Viva voce		**5**
Total Marks		**40**

Programme Name: BCA	**Semester: VI**
Course Title: Big Data Analytics	
Course Code: HRF220	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Identify and list various Big Data concepts, tools and applications.
CO2	Describe Hadoop architecture and ecosystem.
CO3	Analyze MapReduce data processing.
CO4	Understand NoSQL databases and gain the basic knowledge of Hive queries
CO5	Understand social network analysis basics

CO-PO Mapping Matrix

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**2**	**1**	**3**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**2**	**-**
CO4	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**1**
CO5	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**2**	**1**

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

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

Text Books

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

Course Pedagogy

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Programme Name: BCA	**Semester: VI**
Course Title: Course Title: Big Data Analytics Lab	
Course Code: HRF220P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Understand Big Data environment and configure basic Hadoop ecosystem tools
CO2	Develop basic MapReduce programs for data processing tasks such as word count, maximum, minimum and data analysis.
CO3	Perform NoSQL database operations using MongoDB including CRUD operations and data retrieval
CO4	Apply Hive queries for managing and analyzing large datasets.
CO5	Implement simple Big Data applications using MongoDB and Hadoop tools.

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	**2**	**-**
CO3	**2**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**-**
CO4	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**
CO5	**2**	**2**	**3**	**2**	**3**	**1**	**1**	**-**	**2**	**1**

List of Practical Experiments

Part A

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

Part B

8. Create a database and collection in MongoDB and display the created database.
9. Insert student records into MongoDB collection and perform query operations:
   i. Display all records
   ii. Display records with condition
   iii. Display selected fields
10. Implement update and delete operations in MongoDB.
11. Implement NoSQL database operations using MongoDB:
   i. CRUD operations (Create, Read, Update, Delete)
   ii. Working with Arrays in MongoDB
12. Implement MongoDB functions:
   i. Count
   ii. Sort
   iii. Limit
   iv. Skip
   v. Aggregate functions
13. Create Hive table and load data. Perform basic Hive queries:
   i. Select records
   ii. Where condition
   iii. Order by clause
14. Implement a simple application that stores big data in MongoDB (Example: Student database, Employee database, Product database).

Evaluation scheme for practical examination:

Assessment criteria		**Marks**
Writing	One program from part A	**15**
	One program from part B	**15**
Execution	Any one of the written problems	**5**
Viva voce		**5**
Total Marks		**40**

Programme Name: BCA	**Semester: VI**
Course Title: Web Content Management System	
Course Code: HRF230	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assessment Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Explain the principles of web content development, content formats, and guidelines for creating effective digital multimedia content.
CO2	Develop digital media elements such as graphics, audio, presentations, and multilingual web content using appropriate tools.
CO3	Design and manage dynamic web content including blogs, wiki sites, and websites using CSS and content management techniques.
CO4	Apply modern web technologies and platforms such as Moodle, Joomla, and Drupal for course creation, content management, and online publishing

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**2**	**2**	**-**	**2**	**1**	**-**	**-**	**2**	**-**
CO2	**2**	**2**	**3**	**-**	**3**	**1**	**-**	**-**	**2**	**1**
CO3	**2**	**3**	**3**	**1**	**3**	**1**	**1**	**-**	**2**	**1**
CO4	**2**	**2**	**3**	**1**	**3**	**1**	**1**	**-**	**3**	**1**

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

Text Books:

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

Course Pedagogy

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: VI**
Course Title: Course Title: Web Based Mini Project	
Course Code: HRF230P	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assessment Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Identify and analyze real-world problems and propose suitable web-based solutions using modern web technologies
CO2	Design and develop dynamic and responsive web applications using technologies such as HTML, CSS, JavaScript, and server-side scripting (e.g., PHP).
CO3	Apply software development life cycle (SDLC) phases including planning, design, implementation, testing, and deployment in a mini project
CO4	Demonstrate the ability to integrate front-end and back-end components to build a complete functional web application
CO5	Work effectively in teams, manage project tasks, and demonstrate professional ethics in project development.
CO6	Prepare technical documentation and present the project effectively using appropriate tools and communication skills

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**3**	**3**	**1**	**2**	**1**	**1**	**-**	**2**	**1**
CO2	**2**	**3**	**3**	**2**	**3**	**1**	**1**	**-**	**2**	**1**
CO3	**2**	**3**	**3**	**1**	**2**	**1**	**1**	**1**	**2**	**1**
CO4	**2**	**3**	**3**	**2**	**3**	**1**	**1**	**-**	**2**	**1**
CO5	**1**	**2**	**2**	**-**	**1**	**2**	**3**	**2**	**2**	**2**
CO6	**1**	**1**	**1**	**-**	**1**	**3**	**2**	**1**	**2**	**2**

Course Pedagogy

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

List of Web-Based Mini Projects:

1. Student Record Management System
2. Employee Details Management
3. Library Management (Mini Version)
4. Online Complaint Registration System
5. College Event Registration Portal
6. Online Assignment Submission System
7. Student Feedback System
8. Attendance Management System (Web-based)
9. Result Publishing System

10. Online Book Store
11. Food Ordering System (basic version)
12. Bus/Train Ticket Booking (demo system)
13. Online Rental System (rooms, bikes, etc.)
14. Personal Expense Tracker
15. To-Do List / Task Manager
16. Online Notes Sharing Platform
17. Weather App (API-based)
18. Online Quiz System
19. Online Voting System (with login authentication)
20. Course Recommendation System
21. Web-Based Health Monitoring System
22. Student Performance Analysis System
23. Employee Timesheet System
24. Online Survey & Feedback Analyzer

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

Technology to use:

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

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

Database: MySQL / MongoDB etc.,

Project Guidelines:

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

Each seminar will be considered for their internal assessment.

Scheme of valuation - 50 Marks

1. **IA – 10 Marks**
   - Synopsis - **05 Marks**
   - Seminar - **05 Marks**
2. **Dissertation – 40 Marks**
   - Documentation - 15 **Marks**
   - Presentation / Demonstration - 15 **Marks**
3. **Viva- 10 Marks**

Program Name: BCA	**Semester: VI**
Course Title: Software Project Management	
Course Code: HRF240	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Understand software project basics.
CO2	Analyze the requirements and formulate appropriate plan
CO3	Design Software effort estimation by adopting different project control measures activity planning
CO4	Use resource allocation and risk project management techniques appropriately
CO5	Demonstrate Managing people and organizing teams uploading software quality management guidelines

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**2**	**1**	**-**	**1**	**1**	**1**	**-**	**2**	**1**
CO2	**2**	**3**	**2**	**-**	**2**	**1**	**1**	**-**	**2**	**1**
CO3	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**2**	**1**
CO4	**2**	**3**	**2**	**-**	**2**	**1**	**1**	**1**	**2**	**1**
CO5	**1**	**2**	**2**	**-**	**1**	**2**	**3**	**2**	**2**	**2**

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

Unit 2:	
Project evaluation: Introduction, a business case, Project portfolio management, Evaluation of individual projects, Cost-benefit evaluation techniques, Risk evaluation, Programme management, Managing the allocation of resources within programmes, Strategic programme management, Creating a programme, Aids to programme management, Benefits management. Selection of an appropriate project approach: Introduction, Build or buy? Choosing methodologies and technologies, Choice of process models, Structure versus speed of delivery, the waterfall model, the spiral model, Software prototyping, Agile methods, managing iterative Processes, Selecting the most appropriate process model.	11
Unit 3:	
Software effort estimation: Introduction, need of estimation. Problems with over and under-estimates, the basis for software estimating, Software efforts estimation techniques, Bottom-up estimating, the top-down approach and parametric models, Expert judgment, estimating by analogy. Activity planning: Introduction, objectives, Project schedules, Projects and activities, Sequencing and scheduling activities, Network planning models, Shortening the project duration, Identifying critical activities. Risk Management: Introduction, Categories of risk, framework for dealing with risk, risk identification, risk assessment, risk planning, risk management.	11
Unit 4:	
Resource allocation: Introduction, the nature of resources, identifying resources requirements, scheduling resources, creating critical paths, Counting the cost, being specific, Publishing the resources schedule, Cost schedules. Managing people and organizing teams: Introduction, Understanding behavior, Motivation, team work, Decision Making, Leadership. Software quality: Introduction, importance, Product versus process quality management, Techniques to help enhance software quality, Quality plans.	11

Text Books:

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

Course Pedagogy

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: VI**
Course Title: Mobile Communication	
Course Code: HRF250	**No of credits: 03 (3:0:0)**
Total Contact Hours: 44	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 03	
Formative Assessment Marks: 20	**Summative Assess Marks: 80**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Understand the basic concepts of wireless and mobile communication
CO2	Explain multiple access techniques used in mobile communication such as FDMA, TDMA, and CDMA.
CO3	Analyze radio propagation mechanisms and wireless transmission techniques used in mobile communication environments
CO4	Focus on cellular network design concepts, including frequency reuse, handoff strategies, and channel allocation

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**3**	**2**	**1**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO2	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO3	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**-**
CO4	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**1**	**2**	**-**

Course Contents	**Hours**
Unit 1:	
Introduction to Mobile Communication: Evolution of mobile communication systems. **B**asic concepts of wireless communication, Cellular communication principles, Frequency reuse and channel assignment strategies, multiple access techniques such as FDMA, TDMA, and CDMA.	11
Unit 2:	
Wireless Transmission and Propagation: Free space propagation model, Radio wave propagation mechanisms, Path loss and shadowing, fading models, Doppler Effect in mobile communication. : Cellular Network Design, Cell structure and cell splitting Handoff and handover strategies	11
Unit 3:	
Traffic engineering in cellular systems, Channel allocation techniques, Capacity improvement techniques. Wireless Network Technologies**:** Architecture and operation of GSM, Overview of 3G, 4G, and 5G networks, Mobile switching and call processing, Wireless LAN and Bluetooth technologies.	11

Unit 4:	
Mobile Network Protocols and Security: Mobile IP and mobility management, Routing in mobile networks, Security issues in wireless networks, Authentication and encryption techniques, Mobile application services.	11

Text Books:

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

Course pedagogy

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

Formative Assessment for Theory	
Internal Assessment C1 (Test)	**10**
Internal Assessment C2 (Seminar/Assignment/Quiz/ Small Project etc.	**10**
Total	**20**

Program Name: BCA	**Semester: VI**
Course Title: Course Title: Power BI	
Course Code: HRF260	**No of credits: 02 (0:0:2)**
Total Contact Hours: 60	**Duration of SEA/Exam: 03 Hours**
Hours/Week: 04	
Formative Assessment Marks: 10	**Summative Assess Marks: 40**

Course Outcomes (COs): Upon successful completion of this course, students will be able to:	
CO1	Import, clean, and transform datasets using tools such as Power Query Editor for effective data preparation
CO2	Create meaningful data visualizations including bar charts, line charts, pie charts, and donut charts to represent business data
CO3	Develop interactive reports and dashboards to analyze key performance indicators (KPIs) and business performance.
CO4	Apply data modeling techniques and DAX expressions to establish relationships between tables and generate calculated fields for advanced analysis

CO-PO Mapping Matrix

COs \ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**2**	**2**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**1**
CO2	**2**	**2**	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**1**
CO3	**2**	**3**	**2**	**3**	**3**	**1**	**1**	**-**	**2**	**1**
CO4	**3**	**3**	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**1**

Course Pedagogy

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

List of Practical Experiments:

Part -A

1. Import a dataset from an Excel file and clean the data by removing duplicates and handling missing values.
2. Use Power Query Editor to transform a dataset, such as splitting columns, merging tables, or changing data types.
3. Create a bar chart to show the total sales by region.

4. Create a line chart to display the trend of sales over time.
5. Build a report that includes various visualizations, such as pie charts, bar charts, and tables, to analyze sales data.

Part -B

6. Create a dashboard that combines several key performance indicators (KPIs) to give an overview of business performance.
7. Create a relationship between tables manually through Power BI.
8. Use the DAX expression to add a new column in the data source.
9. Use the Donut Chart for Profit Analysis.
10. Analyze the more profitable day from the sales analysis table using Bar Chart in Power BI.

Evaluation Scheme for Lab Examination:

Assessment Criteria		**Marks**
Writing	One program from Part A	15
	One program from Part B	15
Execution	Any one of the Written programs	5
Viva Voce		5
Total		**40**

QP Pattern for Theory Courses (3 Credits):

Instructions: Answer Part-A, Part-B and Part-C:

Time: 3 Hours Max Marks:80

Part-A

I 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

II Answer any 4 questions out of 6 questions 4X5=20

Q. No. 13 to Q. No. 18.

(4Questions drawn from each unit and 2 questions from any unit)

Part-C

III Answer all the Questions. Each question carries 10 Marks. 4 X 10 =40

(Each question with internal choice and with maximum of 2 sub questions)

Q. No. 19 to Q. No. 22.

Question paper pattern for Theory Courses (2 Credits):

Time: 2 ½ Hours Max Marks:40

Instructions: Answer Part-A and Part-B

Part-A

I **Answer any 5 questions out of 6 Questions: 5x2=10**

Question No. 1 to 6

Part B

II Answer the following questions: 10x3=30

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)