Course	Bachelor in Computer Application (BCA)	**Semester - 1**
Type of Course	Core Courses	
Prerequisite	Basic knowledge of computer fundamentals	
Course Objective	1.Formulate algorithm/flowchart for given arithmetic and logical problem 2.Translate algorithm/flowchart into C program using correct syntax and execute it. 3.Write a program using branching ,looping, iteration and recursion.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction** **Fundamental of Computer** Basic block diagram of Computer component, hardware, software, memory, generation of computer, Flowcharts and algorithm. **Overview of C** Introduction, Importance of C, Sample C programs, Basic structure of C programs, Programming style, Executive a C program. **Constants, Variables and data Types** Introduction, Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, assigning values to variables, Defining symbolic constants. **Operators and Expression** Introduction, Arithmetic of Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bit-wise Operators, Special Operators, Arithmetic Expressions, Evaluation of expressions, Precedence of arithmetic operators, Some computational problems, Type conversions in expressions, Operator precedence and associatively, Mathematical function.	**10**	**25**
2	**Management Input and Output Operators, Loop and arrays** Introduction, reading a character, writing a character, formatted input, formatted output, structure of c program input output function **Decision Making statement** Introduction, Decision making with IF statement, Simple IF statement, the IF ELSE statement, Nesting of IF … ELSE statements, The ELSE IF ladder, The switch statement, the turnery (? :) Operator, the GOTO statement. **Decision Making Looping** Introduction, the WHILE statement, the DO statement, The FOR statement, Jumps in loops Break and continue. **Array** Introduction, One-dimensional arrays, Two-dimensional arrays, Initialization of two-dimensional arrays, Concept of Multidimensional arrays	**20**	**30**
3	**Handling of Character strings**	**15**	**25**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Introduction, Declaring and initializing string variables, reading string from terminal, writing string to screen, Arithmetic operations on characters, Putting string together, String Operations String Copy, String Compare, String Concatenation and String Length, String Handling functions. **User-Defined Functions** Introduction, Need for user-defined functions, The form of C function, Return values and their types, Calling a function, category of functions, No arguments and no return values, Arguments with return values, Handling of non-integer functions, Nesting of functions, Recursion, Functions with arrays, The scope and Lifetime of variables in functions, ANSI C functions		
4	**Structures , Unions and Pointer**	**15**	**20**
	Introduction, Structure definition, giving values to members, Structure initialization, Comparison of structures, Arrays of structures, Arrays within structures, Structures within Structures, Structures and functions, Unions, Size of structures, Bit fields. **Pointers** Introduction, understanding pointers, Accessing the address of variable, Declaring and initializing pointers, Accessing a variable through its pointer, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and character strings, Pointers and Functions, Pointers and structures. Dynamic memory allocation **File Management in C** Introduction, Defining files and its Operations, Error handling during I/O operations, Random access files, Command line arguments.		
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze
Weightage	10	30	30	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Formulate algorithm/flowchart for given arithmetic and logical problem
CO2	Translate algorithm/flowchart into C program using correct syntax and execute it.
CO3	Write a program using branching ,looping, iteration and recursion.
CO4	Implement simple program using Structure , Pointer and Union.
CO5	Implement simple program using array and pointer.

Reference Books

1. **"Computer programming" (TextBook)**
   By Ashok N. Kamthane | Pearson Education
2. **ANSI C (TextBook)**
   By Balaguruswami | Wiley India Pvt Ltd
3. **Let Us C (TextBook)**
   By Yashwant Kanetker | BPB Publication

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List of Practical	
1.	Write a program to display “Hello Computer” on the screen.
2.	Write a C program to display Your Name, Address and City in different lines.
3.	Write a C program to find the area of a circle using the formula: Area = PI * r.
4.	Write a C program to swap a variable value of no1 and no2.
5.	Write a C program to print the multiply, addition, division & subtraction value of two accepted numbers.
6.	Write a program to find a maximum from given two numbers.
7.	Write a program to find a minimum from given two numbers.
8.	Write a program to find a maximum from given three numbers.
9.	Write a program to find a minimum from given three numbers.
10.	Write a C program to print a multiplication table from 1 to 12.
11.	Write a C program to find addition of 45 to 65 using loop.
12.	Write a C program to check whether a number is prime or not.
13.	Write a C program to show month using Switch statement.
14.	Write a C program to print the 3x3 array.
15.	Write C program to print range of 101 to 130 using array.
16.	Write a C program to find the length of the given string.
17.	Write a C program to copy one string into another string.
18.	Write a C program to concate (merge) the two strings.
19.	Write a C program to print the following shape.
20.	Write a C program to find the addition of two values using function.

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Course	Bachelor in Computer Application (BCA)	**Semester - 1**
Type of Course	Core Courses	
Prerequisite	Basic knowledge of Computer	
Course Objective	1. Learn basics about computer hardware, software and Operating system. 2. Learn about Networks and data communication. 3. Learn about Enterprise systems and functions.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Computer Hardware System** Concepts and generation of computer, CPU, Basic Logic Gates, Computer Memory and Mass Storage Devices, Computer Hierarchy, Input and Output Technologies	10	15
2	**Operating Systems and Application, System Software Application and System Software** Application and System Software, Compilers and Interpreters, Process of Software Development, Data Analysis using Spreadsheets **Operating Systems** Functions of Operating Systems, Types of Operating Systems (Batch Processing, Multi-tasking, Multi-programming and Real-time Systems)	25	35
3	**Data Communication and Networks** Concepts of Data Communication, Types of Data-Communication, Communications Media, Concepts of Computer Networks, Primary Network Topologies, Operation of the Internet and services provided by Internet, World Wide Web, Intranets and Extranets	10	25
4	**Functional and Enterprise Systems** Data, Information and Knowledge Concepts, Decision Making Process, Physical Components of Information Systems, Computer N/W: Need for computer networking (LAN and WAN) their characteristics, features and uses, Networking goals and applications; International, national, public and private networks, Networking aspects of video conferencing, imaging and multimedia.	15	25
	Total	60	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Create
Weightage	20	20	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand computer hardware concepts, generations, and input/output technologies.
CO2	Gain proficiency in operating systems, software development, and data analysis.
CO3	Explore functions and types of operating systems.
CO4	Acquire knowledge of data communication, networks, and the Internet.
CO5	Understand functional systems, decision-making processes, and computer networking needs.

Reference Books	
1.	**Introduction to computers (TextBook)** By Peter Norton | Mc Grew Hill

List of Practical	
1.	MS-WORD Microsoft Word is a word processor developed by Microsoft. It was first released in 1983 under the name Multi-Tool Word for Xenix systems. MSWord is a popular word-processing program used primarily for creating documents such as letters, brochures, learning activities, tests, quizzes and students' homework assignments. There are many simple but useful features available in Microsoft Word to make it easier for study and work. That's why so many people would prefer to convert the read-only
2.	Create a employee table (EMP_ID , EMP_NAME , SALARY , SALE_AMOUNT , COMMISSION , TOTAL SALARY)
3.	Create item table (ITEM_NO , NO OF ITEM , ITEM PRICE , TAX)
4.	Create a presentation about your self-introduction.
5.	Create power point presentation to introduction about Rai University.
6.	Write a medical leave application for student to their mentor and below all steps are used to write application.
7.	Create power point presentation to introduction about festival celebration in India.
8.	Write closing account in bank for customer to manager and below all steps are used to write application.
9.	Clear Print Guidelines Example A: Example A is Times New Roman, size ten, with single spacing. Example B is Arial, size twelve with 1.5 spacing. As you can see, smaller font sizes, single spacing and serif fonts are harder to read. Additionally, it is easier to keep one's place on a page with left aligned text, as in example B, as left alignment gives the body of the text a specific shape and gives uniformity between words. Example A, which is justified, has no natural shape.
10.	Create power point presentation to introduction about India.

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Course	Bachelor in Computer Application (BCA)	**Semester - 1**
Type of Course	General Elective Courses	
Prerequisite		
Course Objective	-	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
4	0	0	4	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Set Theory** Introduction, Definition, Sets and their representation, The empty set, Finite and infinite set, Equal set, Subsets and supper set, Intervals, Power set, Venn diagram, Union of sets, Intersection of sets.	17	28
2	**Relation and function** Cartesian product of the sets, relations, Functions, Types of functions, algebra of functions, Examples	15	26
3	**Matrix and determinants** Introduction of matrices, Definition of different matrices, Determinants of matrix, minors, cofactors, determinant of matrix. Adjoint of matrix, Inverse of the matrixIntroduction of matrices, Definition of different matrices, Determinants of matrix, minors, cofactors, determinant of matrix. Adjoint of matrix, Inverse of the matrix	15	18
4	**Limit Differentiation and integration** Limit, Concept of limit, some standard limit, continuity of function, Definition of derivative, rules of derivative, Standard formulae and examples based on standard forms	13	28
	Total	60	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	15	20	25	15	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Student will be able to solve problems based on set theory.
CO2	Student will able to explain relations and functions.
CO3	Student will able to solve problems based on matrix and determinant.
CO4	Student will able to compute limits, derivatives, and integrals.
CO5	Student will Able to apply differential and Integral equations to significant applied problems.

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Reference Books	
1.	**Class XI Mathematics NCERT book (TextBook)** By NCERT | NCERT
2.	**Basic mathematics (TextBook)** Atul Prakashan
3.	**Business Mathematics** By V.K.Kapoor | S. Chand and sons, New Delhi

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Course	Bachelor in Computer Application (BCA)	**Semester - 1**
Type of Course	Ability Enhancement Courses	
Prerequisite	Basic knowledge of science & mathematics.	
Course Objective	1. Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions. 2. Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving. 3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems 4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		LAB	
Lecture	Tutorial	Lab	Credit	External Mark (T)	Internal Marks (T)		Total Marks
3	1	0	4	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**The multidisciplinary nature of environmental studies** Environmental Science 'definition, scope & importance, Evolution of the universe, origin of the earth; solar system; evolution of life; atmosphere of the primitive earth, abiotic component of environment, Environmental balance, balance in O2 and CO2 in air; thermal balance; balance in predator and prey population	15	25
2	**Ecology** Ecology & its branches, scope of Ecology and its relation to other divisions of sciences; autecology and synecology, Concept and structure of ecosystem, functions of ecosystem, Types of Ecosystems, Concept of habitat; ecological niche; guild, Significance of ecological adaptation; ecological adaptation in plants and animals- Zeric adaptations in plants and animals; adaptations of plants and animals to aquatic habitat; arboreal adaptations in plants and animals	15	25
3	**Ecosystem** Concept and scope of environmental chemistry, chemical toxicology, hazardous chemicals, carcinogens, occupier, effluent etc. The natural cycles of the environment, Ozone depletion 'causes and effects; Global warming 'major greenhouse gases, causes and effects; Acid rain 'causes and effects, Acid 'base reactions in water, Chemistry of decaying compounds, Case Studies. Earth - Its interior and surface, Layers of the earth, Earths Crust: Formation of Rocks Major land forms and their transformation, Denudation and its agents: Weathering ' Mechanical and chemical - Agents of weathering, Composition of soil, Formation and types of soils.	15	25
4	**Biogeochemical cycles and Environmental Pollution**	15	25

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Biogeochemical cycles, Carbon cycle, Nitrogen cycle, Phosphorus cycle, Oxygen cycle, Water cycle Environmental Pollution Types of Environmental Pollution, Water Pollution, Air Pollution, Land and Noise Pollution, Current Issues in environment sciences		
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	40	30	5	5	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions
CO2	Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
CO3	Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
CO4	Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Reference Books

1.	**Textbook of Environmental** By Erach Bharucha | Universities Press (India) Private Ltd, Hyderabad. | Second edition, Pub. Year 2013
2.	**Environmental Sciences** By Daniel B Botkin & Edward A Keller | John Wiley & Sons.

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Course	Bachelor in Computer Application (BCA)	**Semester - 1**
Type of Course	Ability Enhancement Courses	
Prerequisite	Basic knowledge of English	
Course Objective	1. To understand the process of e-mail communication minutes of meeting. 2. To make aware about barriers to communication with ethical context. 3. To make effective and impressive communication. 4. Better presentation and communication using proper body language.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
2	0	0	2	25	25	0	50

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Fundamentals of grammar** Parts of Speech (Noun, Pronoun, Adjective, Verb, Adverb, Conjunction, Preposition, Interjection) Article Tense: Application of tenses with respect to time, All tenses & their Sub-divisions Forming of Sentences & Clauses, "WH's Concepts,Understanding Sentences, Punctuation I, Degree of comparison I (Positive, Comparative & Superlative), Tenses (Introduction & Usage) Vocabulary (Roots, Prefix, Suffix, Homonyms, Synonyms & Antonyms) Auxiliaries, Modal Verbs	**12**	**25**
2	**Listening** Introduction, Definition of Listening, Listening vs Hearing, Process of Listening, Problems Students Face in Listening, Strategies of Listening, Barriers to Listening, Listening in the Workplace, Activities That Help you to become better listeners.	**11**	**25**
3	**Reading** Introduction, The Reading Process, Reading and Meaning, Methods to improve Reading, Strengthening your Vocabulary, Understanding Graphics and Visual Aids, Previewing, Reading in thought Groups, Avoiding the Re-reading of the same phrases, Barriers to Reading, Skills for Speed Reading, Sub-Skills of Reading, Skimming, Scanning, Extensive Reading, Intensive Reading, Reading E-Mail, E-Books, Blogs and Web Pages	**11**	**25**
4	**Letter writing** Formal and informal; CV; Report Writing; Presentation as a skill?Elements of Presentation Strategies – Audience – Objectives –Medium - Key Ideas, Structuring The Material, Organizing Content, Audio -Visual Aids – Handouts - Use of Power Point	**11**	**25**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Analyze	Evaluate	Create
Weightage	25	25	25	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books

1. **High School English Grammar & Composition (TextBook)**
By Wren & Martin | Blackie

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2.	**Learn English vocabulary at a Glance** By Dr. Rakesh Bharadwaj | Dr. Rakesh Bharadwaj

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Course	Bachelor in Computer Application (BCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	02080201-T - COMPUTER FUNDAMENTALS AND PROGRAMMING WITH C	
Course Objective	1. To Understand different types of data. 2. To develop the capability of selecting a particular data structure and implement algorithm.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Data Structure** Introduction to Data Structure and different types of data Data types, primitive and non-primitive Linear & Non Linear Data Structures String, Introduction, Operation performed on string Array, Introduction to Arrays, Linear array and its representation	15	25
2	**Linear data Structure** Representation of arrays, Applications of arrays, sparse matrix and its representation **Stack** Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression ,Recursion **Queue** Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue **Linked List** Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list	15	25
3	**Non Linear Data Structure Tree** Definitions and Concepts, Representation of binary tree, Binary tree traversal (In order, post order, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications of Trees- Some balanced tree mechanism, Height Balanced, Weight Balance , **Graph** Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)	15	25
4	**Hashing ,Sorting and Searching Hashing** The symbol table, Hashing Functions, Collision-Resolution Techniques **Sorting and Searching** Sorting types, Insertion, sort, Selection Sort, Quick Sort, Merge Sort, Radix sort, Searching types, Sequential Search and Binary Search	15	25
	Total	60	100

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy					
Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	15	30	20	15	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand types of data structure mechanisms.
CO2	Implement various types of algorithms using Data Structures.
CO3	Implement various types of searching and sorting algorithms using Data Structures.
CO4	Compare different Sorting and Searching Algorithms.
CO5	Apply various hashing techniques.

Reference Books

1.	**Data Structures using C & C++ (TextBook)** By Ten Baum | Prenctice-Hall International
2.	**Fundamentals of Computer Algorithms by (TextBook)** By Horowitz, Sahni | Galgotia Pub. 2001 ed.

List of Practical

1.	Write a C program to display linear array elements.
2.	Write a C program to calculate length of a given string.
3.	Write a C program to perform index operation on a given String.
4.	Write a C program to Concate two String.
5.	Write a C program to find Sub string of given string.
6.	Write a C program to implement PUSH and POP operation of STACK.
7.	Write program to implement simple queue using C language.
8.	Write a C program to search an element using linear search.
9.	Write a C program to search an element using Binary search.
10.	Write a C program to sort given list using Insertion sort
11.	Write a C program of matrix addition.
12.	Write a C program of matrix multiplication.
13.	Write a C program to traverse single linked list
14.	Write a C program to implement Bubble sort
15.	Write a C program to implement Radix sort
16.	Write a C program to implement Merge sort
17.	Write a C program to implement Selection sort

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Course	Bachelor in Computer Application (BCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	03080301-T - OBJECT ORIENTED PROGRAMMING WITH C++	
Course Objective	1. To understand the Fundamental of Database Management System, RDBMS and locking mechanism. 2. To learn the fundamental of data models and SQL query. 3. To develop application using PL/SQL blocks.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction** What is database system, purpose of database system, view of data, Types of Databases, database architecture, transaction management **Data Models** Hierarchical data model, Network data model, Relational Data model	**10**	**15**
2	**Relational Database Design and E-R Model, E-R Model, Normalization** Structure of Relational databases, Domains, Relations, Relational algebra – fundamental operators and syntax, relational algebra queries, tuple relational calculus Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets, extended E-R features – generalization, specialization, aggregation, reduction to E-R database schema, Data redundancy Normal forms 1NF, 2NF, 3NF, BCNF and 4NF	**10**	**15**
3	**Structured Query Language, Constraints, Functions, Advanced Query** Introduction to SQL, DDL, DML, DCL, TCL. Basic commands and Functions of SQL, Data Definition Language (DDL), Data Manipulation language (DML),Data Control Language (DCL), Transaction control Language (TCL) and all related commands, Use of Group by, Having, order by Primary key, foreign key, unique, not null, check, IN operator Aggregate functions, Built-in functions –numeric, date, string functions Set operations, Sub-queries and correlated sub-queries, Join and types of Join	**20**	**30**
4	**Introduction to PL/SQL, Basics of PL/SQL, Transaction Management and Concurrency Control** The PL/SQL Syntax, The PL/SQL Block Structure, Fundamentals of PL/SQL, Advantages of PL/SQL data Types. Advanced SQL features such as updatable views, stored procedures, Triggers Transaction concepts, ACID properties, Serializability and Concurrency Control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.	**20**	**40**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	15	25	20	20	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand the basic networking and internet concepts
CO2	Understand principle of basic world wide web
CO3	Use various HTML tags and advance html to develop the user friendly web pages
CO4	Use various CSS to develop the user friendly web pages and more attractive.
CO5	Use the JavaScript to develop the dynamic web pages.

Reference Books	
1.	**Database System Concepts` (TextBook)** By Abraham Silberschatz, Henry F. Korth and S. Sudharshan | Sixth Edition, Tata Mc Graw Hill, 2011
2.	**An Introduction to Database Systems** By C.J.Date, A.Kannan and S.Swamynathan | Eighth Edition, Pearson Education, 2006.
3.	**Introduction to Database Management Systems (TextBook)** By Atul Kahate | Pearson Education, New Delhi, 2006

List of Practical	
1.	Perform the following : (a) View all databases, create a database of university, select that database and view all table in it. (b) Perform DDL commands (create, Alter, Truncate, Drop).
2.	Perform DML (insert, update, delete) and DQL commands on student_info table.
3.	Retrieve details from student_info table using distinct, order by clause and LIMIT clause.
4.	Create customers table using Constraints with given Attributes: Customer_id – Primary key, Auto increment, Customer_name – Not Null, Contact_no – Unique key, City – Not Null.
5.	Retrieve details from customers table using group by clause.
6.	Create Product table with given attributes and Perform Aggregate functions (count, sum, avg, min, max) on product table. Product_id – Primary key, Product_name - Not Null, Quantity – Not Null,
7.	Perform Numeric functions (sqrt, abs, floor, ceiling, round, square, power) on product table.
8.	Perform String functions (ASCII, Char, Concat, Concat_ws, Left, Right, Lower, Upper, Ltrim, Rtrim, Trim, Reverse, substring, replace) on student_info table.
9.	Perform Date functions (NOW, CURDATE, CURTIME, DATE, EXTRACT) on student_info table.
10.	Apply check and default constraints on customers table.
11.	Retrieve details from customers table using IN operator.
12.	Perform join (inner, left, right, full outer) on tables.
13.	Write a Subquery to transfer all the records from one table to another.

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Course	Bachelor in Computer Application (BCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	Basic knowledge of Maths	
Course Objective	1. Student will be Able to understand the basics concepts of Discrete Mathematical Structures 2. student will have developed ability to Understand the concept of Group Theory 3. Students will achieve command of the fundamental definitions and concepts of graph theory 4. Solve simple application problems 5. Student will have developed ability to Distinguish various types of graphs	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	1	0	4	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**UNIT-I** Binary operations with properties, Definition of group and examples, commutative group, Elementary properties of group, Order of a group and order of an element, Sub-group	**12**	**28**
2	**UNIT-II** Cyclic group, Right Coset and left coset, equivalence class, Lagrange's theorem, Euler's theorem, Fermat's theorem, permutation and example, transposition and example	**9**	**26**
3	**UNIT-III** Graph and multi graphs, degree of a vertex, paths, connectedness, connected components, cut points, bridges, complete graphs, regular graphs, matrices and graphs	**7**	**18**
4	**UNIT-IV** Planner graphs, maps and regions, Euler's formula (only statement), non-planner graphs, colored graphs, coloring of maps, trees, spanning trees.	**12**	**28**
	Total	**40**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	10	25	25	25	15

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Student wil be Able to understand the basics concepts of Discrete Mathematical Structures
CO2	student will have developed ability to Understand the concept of Group Theory
CO3	Students will achieve command of the fundamental definitions and concepts of graph theory

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CO4	Solve simple application problems
CO5	student will have developed ability to Distinguish various types of graphs

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Reference Books	
1.	**Discrete Mathematics** By S. Lipschutz and M. l. Lipson | Schaum's Outline Series McGRAW-HILL | Third Edition
2.	**Graph Theory with Applications to Engineering and Computer Science** By Narsingh Deo | Dover Publications Inc.
3.	**GRAPH THEORY WITH APPLICATIONS** By J. A. Bondy and U. S. R. Murty | Elsevier Science Ltd, Pub. Year 1976

List of Tutorial	
1.	Examples on groups
2.	Examples on sub groups.
3.	Examples on equivalence relations.
4.	Examples on paths
5.	Examples on Euler's formula.

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Course	Bachelor in Computer Application (BCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	An open mindset and willingness to cultivate personal growth through soft skills development.	
Course Objective	1. Effective Communication: Enhance verbal and non-verbal communication skills for interpersonal and professional success. 2. Self-Confidence: Build self-assurance and assertiveness in various personal and professional scenarios. 3. Team Collaboration: Develop teamwork, leadership, and conflict resolution skills for better collaboration. 4. Emotional Intelligence: Improve self-awareness and empathy to manage emotions and relationships effectively. 5. Adaptability and Resilience: Foster adaptability and resilience to navigate challenges and change with confidence.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

SEE *- Semester End Examination,* ***CIA*** *- Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to soft skill** Meaning and introduction to soft skill, Types of soft skill (communication, empathy, leadership, time management, observation, conflict resolution, listening skill,) Difference between soft skill and hard skill, IQ,SQ,EQ and emotion competence	15	25
2	**Habits** Guiding Principles, Identifying Good And Bad Habits, Habit Cycle; Breaking Bad Habits, Using The Zeigarnik Effect For Productivity And Personal Growth, Forming Habits of Success	15	25
3	**Personality development** Meaning of personality, elements of personality Determents of personality Personal development plan	15	25
4	**Self-management skill** Time management (planning, scheduling and meeting) Emotion and stress management SWOT analysis Etiquettes and manners Personal grooming (Appearance, Dressing)	15	25
	Total	60	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Analyze	Evaluate	Create
Weightage	25	25	25	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may

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vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Effective Communication: Enhance verbal and non-verbal communication skills for interpersonal and professional success.
CO2	Self-Confidence: Build self-assurance and assertiveness in various personal and professional scenarios.
CO3	Team Collaboration: Develop teamwork, leadership, and conflict resolution skills for better collaboration.
CO4	Emotional Intelligence: Improve self-awareness and empathy to manage emotions and relationships effectively.
CO5	Adaptability and Resilience: Foster adaptability and resilience to navigate challenges and change with confidence.

Reference Books	
1.	**Soft skill know the self and know the world (TextBook)** By Dr. K. Alex –S.chand | PHL learning Pvt. Ltd. New Delhi
2.	**Personal growth and wealth** By Dale Carnegie , Napoleon Hill, Dr. Joseph Murphy

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Course	Bachelor in Computer Application (BCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	13990102- T - COMPUTER FUNDAMENTAL AND EMERGING TECHNOLOGY	
Course Objective	1. To develop skills needed for building interactive, data-driven sites 2. To learn object oriented concepts with PHP 3. To learn effective usage of cookies and sessions	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Internet** Introduction to Internet, Evolution & history of internet, Growth of Internet, Owners of Internet, Services of Internet, How does Internet works?, Internet addressing & DNS, Internet Vs Intranet, Impact of Internet, Governance on Internet, Getting connected, Different types of connections, Dial-UP connections: ISDN, ADSL, Leased Line Connections, Satellite Connections. Level off internet connectivity, One level, Two level, Three level,Internet service provider, Internet account options, Telephone option, Protocol option, Service option, Switching: Circuit switching, Packet switching, Message switching, Routers, Gateways.	**15**	**25**
2	**Internet Applications and Services** Email, Remote Login, Telnet, FTP, Search Engines, VPN, Firewall	**15**	**25**
3	**Introduction to HTML** HTML, Working with List, Working with Table	**15**	**25**
4	**Advance HTML** Working with Frames, Working with Forms, Working with Link & Images, Working with Layer, Working with Multimedia	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	15	25	20	15	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand the basic networking and internet concepts in world wide web
CO2	Use various HTML tags and advance html to develop the user friendly web pages
CO3	Use various CSS to develop the user friendly web pages and more attractive.
CO4	Use the Cookies,Session and security in PHP web development.

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CO5	Use the object oriented programming with PHP to develop the dynamic web pages.

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Reference Books	
1.	**HTML 5 in Simple Steps (TextBook)** By Kogent Learning Solutions Inc. | Dreamtech Press
2.	**Internet Technology and Web Design (TextBook)** By ISRD Group | Tata McGraw Hill

List of Practical	
1.	Write a HTML code for display various list.
2.	Write an HTML code to display Student detail form.
3.	Create your 12th mark sheet in HTML Code.
4.	Write an HTML code to display your CV on a web page
5.	Write HTML document to illustrate the uses of the following tags with all attributes.
6.	Design a web page which will have output like this.
7.	Make a table with your friend's details in it. i. Column One, your friends names ii. Column Two, Address of your friends iii. Column Three, Mobile No of your friends iv. Column Four, Birth-Date of your friends
8.	Write an HTML code to display your education details in a table format with background color and heading etc.
9.	Write an HTML code to create a frameset having header, navigation and content sections.
10.	Write a HTML document to illustrate the uses of tags.
11.	Make Registration form like this.
12.	Display images with its content and background color.

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	13990101- T - PROGRAMMING IN C	
Course Objective	1. Allow programmers to think in terms of the structure of the problem rather than in terms of the structure of the computer. 2. Decompose the problem into a set of objects 3. Objects interact with each other to solve the problem	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction of OOPS, Principles of OOP, C++ Basics** Introduction to Object Oriented Programming, Difference between Procedure Oriented and Object Oriented Programming, Difference between C and C++ Class, Object, Inheritance, Polymorphism, Dynamic Binding, Message Passing Programming Structure, Variables in C++, C++ Output/ Input, Keywords in C++, New style of the header file specification, Comments in C++, Token, Enum, Typecasting, Operators, Control Structures, Default Arguments, Scope Resolution Operator, New and Delete Operator, Manipulators	**15**	**25**
2	**Classes, Object and Function, Constructor & Destructor** Introduction to Class and Objects, Access Specifier, Memory Allocation for an object, Simple Function, Call and Return by Reference, Static data, Function and Members, Inline Function, Function Overloading, Friend Functions, Friend Class, Array of Class Object. Constructor, Characteristics of Constructor, Types of Constructor, Destructor, Characteristics of Destructor	**15**	**20**
3	**Inheritance** Introduction, Advantages of Inheritance, Inheritance using different access Specifiers, Initialization of Base class members through a derived class object, Different forms of Inheritance, Virtual Base Classes, Abstract Class, Function Overriding.	**10**	**20**
4	**Operator Overloading, Files & Pointers** Introduction to Operator overloaded, Rules for Overloading Operator, Declaration of Operator Overloading, Unary Operator Overloading, Binary Operator Overloading, Data Conversion, and Type Conversions C++ Streams, C++ Streams Classes, I/O Operations, Open, and Close File, Read/write modes in C++, Managing Output with Manipulators, File Modes and File Pointers, Pointer to constant and constant to Pointer	**20**	**35**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	30	20	30	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Learn Basic concept of C++ programming & understand the fundamental principles of OOP concept.
CO2	How to write a C++ program using the concept of Classes, Object, Function, Constructor & Destructor.
CO3	Understing the concept of inheritance & polymorphism along with menthod over-loading concept.
CO4	Implement the concept of operator Overloading.
CO5	Implement the concept of Files & Pointers using functions

Reference Books	
1.	**Let us C++ (TextBook)** By Y kanitkar | BPB Publication
2.	**Object Oriented Programming with C++ (TextBook)** By E Balaguruswami | The Mc Graw-Hill Education India Pvt. Ltd

List of Practical	
1.	Write a program to print “Hello World”.
2.	Write a program to perform operation of calculator.
3.	Write a program to add two numbers by using function
4.	Write a program to swap two numbers.
5.	Write a program to check whether number is even or odd.
6.	Write a program to find largest number among three numbers
7.	Write a program to generate multiplication table of a given number.
8.	Write a program to reverse a number
9.	Write a program to calculate power of a number.
10.	Write a program to multiply two numbers.
11.	Write a program to subtract complex number using operator overloading.
12.	Write a program to check whether a number is palindrome or not.
13.	Write a program to check whether a number is prime or not.
14.	Write a program to find the length of a string.
15.	Write a program to concatenate two strings.
16.	Write a program to write content of a file “studentmarks.txt”.
17.	Write a program to read from file “studentmarks.txt”.
18.	Write a program to using copy constructor to copy data of an object to another object.
19.	Write a program of multiple inheritance.
20.	Write a program which illustrates the use of parameterized constructor.

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	05070306-T - INTERNET AND WEB TECHNOLOGY(T)	
Course Objective	1. Develop dynamic web application using PHP and MySQL 2. Develop Web application with files and forms 3.Understand Joomla and can work with Joomla components	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction To PHP Building blocks of PHP** Basic syntax, Variables, Data Types, Operators and expressions, Constants. Flow Control: Switch flow, Loops, Code Block, Sending data to the browser. **Working With Arrays:** Arrays, Creating array, Array related Functions. Working with Function: Function, Calling Function, Defining Function, Returning the Values from user defined function, Variable Scope, Argument. **Working with Strings And Date and Time Functions:** formatting String with PHP, Date and Time Function, String Manipulation and Investigating Strings with PHP. **Working with Forms:** Creating form, Handling form, Validating form data, Accessing form data, use of Hidden fields to save State, Redirecting user, file Upload and Sending Mail on Form Submission.	**15**	**25**
2	**Introduction to MySQL & Interacting with MySQL Understanding the Database Design Process** The importance of good database design, Types of Table Relationship, Understanding Normalization. Learning Basic SQL Command: Table Creation, Insert row, Select Command Using Where Clause, Update and Delete Command, Replace Command, String Function, Date and Time Functions, Stored Procedures, Join, Indexing and Sorting query. **Using MySQL with PHP:** connecting to MySQL and selecting the database, executing simple queries, retrieving query results, counting return Records, updating, Record Addition, Viewing Record, and Deletion Record with PHP	**15**	**25**
3	**Introduction to Cookies & working With Files and Directories** **Working with files:** Include Files with INCLUDE, creating and deleting files, opening a file for reading, writing or Appending, Reading from files, Validating Files. Working with Directories: Open Pipes to and from Process using Popen(), Running command with Exec(), Running Command with System() or Passthrough(). **Working with Cookies and User Session : -** Introduction of Cookie, Setting a Cookie with PHP, Introduction of Session, Improving Session Security, Starting a Session, Working with Session Variables, Passing Session Id in the query String, Destroying Session and Unsetting Variables.	**15**	**25**
4	**Introduction to Object Oriented Programming With PHP and Error Handling**	**15**	**25**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Introduction, the basic, auto loading objects, Class, Extends, Constructs, Scope Resolution Operator, Parent, serializing object, The magic objects – sleep and awake, reference inside the constructor, comparing objects. Visibility, overloading, object interface, pattern, magic method, reflection, extending exception. Error Handling and Debugging: General error types and debugging, displaying PHP errors, Adjusting Error Reporting, Creating Custom error handler, PHP debugging techniques, SQL and MySQL debugging techniques.		
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	10	20	25	30	15

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Develop Web application with files and forms
CO2	Explain the working approach of PHP.
CO3	Implement simple programming logic using conditional statements, loops, Operators.
CO4	Implement Object oriented programming concepts in backend development.
CO5	Developing and Testing web application using PHP and MySQL.

Reference Books

1. **PHP MySQL and Apache, SAMS Teach Yourself (TextBook)**
By Julie C. Meloni | SAMS

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List of Practical	
1.	Write a Program to print “Hello World”.
2.	Write a program to concatenate two strings.
3.	Write a program to add two integer numbers.
4.	Write a program to swap two numbers.
5.	Write a program to find the area and perimeter of a circle.
6.	Write a program to print bio when name is echoed.
7.	Write a program to print birth date and time
8.	Write a program to print the date in different formats.
9.	Write a program to print the current time zone.
10.	Write a program to accept the details from a form and show it into different pages.
11.	Write a program to accept the details from a form and show it on the same page.
12.	Create a form and use different validators.
13.	Write a program to check the eligibility of voting in India.
14.	Write a program to connect php to MySql and show the message “Connection Established”.
15.	Write a program to demonstrate Cookie.
16.	Write a program to demonstrate a Session.

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	13990101- T - PROGRAMMING IN C	
Course Objective	The goal of this course is to provide students with an understanding of basic concepts in the Operating System. At the end of this course students will: understand key mechanisms in design of operating systems modules understand process management, concurrent processes and threads, memory management, virtual memory concepts, deadlocks compare performance of processor scheduling algorithms produce algorithmic solutions to process synchronization problems use modern operating system calls such as Linux process and synchronization libraries practice with operating system concepts such as process management, synchronization, networked processes and file systems	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to OS** Introduction: What is an OS?, Evolution Of OS, OS Services, Types Of OS, Concepts of OS, Different Views Of OS, Process Management: Process, Process Control Block, Process States, Threads, Types of Threads, Multithreading.	**10**	**20**
2	**Deadlock** Inter-process Communication: Race Conditions, Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation , Peterson's Solution, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader 's & Writer Problem, Dinning Philosopher Problem etc., Scheduling, Scheduling Algorithms. Deadlock: Deadlock Problem, Deadlock Characterization, Deadlock Detection, Deadlock recovery, Deadlock avoidance: Banker's algorithm, Deadlock Prevention.	**20**	**30**
3	**Memory Management** Paging: Principle Of Operation, Page Allocation, H/W Support For Paging, Multiprogramming With Fixed partitions, Segmentation, Swapping Virtual Memory: Concept, Performance Of Demand Paging, Page Replacement Algorithms, Thrashing, Locality.	**20**	**25**
4	**Input Output Management** Principles Of Input/Output H/W : I/O Devices, Device Controllers, Direct Memory Access Principles Of I/O S/W :Goals Of The I/O S/W, Interrupt Handler, Device Driver Device Independent I/O Software Disks : RAID levels, Disks Arm Scheduling Algorithm, Error Handling	**10**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	20	30	15	15	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand key mechanisms in design of operating systems modules
CO2	Understand process management, concurrent processes and threads, memory management, virtual memory concepts, deadlocks
CO3	Understand Input Output Management and use of Device Driver and Secondary Storage (Disk) Mechanism.
CO4	Analyze different IPC problems and its solutions
CO5	Compare performance of processor scheduling algorithms.

Reference Books

1.	**Operating System by Tanenbaum (TextBook)** By Tanenbaum | Pearson publication
2.	**Operating Systems** By Stallings | Pearson Education

List of Practical

1.	Write a shell script to display “Hello Computer” on the screen
2.	Write a shell script to print the multiply value of two accepted numbers.
3.	Write a shell script to print the addition value of two accepted numbers.
4.	Write a shell script to print the division value of two accepted numbers
5.	Write a shell script to print the subtraction value of two accepted numbers.
6.	Write a shell script to swap a variable value of no1 and no2.
7.	Write a shell script to find a maximum from given two numbers.
8.	Write a shell script to find a minimum from given two numbers.
9.	Write a shell script to find a minimum from given three numbers.
10.	Write a shell script to display first 25 Fibonacci nos.

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	02060402-T - BASICS OF MICROPROCESSORS & ITS ARCHITECHTURE	
Course Objective	1. To understand the principles and tools of systems analysis and design. 2. To understand the application of computing in different context.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**System Concepts and Information Systems Environment** Definition of system, Characteristics of a system, Elements of a system, Types of system, SDLC, Prototyping, Role of system Analyst	**15**	**25**
2	**System Analysis** System planning and initial investment, Dimensions of planning, Determining the user's information requirements, Information Gathering, Tools for structured Analysis, Cost/benefit Analysis	**15**	**25**
3	**System Design** Process of design, Design methodologies, Audit considerations, Input/output Design, Database design, OOAD concepts, Architectural, behavior diagrams	**15**	**25**
4	**System Implementation** System Testing, Nature of test, Test Plan, Quality assurance, Goals in SDLC., Levels of quality Assurance, Software Maintenance, Process scheduling – what is Project Management, Security, Disaster/ Recovery and Ethics in development., Control Measures	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	30	20	20	10	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand the principles, methods and techniques of systems development.
CO2	Understand the problems relating to systems development.
CO3	Summarize The Key Concept Principle Of Object Oriented Analysis And Design
CO4	Understand the various stages of a phased systems analysis method.
CO5	Student Will Able To Create Object Oriented Modules And Diagrams To Represent Complex System.

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CO6	Apply Structure Modelling Techniques To Visually Represent And Interaction Between Object In System.

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Reference Books	
1.	**Systems Analysis and Design (TextBook)** By Elias M. Awad | Galgotia Publisher

List of Practical	
1.	Draw architectural diagram of SDLC
2.	Show class diagram using any example
3.	Show Object diagram using any example
4.	Show Package diagram using any example
5.	Show class diagram using any example
6.	Show Composite structure diagram using any example.
7.	Show Sequence diagram using any example
8.	Show Activity diagram using any example
9.	Show USE CASE diagram using any example.
10.	Show Interaction diagram using any example
11.	Show Component diagram using any example.

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	13990503-T - PYTHON	
Course Objective	1. To enable computers to learn and improve from experience, without being explicitly programmed. 2. To learn from data and make predictions or decisions based on patterns and relationships discovered in that data.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Machine Learning** Machine Learning, Machine Learning Examples, Types of Machine Learning, Supervised Learning, Examples of Supervised Learning, Unsupervised Learning, Semi Supervised Learning, Reinforcement, ML Applications, Machine Learning Life Cycle, AI vs ML, Data in Machine Learning, Data Processing, Data Cleaning, Inconsistent column, Missing data, Outliers, Duplicate rows, Data cleansing tools, Tidy data set.	**10**	**20**
2	**Introduction to Supervised Learning** Classification problems, Linear Regression – Predicting numerical value, finding best fit line with linear regression, Perceptron, learning neural networks structures, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, support vector machines.	**10**	**25**
3	**Unsupervised Learning** **Fuzzy C-Means** – Clustering, Types of Clustering, Fuzzy, Fuzzy terms, Fuzzy set, Fuzzy C Means, Membership function, Algorithmic steps for Fuzzy c-means clustering, Result of Fuzzy c-means clustering. **Unsupervised Learning** - Machine Learning, Unsupervised Learning, Advantages of Unsupervised Learning, Disadvantages of Unsupervised Learning, Difference between Supervised and Unsupervised Learning, Types of Unsupervised Learning, Clustering, Example of Clustering, Types of Clustering, Types of Clustering Techniques, Partitioning (Centroid) Clustering, K-Means Clustering, Example of centroid-based clustering.	**20**	**30**
4	**Machine Learning and Speech Recognition** **Speech Recognition -** Introduction to Speech Recognition, Types of Speech Recognition, Speaker Dependent Model, Speech Recognition Applications, features of speech recognition systems, Advantages of Speech Recognition, Disadvantages of Speech Recognition. **Pattern Recognition –** Define pattern, Pattern Recognition, Applications Of Pattern Recognition, Pattern Recognition System, People detection with recognition based on video deep learning, Design Principles, Features, Training and Learning in Pattern Recognition, Advantages, Disadvantages.	**20**	**25**
	Total	**60**	**100**

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	20	20	20	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Explain the concept of supervised, unsupervised and semi-supervised learning.
CO2	Develop algorithms to learn linear and non-- linear models using software.
CO3	Perform creative work in the field ML to solve given problem.
CO4	Explain the principles and applications of agglomerative hierarchical clustering.
CO5	Explain the challenges and solutions associated with noise in maximum margin classification.

Reference Books

1. **An Algorithmic Perspective (TextBook)**
   By Tom M Mitchell | McGraw Hill Education, 2013.
2. **The Art and Science of Algorithms that Make Sense of Data**
   By Peter Flach | First Edition, Cambridge University Press, 2012.

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	02080503-T - SYSTEM ANALYSIS AND DESIGN	
Course Objective	1. Strong grasp of DeFi fundamentals, including blockchain's role. 2. Practical experience with DeFi applications like decentralized exchanges, lending, yield farming, and stablecoins. 3. Analytical skills in addressing DeFi challenges, regulations, and predicting future trends.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Decentralized Finance (DeFi)** Introduction of DeFi,Key concepts and principles of DeFi,Advantages and benefits of DeFi,Centralized and decentralize concepts, Applications of centralized system and decentralized system,Comparison between centralized finance and decentralized finance	**10**	**15**
2	**Blockchain Technology** Introduction to blockchain technology Key components of a blockchain Distributed ledger technology Consensus mechanisms in blockchain	**15**	**25**
3	**Smart Contracts and Decentralized Applications (DApps)** Introduction to smart contracts How smart contracts work Benefits and use cases of smart contracts Decentralized applications (Dapps) and their role in DeFi	**15**	**25**
4	**Decentralized Finance Platforms and Services** Overview of popular DeFi platforms (e.g., Ethereum, Binance Smart Chain) Decentralized exchanges (DEX) Decentralized lending and borrowing platforms Yield farming and liquidity mining, Decentralized stablecoins and decentralized oracles	**20**	**35**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Evaluate
Weightage	20	25	30	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Strong grasp of DeFi fundamentals, including blockchain's role.
CO2	Basic Understanding of Centralized and Decentalized System.
CO3	Compare different application and understand their working by analyzing them.
CO4	Practical experience with DeFi applications like decentralized exchanges, lending, yield farming, and stablecoins.
CO5	Analytical skills in addressing DeFi challenges, regulations, and predicting future trends.

Reference Books

1.	**Mastering DeFi (TextBook)** By Fabian Klauder | Packt Publishing.
2.	**DeFi and the Future of Finance** By Campbell R. Harvey and Ashwin Ramachandran | Wiley

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	13990503-T - PYTHON	
Course Objective	1. To extract valuable insights, patterns, and knowledge from raw data 2. To learn from data and make predictions or decisions based on patterns and relationships discovered in that data.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	3	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Data Analysis and Visualization** Overview of data analysis and visualization, Introduction to different types of data (structured, unstructured, semi-structured), Basics of data collection and cleaning, Understanding data analysis workflow, Introduction to data visualization techniques and best practices.	**10**	**15**
2	**Data Analysis Techniques** Introduction to statistical analysis, Descriptive statistics: measures of central tendency and dispersion, Inferential statistics: hypothesis testing, confidence intervals, Exploratory data analysis: data exploration and visualization,	**15**	**25**
3	**Data Visualization Tools** Introduction to data visualization tools **Working on different library & tools** Creating basic visualizations (bar charts, line graphs, scatter plots), Customizing visualizations: colors, labels, axes, and legends, Creating interactive visualizations (filters, tooltips, drill-downs), Incorporating visualizations into reports and dashboards	**20**	**30**
4	**Advanced Data Analysis and Visualization** Time series analysis and forecasting, Characteristics of Time Series data, Applications, Time Series Models Network analysis and visualization, Storytelling with data: effectively communicating insights through visualizations	**15**	**30**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	30	20	20	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may

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vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Explain the concept of visualization in the processing and analysis of data
CO2	Develop visualization methods and visualization systems using software applications
CO3	Perform creative work in the field of visualization.
CO4	Evaluating the effectiveness of visualizations for specific data, task, and user types.
CO5	Apply different techniques of visulaization get results.

Reference Books	
1.	**Data Visualization (TextBook)** By Kieran Healy | Princeton University Press
2.	**Fundamentals of Data Visualization** By Claus O. Wilke | O'Reilly Media

List of Practical	
1.	Write a program for data processing using pandas library of python to convert one dimensional array of tuple and dictionary to series.
2.	Write a program for data processing using pandas library of python to convert two dimensional array to dataframe and exploring different commands of dataframe.
3.	Creating dataframe, reading, writing, accessing, filtering, sorting, adding and modifying data in dataframe for data analysis.
4.	Data processing for sorting, adding and modifying data in data frame for data analysis.
5.	Grouping and aggregating, merging and joining, reshaping data, handling dates and times for data analysis
6.	Basic data visualization using matplotlib library of python library bar charts, line graphs, scatter plots.
7.	Basic data visualization using plotly library of python library bar charts, line graphs, scatter plots.
8.	Basic and Customised data visualizations: colors, labels, axes, and legends and Creating interactive visualizations (filters, tooltips, drill-downs) using different library of python
9.	Time series analysis and forecasting.
10.	Data exploration of real world projects.

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Course	Bachelor in Computer Application (BCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	02070601-T - INTRODUCTION OF WEB TECHNOLOGY	
Course Objective	1. Understand cryptocurrencies, block chain, and security. 2. Master Bitcoin, altcoins, and real-world applications. 3. Discuss regulations, risks, and future trends 4. Evaluating different consensus mechanisms and their implications. 5. Create Private network and apply functions on it.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Cryptocurrency and Blockchain Technology** Overview of cryptocurrencies and their historical context, Introduction to block chain technology and its core concepts, Cryptographic principles underlying cryptocurrencies, Key components of a block chain ecosystem, Types of block chain networks: public, private, and hybrid	**10**	**15**
2	**Bitcoin and Blockchain Fundamentals** Understanding Bitcoin: its origin, purpose, and architecture Bitcoin mining: consensus mechanisms and proof-of-work Bitcoin transactions: inputs, outputs, and scripts Wallets and addresses: generating, storing, and using cryptocurrencies Bitcoin security and privacy considerations	**20**	**30**
3	**Alternative Cryptocurrencies and Consensus Mechanisms** Overview of alternative cryptocurrencies (Altcoins) like Ethereum, Litecoin, Ripple, Smart contracts and decentralized applications (DApps), Ethereum and the concept of programmable money, Consensus mechanisms beyond proof-of-work: proof-of-stake, delegated proof-of-stake, Evaluating different consensus mechanisms and their implications	**20**	**30**
4	**Blockchain Technology** Introduction of block chain technology, Types of block chains (public, private, consortium), Consensus algorithms (Proof of Work, Proof of Stake, etc.), Smart contracts and decentralized applications (DApps)	**10**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Create
Weightage	20	20	30	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand cryptocurrencies, block chain, and security.
CO2	Basic knowledge of Master Bitcoin, altcoins, and real-world applications.
CO3	Discuss regulations, risks, and future trends.
CO4	Evaluating different consensus mechanisms and their implications.
CO5	Create Private network and apply functions on it.

Reference Books

1.	**Mastering Bitcoin (TextBook)** By Andreas M. Antonopoulos | O'Reilly Media, 2014
2.	**Cryptocurrency** By Edward Cartwright | Polity, 2018

List of Practical

1.	Set up a cryptocurrency wallet and perform a small transaction to understand the process.
2.	Explore blockchain explorers to analyze transaction details.
3.	Simulate a proof-of-work mining process to understand hashing and difficulty.
4.	Create a simple smart contract using a blockchain platform like Ethereum
5.	Compare different consensus mechanisms and their use cases.
6.	Build a private blockchain network, configure nodes, and test scalability.

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	02070303-T - BASICS OF OPERATING SYSTEM	
Course Objective	1. Get knowledge about Linux system in CUI and GUI surfaces. 2. Learn programming techniques in Linux scripting.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Overview of Unix** UNIX as an operating system – Kernel – Shell – User – UNIX File System – Files & Directory – File System, Hierarchy, Basic UNIX Commands, Listing Files & Directories. Copying, Deleting, Renaming, Comparing, Splitting, Linking Files., Creating, Navigating, and Removing Directories.	**15**	**25**
2	**Unix Commands** Setting Access permission of files & directories, Using VI editor of UNIX. Paging & Printing Files., Status of users terminals & setting terminal, Characteristics, Cutting, Pasting, Sorting of Files., Searching for a pattern in a string. Process Status, Process Killing	**15**	**25**
3	**System Administration** Adding & Modifying Users' accounts, Controlling Passwords. Creating & Mounting File System, init process & inittab startup files, Run levels., Managing Disk Space(df , du ,cpio), Searching Files with the find command, Using FTP protocol to move files between computers. 'Shutdown' commands.	**15**	**25**
4	**Shell Programming** Shell Script, System variables & shell variables. Shell termination, Looping statements; conditional statements; case statements. Logical operators, Mathematical expression, Command line parameters – Positional parameters. String handling.	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	20	25	25	15	15

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understanding of the Linux operating system architecture and its various components, including kernel, shell and utilities.
CO2	Learn editor and implement different commands on linux terminal.
CO3	Test how to work with users accounts and manage system administration.
CO4	Create file system and directories, operate those using programs.
CO5	Evaluate shell scripts, positional parameters and string handling to solve certain problems.
CO6	Prepare C programming and shell scripts using Linux.

Reference Books

1.	**Advanced C Programming by Example** By John W Perry | PWS Publishing Company
2.	**Advanced Programming in Unix Environment** By Richard Stevens | Addison Wesley
3.	**Begining Linux Programming (TextBook)** By Neil Mathew & Richard Stones | Wrox Press
4.	**Beginning RedHat Linux** By Bhattacharya, Mauro, Mamone, Kapil Sharma, Thomas, Whiting, Gundavaram | Wrox Press
5.	**Expert C Programming** By Peter Van Der Linden | Publisher - Prentice Hall, also available through o'Reilly Media Press
6.	**Instant Linux/Unix (TextBook)** By Andrew E vans, Neil M athew & Richard Stones | Wrox Press
7.	**Linux Cookbook (TextBook)** By Carl a Schroder | o'Reilly Media

List of Practical

1.	Create a Shell Script to print 'Rai University'
2.	Create a Shell Script to read and display content of file.
3.	Create a Shell Script to read from command line.
4.	Create a Shell script to append content of one file to another
5.	Create a Shell script to accept a string in lower case letters from a user, & convert to upper case letters.
6.	Create a Shell script to find numbers of characters, words & lines of a given input file.
7.	Create a Script to reverse a string and display it.
8.	Create a Script to check a string is palindrome.
9.	Create a shell script to reverse the digits of a given 5-digit number.
10.	Create a shell script to print 20 to 1. In reverse order.
11.	Write a shell Script to print 'Rai University' 10 times with use of While loop.
12.	Write a program to print 1 to 5 with use of for loop.
13.	Write a program to demonstrate case statement demo.
14.	Write a program to read two numbers from user and find that both are equal or not. Use if statement.
15.	Write a program demonstrate if ..elif demo.

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Core Courses	
Prerequisite	02070303-T - BASICS OF OPERATING SYSTEM	
Course Objective	1. To understand the basic concepts of Path testing, Logic based testing 2. To implement Data flow testing, domain testing	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**INTRODUCTION TO DATA WAREHOUSING** Introduction – What is Data Warehousing - Data Warehousing concepts, Data Warehousing building blocks : Defining features – Data Warehouse and Data Marts, Issues in Data Warehousing -Benefits of Data Warehousing, Overview of Components, Metadata : Use of metadata in Data Warehouse, Categories of Metadata – Roles of Metadata, Architecture of Data Warehouse, Data Warehouse models, Methodology for Data Warehousing	**15**	**25**
2	**DATA DESIGN AND DATA PREPARATION** ETL Process overview, Data Extraction, Data Transformation, Data Loading, Data Quality, Challenges, ETL Tools, OLAP in Data Warehouse, Features and operations of OLAP – (Drill-down, Rollup, Slice, Dice), OLAP schema design OLAP Models	**15**	**25**
3	**INTRODUCTION TO DATA MINING** Motivation for Data Mining, Data Mining: On What kind of Data?, Definition and Functionalities: What kind of patterns can be mined?, Issues in DM, KDD Process, Classification of Data Mining Systems	**10**	**15**
4	**DATA PREPROCESSING, CONCEPT DISCRIPTION AND ASSOCIATION RULE MINING** Why Preprocess the Data?, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation, Data Mining Primitives: What Defines a Data Mining Task? What is concept description?, Association Rule Mining: Market basket analysis, Basic concepts, Finding frequent item sets: Apriori algorithm, generating rules, Improved Apriori algorithm, Frequent pattern growth algorithm.	**20**	**35**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	30	10	10	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand the functionality of the various data mining and data warehousing component
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analyzing techniques of various data using OLAP Cube
CO4	Describe different methodologies used in data mining and data ware housing.
CO5	Compare different approaches of data ware housing and data mining with various technologies

Reference Books	
1.	**Data Mining: Concepts and Techniques** By Jiawei Han and Micheline Kamber | Morgan Kaufmann Publishers

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Core Courses	
Prerequisite	02070403-T - INTRO. TO COMPUTER ORG. & ARCHITECHTURE	
Course Objective	1. Build an understanding of the fundamental concepts of computer networking 2. Familiarize the student with the basic taxonomy and terminology of the computer networking. 3. Allow the student to gain expertise in some specific areas of networking.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Networking** Definition of network and Data Communication, Network Applications, Standard organization (ISO, CCITT, ANSI, IEEE, ITU, ISOC, IETF) Data Flow: Simple Duplex, Half duplex, Full Duplex, data communications key points Categories of network :LAN, WAN, MAN Internetworks, Definition of Protocol, line configurations, multi point, point-point, unicast, multicast, broad cast	15	25
2	**The Reference Model and Topology** OSI model & function of each Layer, TCP/ IP model Comparison of OSI & TCP/IP Topology and its Types: Mesh, Star, Ring, Bus, Tree Configuration of topologies in Cisco packet tracer Different types of servers, File Application, Print, Mail, Proxy, Web servers	15	25
3	**Transmission Media & Network Components** Transmission Media: Guided Media and Unguided media Network Components: Hub ,Switches, Routers ,Bridge, NIC, Repeater, Gateway, Network software, Wired Network, Wireless Networks Network commands	15	25
4	**IP Protocol and Network Applications** IP protocol, IP V4 Header & protocol functions, IP addressing schemes, Subnet & subnet masking HTTP,WWW,URL,DHCP,DNS (Domain Name System),Name Server, File transfer protocol & Trivial FTP, Electronic Mail, Functions of E-mail systems (mail box & address),User agents, Message format, Mail Protocols (SMTP, POP, IMAP, MIME).	15	25
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	30	20	20	15	5

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Describe the components and infrastructure that form the basis for most computer networks
CO2	Describe the technical aspects of data communications on the Internet.
CO3	Design different topologies using Packet tracer.
CO4	Understand the use of various Network components and Transmission Media.
CO5	Explain Network Applications such as IPv4, IPv6, Subnet masking, http, DNS etc.

Reference Books	
1.	**Computer Network (TextBook)** By Andrew S. Tanenbaum | Pearson
2.	**Introduction to Data Communication and Networking (TextBook)** By Behrouz Forouzan | TMH

List of Practical	
1.	Bus Topology using CISCO Packet Tracer
2.	Star Topology using CISCO Packet Tracer
3.	Mash Topology using CISCO Packet Tracer
4.	Ring Topology Using CISCO Packet Tracer
5.	Network basics Commands

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Core Courses	
Prerequisite	03080101-T - PROGRAMMING IN C	
Course Objective	1. Establishing Fundamental Java Programming Skills 2. Mastery of Object-Oriented Concepts in Java 3. Advanced Java Concepts: Inheritance, Polymorphism, Exception Handling, and GUI Programming	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Java** Basics of Java programming, Creating first java classes. Features of Java, Adding comments to a java, Saving, compilingand running a java application. Creating a java application using GUI output Data types, Variables, Operators. Control structures including selection, Looping, Java methods, Overloading, Math class. Arrays in Java, Advantages of Java, Applications of Java, Constants, Literals, variables, Keywords, Identifiers, numeric type conversion, Operators in Java. String handling functions and string buffer class.	**10**	**25**
2	**Methods, Object , Classes, Conditions & Loops in Java** Basics of objects and classes in Java. Constructors, Finalizer, Visibility modifiers, Methods and objects. Inbuilt classes like String, Character, String Buffer, File this reference. Method overloading, Constructors, Sending arguments to constructors, Constructors overloading. 'this' keyword, Static variable. Working with constants, if and if…..else, Nesting if… else, Using logical AND and OR operators, switch statement, Using the conditional AND not operators, Using the NOT operator, Understanding precedence. While loop, for loop, do…. while loop.	**15**	**25**
3	**Inheritance and Polymorphism** Inheritance in Java, Super and sub class. Overriding, Object class, Polymorphism, Dynamic binding. Generic Programming, Casting objects, Instance of operator, Abstract class, Interface in Java, Package in Java, Accessing super class methods. Constructor calling during inheritance, Extending classes. Method overriding, Final method, Final super class, Static method.	**20**	**25**
4	**Exception Handling & Multi-Threading** Learning about exceptions, Understanding the limitations of traditional error, and handling. Trying code and catching exceptions. Throwing and catching multiple exceptions. 'finally' block, Understanding the advantages of exception handling. Checked and unchecked exception, Creating own exceptions (custom exception). Introduction, Thread Life Cycle. Creating and running thread (using Thread class and, Runnable interface).Thread Priorities. Thread join (), sleep () method, Thread synchronization. Exception handling with try-catch-finally, Collections in Java. Introduction to JavaBeans and Network Programming.	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	25	25	10	10	10	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand fundamentals of Java programming
CO2	Learn object-oriented programming, including inheritance and polymorphism
CO3	Gain proficiency in exception handling and multithreading
CO4	Explore inbuilt classes and libraries in Java
CO5	Basic knowlwdge of advanced topics such as JavaBeans, network programming, and collections

Reference Books

1.	**Object Oriented Programming in java (TextBook)** By Dr. G.T.Thampi | Dreamtech
2.	**Programming with Java (TextBook)** By E. Balagurusamy | Sixth Edition, Tata Mc Graw Hill

List of Practical

1.	Write a program to convert rupees to dollar. 60 rupees=1 dollar.
2.	Write a program that calculate percentage marks of the student if marks of 6 subjects are given.
3.	Write a program to enter two numbers and perform mathematical operations on them.
4.	Write a program to find length of string and print second half of the string.
5.	Write a program to accept a line and check how many consonants and vowels are there in line.
6.	Write a program to count the number of words that start with capital letters.
7.	Write a program to find that given number or string is palindrome or not.
8.	Create a class called Student. Write a student manager program to manipulate the student information from files by using FileInputStream and FileOutputStream.
9.	Refine the student manager program to manipulate the student information from files by using the BufferedReader and BufferedWriter.
10.	Refine the student manager program to manipulate the student information from files by using the DataInputStream and DataOutputStream. Assume suitable data.

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	05070409-T - MACHINE LEARNING ALGORITHMS(T)	
Course Objective	1. To explain the fundamentals of deep learning, Convolution neural network. 2. Explore Convolutional Neural Networks (CNNs) in depth, including their architecture and applications. 3. Examine various problem domains in machine learning, such as classification, detection, segmentation, and generation. 4. Apply transfer learning methods to enhance model performance and efficiency. 5. Utilize hyperparameter optimization techniques to fine-tune models for improved results	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Deep Learning** Overview of machine learning and deep learning ,History and evolution of neural networks, Biological inspiration: the neuron and neural networks, Types of neural networks (Feedforward, Recurrent, Convolutional)	**10**	**20**
2	**Neural Network Fundamentals** Perceptrons and activation functions, Backpropagation and gradient descent, Weight initialization and regularization, Loss functions for various tasks (classification, regression)	**15**	**25**
3	**Deep Learning Frameworks** Introduction to deep learning libraries (TensorFlow, PyTorch), Setting up development environments, Building and training simple neural networks	**10**	**15**
4	**Natural Language Processing (NLP) with Deep Learning, Advanced Topics in Deep Learning** Text data preprocessing, Word embeddings (Word2Vec, GloVe), Recurrent Neural Networks for NLP, Sequence-to-sequence models for machine translation Generative Adversarial Networks (GANs),Reinforcement Learning basics,Transfer learning and fine-tuning pre-trained models,Ethical considerations in deep learning	**25**	**40**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	20	20	20	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	To explain the fundamentals of deep learning, Convolution neural network.
CO2	Explore Convolutional Neural Networks (CNNs) in depth, including their architecture and applications.
CO3	Examine various problem domains in machine learning, such as classification, detection, segmentation, and generation.
CO4	Apply transfer learning methods to enhance model performance and efficiency.
CO5	Utilize hyperparameter optimization techniques to fine-tune models for improved results.

Reference Books

1.	**"Deep Learning" (TextBook)** By Ian Goodfellow | Third Edit on, O'reily Media, 2012
2.	**Dive into Deep Learning** By Yoshua Bengio | (1 ed.), Corwin, 2019

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	13990402-T - JAVA PROGRAMMING	
Course Objective	1.Understand the core blockchain concepts and their importance in enterprise settings. 2.Understand demonstrate proficiency in using various Hyperledger frameworks, including Fabric, Sawtooth, and Indy. 3. Understand capable of developing and deploying secure enterprise blockchain applications with appropriate security measures. 4. Understand the integrate blockchain solutions into existing enterprise architecture, ensuring compatibility and efficiency. 5. Understand their knowledge to analyze and propose blockchain solutions for advanced use cases such as supply chain management, identity verification, and more.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Blockchain and Hyperledger** **Understanding Blockchain Technology -** Overview of blockchain fundamentals, Types of blockchain networks (public vs. private), Real-world use cases and examples **Introduction to Hyperledger -** An overview of the Hyperledger project, Key Hyperledger frameworks and tools, Selecting the right Hyperledger framework for your project	**10**	**20**
2	**Hyperledger Fabric - Building a Private Blockchain** **Hyperledger Fabric Basics -** Architecture and components of Hyperledger Fabric, Setting up a development environment, Creating a simple Hyperledger Fabric network **Chaincode Development in Fabric -**Writing smart contracts (chaincode) in Go, Deploying and invoking chaincode, Testing and debugging chaincode	**15**	**25**
3	**Advanced Fabric Development and Deployment** **Fabric Network Configuration -** Configuring channels, peers, and orderers, Identity management in Fabric, Exploring Fabric's consensus mechanisms **Security, Scalability, and Integration -** Security considerations in Fabric, Strategies for scaling Fabric networks, Integrating Hyperledger Fabric with existing systems	**20**	**30**
4	**Beyond Fabric - Other Hyperledger Frameworks**	**15**	**25**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Hyperledger Sawtooth - Overview of Hyperledger Sawtooth, Setting up a Sawtooth development environment, Building a Sawtooth network and transaction processors **Hyperledger Indy and Final Projects -** Introduction to Hyperledger Indy for decentralized identity, Final projects: Students develop and present blockchain applications, Reflection on the future of enterprise blockchain		
		Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Evaluate	Create
Weightage	25	15	20	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand the core blockchain concepts and their importance in enterprise settings.
CO2	Understand demonstrate proficiency in using various Hyperledger frameworks, including Fabric, Sawtooth, and Indy.
CO3	Understand capable of developing and deploying secure enterprise blockchain applications with appropriate security measures.
CO4	Understand the integrate blockchain solutions into existing enterprise architecture, ensuring compatibility and efficiency.
CO5	Understand their knowledge to analyze and propose blockchain solutions for advanced use cases such as supply chain management, identity verification, and more.

Reference Books

1. **Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications (TextBook)**
By Imran Bashir | Packt Publishing

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	13990503-T - PYTHON	
Course Objective	1.Understand the fundamental concepts of machine learning and its various types. 2.Understand the importance of model selection and validation techniques. 3.Understand linkage-based clustering algorithms and the k-means algorithm. 4.Understand Bayesian learning principles and their application in machine learning. 5.Evaluate and apply feature selection, transformation, and learning techniques for enhancing model performance	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction** Machine Learning, Different types of machine learning, Linear regression, Logistic regression, K-Nearest Neighbour, Support Vector Machines: Hard SVM, Soft SVM, Optimality conditions, Duality, Kernel trick, Implementing Soft SVM with Kernels,	**15**	**20**
2	**Decision Trees** Decision Tree algorithms, Random forests, Neural Networks: Feedforward neural networks, Expressive power of neural networks, SGD and Backpropagation, Model selection and validation: Validation for model selection, k-fold cross-validation, Training validation-Testing split, Regularized loss minimization	**15**	**25**
3	**Unsupervised Learning and Generative Models** Clustering: Linkage-based clustering algorithms, k-means algorithm, Spectral clustering Dimensionality reduction: Principal Component Analysis, Random projections, Compressed sensing.	**15**	**20**
4	**Generative Models** Maximum likelihood estimator, Naive Bayes, Linear Discriminant Analysis, Latent variables and Expectation-maximization algorithm, Bayesian learning Feature Selection and Generation: Feature selection, Feature transformations, Feature learning	**10**	**25**
	Total	**55**	**90**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	20	25	10	25	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand the fundamental concepts of machine learning and its various types.
CO2	Understand the importance of model selection and validation techniques.
CO3	Understand linkage-based clustering algorithms and the k-means algorithm.
CO4	Understand Bayesian learning principles and their application in machine learning.
CO5	Evaluate and apply feature selection, transformation, and learning techniques for enhancing model performance

Reference Books

1.	**"Machine Learning" (TextBook)** By Mitchell Tom | Tata Mcgraw- Hill

List of Practical

1.	Write a Python program to implement Simple Linear Regression.
2.	Using Python develop Logistic Regression Model for a given dataset.
3.	Identifying handwritten digits (0-9) using SVM on the MNIST dataset.
4.	Predicting loan approval decisions using a decision tree.
5.	Classifying diseases using a random forest on medical data.
6.	Clustering news articles into topics based on their content.
7.	Reducing image dimensions for face recognition using PCA.
8.	Categorizing sentiment of movie reviews using a Naive Bayes classifier.
9.	Segmenting an image into foreground and background using Gaussian Mixture Model (GMM).
10.	Handwriting recognition using a feedforward neural network.

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Course	Bachelor in Computer Application (BCA)	**Semester - 4**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	13990313-T - CRYPTOCURRENCY AND DIGITAL LEDGERS(T)	
Course Objective	1. Understand the overall concepts of golang and their developing infrastructure. 2. Get knowledge about array,loop and their type casting. 3. Understand basic structure, error handling and interface. 4. Apply different library and build application. 5. Building new applications and perform testing and debugging.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	3	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to GOLANG** Overview of Go language, its history and design principles, Setting up the development environment, Compiling and Executing Go, Programs, Installation, Verifying the Installation,Go syntax basics: Data Types, Variables, Constants, Operators, and Expressions	**10**	**25**
2	**Flow Control** Conditional statements (if, if…else, Nested If, Select, Switch), Loops (for, Nested for, while, Continue, goto, Infinite), Functions and scopes, String, Ponters, Arrays, Slices and Maps, Arrays and Slices in Go, Working with Maps in Go, Range, Recursion, Type Casting	**15**	**25**
3	**Structs and Interfaces, Concurrency in Go** Defining and using structs in Go, Interfaces in Go and their use cases, Error handling Goroutines and Channels, Synchronization and deadlocks, Best practices for writing concurrent code in Go	**10**	**25**
4	**Package Management, Web Development with Go** Go's Standard Library,Third-party packages,Creating and publishing Go packages Introduction to HTTP and REST APIs, Building web applications with Go, Debugging and profiling Go web applications	**10**	**25**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Evaluate	Create
Weightage	15	20	30	15	20

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vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand the overall concepts of golang and their developing infrastructure.
CO2	Get knowledge about array,loop and their type casting.
CO3	Understand basic structure, error handling and interface.
CO4	Apply different library and build application.
CO5	Building new applications and perform testing and debugging.

Reference Books

1.	**Professional C#.Net (TextBook)** By Christian Nagel | Wrox Publication
2.	**ASP.NET Complete Reference** By Matthew Macdonald and Robert Standefer | TMH

List of Practical

1.	write a simple "Hello, World!" program.
2.	Write a program that uses an if statement to check a condition.
3.	Write a program that uses a for loop to iterate over a range of numbers.
4.	Write a program with multiple functions, including functions with parameters and return values.
5.	Write a program to create and initialize an array .Manipulate elements in a slice, including appending and slicing operations.
6.	Define a struct with multiple fields and create instances of the struct. Write methods for the struct.
7.	Write a program that performs an operation that could produce an error (e.g., file I/O).
8.	Write a program that launches multiple goroutines to perform concurrent tasks.
9.	Create a custom Go package with functions.
10.	Create a simple REST API with endpoints for CRUD operations. Implement handlers for the endpoints and test them using a tool like Postman.

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Course	Bachelor in Computer Application (BCA)	**Semester - 5**
Type of Course	Core Courses	
Prerequisite	13990202-T - DATABASE MANAGEMENT SYSTEM	
Course Objective	1.Understand the development of applications using Programming Language of SQL. 2.Understand the uses the database file and need for create & manage files. 3.Use different types of physical implementation of database to manage transactions.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Basic Data base Management System Architecture, Need of ER diagrams** History of Data base Systems DBMS structure, DBMS Applications, File System , View of Data ,Data Abstraction , Data base Users and Administrator, Transaction Management , Storage Manager the Query Processor, Database design and ER diagrams, Beyond ER Design Entities, Attributes and Entity sets, Additional features of ER Model, Concept Design with the ER Model ,Conceptual Design for Large enterprises	**15**	**25**
2	**Relational Database Management System** Introduction to the Relational Model, Relationships and Relationship sets, Integrity Constraint Over relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views, altering of Table, Relational Algebra, Selection and projection set operations, renaming, Joins, Division, Examples of Algebra overviews, Relational calculus, Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra and calculus	**10**	**25**
3	**Introduction to PL/SQL** Form of Basic SQL Query, Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries Set, Comparison Operators, Aggregative Operators, NULL values, Comparison using NULL values, Logical connectivity's Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active databases, Schema refinement , Problems Caused by redundancy, Decompositions, Problem related to decomposition, Reasoning about FDS, Dependency preserving Decomposition, Schema refinement in Data base Design, Multi valued Dependencies	**25**	**30**
4	**Transaction Processing** Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols Multiple Granularity, Recovery and Atomicity, Log Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with loss of nonvolatile storage, Advance Recovery systems, Remote Backup systems	**10**	**20**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	20	20	10	10	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand the development of applications using Programming Language of SQL.
CO2	Understand the uses the database file and need for create & manage files.
CO3	Use different types of physical implementation of database to manage transactions
CO4	Use different types of physical implementation of database and understand ER diagram.
CO5	Write a program using SQL queries to implement join and trigger.

Reference Books	
1.	**Database Systems using ORACLE** By Nilesh shah | PHI Publication
2.	**SQL and Relational Theory (TextBook)** By C.J.Date | O'Reilly, 2009
3.	**SQL/PLSQL,The Programming Language of ORACLE (TextBook)** By Ivan Bayross | BPB Publication

List of Practical	
1.	Create PL/SQL block to perform arithmetic operations.
2.	Implement PL/SQL programs using Control Structure.
3.	Implement PL/SQL program using CURSOR.
4.	Implement PL/SQL program using Exception Handling.
5.	Implement user defined procedures and Function using PL/SQL blocks.
6.	Implement various Triggers.
7.	Practice on Functional Dependencies.
8.	Create stored procedure.
9.	Practice on Normalization using various Normal Forms.
10.	Practice on Transaction Processing.

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Course	Bachelor in Computer Application (BCA)	**Semester - 5**
Type of Course	Core Courses	
Prerequisite	03070501-T - COMPUTER NETWORK	
Course Objective	1. To learn how to use Cloud Services 2. To implement Virtualization, Task scheduling algorithm and to build private network. 3. Apply Map-reduce concept to applications	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Cloud Computing** Overview, Roots of Cloud Computing, Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing. Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks	10	15
2	**Cloud Architecture** Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frameworks, Software as a Service. **Services and Applications** Cloud Deployment Models: Public vs Private Cloud, Cloud Solutions, Cloud ecosystem, Service management, Computing on demand, Identity as a Service, Compliance as a Service.	15	25
3	**Abstraction and Virtualization** Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context. Virtualization of CPU, Memory , I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Center Automation	15	25
4	**Cloud Infrastructure and Cloud Resource Management** Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture, Development, Design Challenges, Inter Cloud Resource Management, Resource provisioning and Platform Deployment, Global Exchange of Cloud Resources, Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards. **Cloud Security** Security Overview , Cloud security challenges, Cloud Security Challenges and Risks Software-as-a-Service Security. Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Application Security, Virtual Machine Security Identity and Presence Identity Management and Access Control. Autonomic Security Establishing Trusted Cloud computing, Secure Execution Environments and Communications, Identity Management and Access control Identity management, Access control, Autonomic Security Storage Area Networks, Disaster Recovery in Clouds	20	35
	Total	60	100

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy					
Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	20	20	20	10	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Analyze the different layers Cloud computing using different architectures with it's advantages and disadvantages.
CO2	Explore the Cloud Architecture along with IaaS, SaaS, PaaS using Application Frameworks.
CO3	Use the concept of Abstraction and Virtualization of CPU, Memory , I/O Devices, Virtual Clusters and Resource management
CO4	Understand the Cloud Infrastructure and Resource Management in Cloud Computing
CO5	Learn about Cloud Security to overcome different types of Challenges and Risks.

Reference Books

1.	**1. Cloud Computing: Principles and Paradigms** By Rajkumar Buyya, James Broberg, Andrzej M Goscinski | Wiley publication
2.	**Cloud Computing Bible (TextBook)** By Barrie Sosinsky | Wiley India
3.	**Cloud Computing: Principles, Systems and Applications (TextBook)** By Nikos Antonopoulos, Lee Gillam | Springer 2012

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Course	Bachelor in Computer Application (BCA)	**Semester - 5**
Type of Course	Core Courses	
Prerequisite	13990101- T - PROGRAMMING IN C	
Course Objective	This course covers the basics and advanced Python programming to harness its potential for modern computing requirements.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Python** The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration. **Functions, Scoping and Abstraction** Functions and scoping, Specifications, Recursion, Global variables, Modules, Files, System Functions and Parameters.	**15**	**25**
2	**Structured Types, Mutability and Higher-Order Functions** Strings, Tuples, Lists and Dictionaries, Lists and Mutability, Functions as Objects **Testing, Debugging, Exceptions and Assertions** Types of testing – Black-box and Glass-box, Debugging, Handling Exceptions, Assertions	**15**	**25**
3	**Classes and Object-Oriented Programming** Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding **Simple Algorithms and Data structures** Search Algorithms, Sorting Algorithms, Hash Tables	**15**	**25**
4	**Advanced Topics I** Regular Expressions – REs and Python, Plotting using PyLab, Networking and Multithreaded Programming – Sockets, Threads and Processes, Chat Application **Advance Topics II** Security – Encryption and Decryption , GraClassical Cyphers,phics and GUI Programming – Drawing using Turtle, Tkinter and Python, Other GUIs	**15**	**25**
	Total	**60**	**100**

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	20	20	10	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Learn basic programming concepts such as function, control structures and Branching Statements in python.
CO2	Understand Object Oriented programming approaches.
CO3	Learn about various structured types.
CO4	Understand the use of Testing, Debugging, Exceptions and Assertions.
CO5	Develop, Test and deploy GUI based application using Python.

Reference Books

1.	**Core Python Programming (TextBook)** By R. Nageswara Rao, | dreamtech
2.	**Fundamentals of Python – First Programs** By Kenneth A. Lambert | CENGAGE Publication

List of Practical

1.	Develop programs to understand the control structures of python
2.	Develop programs to learn different types of structures (list, dictionary, tuples) in python
3.	Develop programs to learn the concept of functions scoping, recursion and list mutability
4.	Develop programs to understand the working of exception handling and assertions.
5.	Develop programs for data structure algorithms using python – searching, sorting and hash tables.
6.	Develop programs to learn regular expressions using python.
7.	Develop a chat room application using multithreading
8.	Learn to plot different types of graphs using PyPlot
9.	Implement classical ciphers using python.
10.	Draw graphics using Turtle.
11.	Develop programs to learn GUI programming using Tkinter.

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Course	Bachelor in Computer Application (BCA)	**Semester - 5**
Type of Course	Core Courses	
Prerequisite	03070501-T - COMPUTER NETWORK	
Course Objective	1. To provide an introduction to the fundamental principles of cryptography and network security. 2. To study various Encryption techniques. 3. To illustrate how to prevent, detect, and mitigate security threats against the network.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	1	0	4	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to cryptography and Network Security** Roadmap, Introduction to security, Security Trends, OSI security Architecture ,Security Attacks, Security services, Security Mechanisms, A model for network Security, Security Attack and Security Threat, Malicious Software Hacking, Cryptography, Digital Signature, Firewall and its types, User identification and authentication, Other security measures	**15**	**25**
2	**Encryption Techniques** Symmetric Cipher model, Substitution Techniques, Transposition Techniques Steganography , Block Cipher Principles, DES (Data Encryption Standard), Strength of DES, Block Cipher design principles. AES (Advance Encryption Standard), Origin, Evaluation, AES Cipher , More on Symmetric ciphers- Block cipher mode of operation.	**15**	**25**
3	**Public Key Cryptography and RSA** Principles of public key cryptosystems, Applications for public key Cryptosystems, RSA Algorithm, Security of RSA, Key Management- Distribution of Public keys, Distribution of secret keys using public key cryptography, Diffie-Hellman Key Exchange	**15**	**25**
4	**Message Authentication, Hash Function and Electronic Mail Security –Network Security** Authentication Requirements, Authentication Functions, MAC (Message Authentication Codes), Hash Functions, Birthday attacks, Secure Hash Algorithm (SHA), PGP and its operation, S/MIME, MIME and its Functionality , IP Security, Applications, Architecture, Services, Security Association , AH,ESP, Web security threats, SSL and SET, FIREWALL and its types	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	15	15	15	15	25	15

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand different types of cryptographic algorithm
CO2	Explain Basic concept of Message Authentication Codes
CO3	Enable the students to learn fundamental concepts of computer security and cryptography and utilize these techniques in computing systems
CO4	Understand management issues and algorithm
CO5	Describe importance of RSA Algorithm and Asymmetric cryptography

Reference Books

1.	**Cryptography and Network Security (TextBook)** By William Stalling | Pearson

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Course	Bachelor in Computer Application (BCA)	**Semester - 5**
Type of Course	Project work, Seminar and Internship	
Prerequisite		
Course Objective	-	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
0	0	4	4	-	-	100	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Project Guideline**		**100**

AIM
This course provides an opportunity for students to apply the knowledge and skills acquired in the core courses to larger and more complex problems and to gain experience in working in teams.
LEARNING OUTCOMES
This course is designed to provide the student experience in working with a client organization from the initial request through a final design and development of prototype software.
The student would be able to..
• Students will be exposed to software development process by choosing a typical business/scientific/administrative/system application.
• Define project scope, assess feasibility, and establish a project schedule.
• Get some experience in working with a client organization.
• Gain experience in working in a group for successfully developing the deliverables.
Mode of study: Half / One day off to work on the project in a week. (Atleast three hours must be allotted in weekly timetable for discussion/preparation of deliverables)
Course Contents:
1. Developing System Design
2. Writing code for the project
3. Doing testing of the code
Deliverables by the students:
· At the end of the semester, the student should be able to successfully develop the project and prepare the documentation (hard copy) as well as presentation of the project details.
· Live Demo of the Project must be shown at the time of presentation.

Total		**100**

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Course	Bachelor in Computer Application (BCA)	**Semester - 5**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	13990409-T - DEEP LEARNING FUNDAMENTALS	
Course Objective	1. Gain proficiency in designing and implementing artificial neural networks with integrated fuzzy logic for enhanced decision-making and pattern recognition. 2. Develop expertise in combining artificial neural networks and fuzzy logic for advanced data processing, modeling, and problem-solving. 3. Acquire a comprehensive understanding of Artificial Neural Networks and Fuzzy Logic, enabling adept application in diverse real-world scenarios. 4. Master the integration of Artificial Neural Networks and Fuzzy Logic for proficient data analysis, decision-making, and problem-solving. 5. Develop expertise in utilizing Artificial Neural Networks and Fuzzy Logic for advanced pattern recognition, decision-making, and intelligent system design.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	Tutorial	Lab	Credit	SEE	CIA		Total Marks
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**ARCHITECTURES** Introduction –Biological neuron-Artificial neuron-Neuron modelingLearning rules-Single layer-Multi layer feed forward network-Back propagation-Learning factors.	15	25
2	**NEURAL NETWORKS FOR CONTROL** Feedback networks-Discrete time hop field networks-Schemes of neuro–control, identification and control of dynamical systems-case studies (Inverted Pendulum, Articulation Control).	15	25
3	**FUZZY SYSTEMS** Classical sets-Fuzzy sets-Fuzzy relations-Fuzzification –Defuzzification- Fuzzy rules. FUZZY LOGIC CONTROL: Membership function – Knowledge base-Decision –making logic –Optimizations of membership function using neural networks-Adaptive fuzzy systems-Introduction to generate to genetic algorithm.	20	30
4	**APPLICATION OF FLC** Fuzzy logic control-Inverted pendulum-Image processing-Home Heating system-Blood pressure during anesthesia-Introduction to neuro fuzzy controller.	10	20
	Total	60	100

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy				
Level	Remembrance	Understanding	Analyze	Create
Weightage	25	20	25	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Gain proficiency in designing and implementing artificial neural networks with integrated fuzzy logic for enhanced decision-making and pattern recognition.
CO2	Develop expertise in combining artificial neural networks and fuzzy logic for advanced data processing, modeling, and problem-solving.
CO3	Acquire a comprehensive understanding of Artificial Neural Networks and Fuzzy Logic, enabling adept application in diverse real-world scenarios.
CO4	Master the integration of Artificial Neural Networks and Fuzzy Logic for proficient data analysis, decision-making, and problem-solving.
CO5	Develop expertise in utilizing Artificial Neural Networks and Fuzzy Logic for advanced pattern recognition, decision-making, and intelligent system design.

Reference Books

1.	**Introduction to Artificial Neural Systems (TextBook)** By Jack M. Zurada | PWS Publishing Co.
2.	**Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence** By Kosko, B | PrenticeHall

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Course	Bachelor in Computer Application (BCA)	**Semester - 5**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	13990411-T - ENTERPRISE BLOCKCHAIN APPLICATION AND HYPER LEDGER	
Course Objective	1. Implement robust encryption mechanisms to protect data integrity and confidentiality in blockchain applications. 2. Employ smart contract security best practices to prevent vulnerabilities and exploits. 3. Establish rigorous access control and authentication measures to safeguard blockchain network assets. 4. Continuously monitor and audit the blockchain application for potential security threats and vulnerabilities. 5. Foster a security-conscious development culture to ensure ongoing protection of blockchain-based systems.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	0	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Blockchain** Case Study: Bitcoin, Distributed Ledger technologies. Blockchain. Cryptography. Consensus Mechanisms. Public vs Permissioned blockchains.	**15**	**25**
2	**Ethereum and Cryptography** Ethereum vs. Bitcoin. Smart Contracts, Public Key Encryption. Digital Signatures. Hash Functions, Logic and Challenges of Smart Contracts.	**15**	**25**
3	**Cryptography and Sample Proposals** Zero-Knowledge Proofs. Secure Multi-Party computation, Sample Proposals: Guaranteed backing through Point-of-Sale. Course Enrollment Credits. Creating a market for the Campus Parking Waitlist.	**15**	**25**
4	**Introduction to Solidity and Smart Contracts** Smart contract programming architecture. Programming, deployment and execution. Solidity and Remix. DApps - Decentralized Applications running on peer-to-peer networks. Dapp User interfaces..	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze
Weightage	25	25	25	25

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Implement robust encryption mechanisms to protect data integrity and confidentiality in blockchain applications.
CO2	Employ smart contract security best practices to prevent vulnerabilities and exploits.
CO3	Establish rigorous access control and authentication measures to safeguard blockchain network assets.
CO4	Continuously monitor and audit the blockchain application for potential security threats and vulnerabilities.
CO5	Foster a security-conscious development culture to ensure ongoing protection of blockchain-based systems.

Reference Books	
1.	**Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications** By Imran Bashir | Packt Publishing

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Course	Bachelor in Computer Application (BCA)	**Semester - 6**
Type of Course	Core Courses	
Prerequisite		
Course Objective	-	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks		LAB	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
-	-	-	12	-	-	400	400

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Project Guideline**		**100**

AIM
This course provides an opportunity for students to apply the knowledge and skills acquired in the core courses to larger and more complex problems and to gain experience in working in teams.
LEARNING OUTCOMES
This course is designed to provide the student experience in working with a client organization from the initial request through a final design and development of prototype software.
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Deliverables by the students:
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· Live Demo of the Project must be shown at the time of presentation.

Total		**100**

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