HAVERI UNIVERSITY, HAVERI

03 - Year BCA Program

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SYLLABUS

Subject: Computer Applications

With Effect from 2024-25

DISCIPLINE SPECIFIC CORE COURSE (DSC) FOR SEM I – IV,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM IV/V/VI AND

ELECTIVE COURSES FOR SEM V AND VI

As per NEP (Revised): 2024-25

BCA
Academic Year 2024-25

Sem.	Type of Course	Theory/ Practical	Course Code	Subject Title	Credits	No. of hour per week Theory / Practical	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
I	DSC-1	Theory	C1BCA1T1	Computer Fundamentals & C-Programming	4	4	3 hrs.	20	80	100
	DSC-2	Practical	C1BCA1P1	C – Programming Lab	2	4	3 hrs.	10	40	50
	DSC-3	Theory	C1BCA1T2	Introduction to Algorithms	4	4	3 hrs.	20	80	100
	DSC-4	Practical	C1BCA1P2	Algorithms Lab (using C)	2	4	3 hrs.	10	40	50
	DSC-5	Theory	C1BCA1T3	Discrete Mathematical Structures	4	4	3 hrs.	20	80	100
II	DSC-6	Theory	C2BCA1T1	Data Structures	4	4	3 hrs.	20	80	100
	DSC-7	Practical	C2BCA1P1	Data Structures Lab (using C)	2	4	3 hrs.	10	40	50
	DSC-8	Theory	C2BCA1T2	Object oriented Programming using JAVA	4	4	3 hrs.	20	80	100
	DSC-9	Practical	C2BCA1P2	JAVA Lab	2	4	3 hrs.	10	40	50
	DSC-10	Theory	C2BCA1T3	Probability and Statistics	4	4	3 hrs.	20	80	100

BCA
Academic Year 2024-25

Sem.	Type of Course	Theory/ Practical	Course Code	Subject Title	Credits	No. of hour per week Theory / Practical	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
III	DSC-11	Theory	C3BCA1T1	Python programming	4	4	3 hrs.	20	80	100
	DSC-12	Practical	C3BCA1P1	Python programming Lab	2	4	3 hrs.	10	40	50
	DSC-13	Theory	C3BCA1T2	Web technologies	4	4	3 hrs.	20	80	100
	DSC-14	Practical	C3BCA1P2	Web technologies Lab	2	4	3 hrs.	10	40	50
	DSC-15	Theory	C3BCA1T3	System Programming	4	4	3 hrs.	20	80	100
IV	DSC-16	Theory	C4BCA1T1	Computer Graphics	4	4	3 hrs.	20	80	100
	DSC-17	Practical	C4BCA1P1	Computer Graphics Lab (using C)	2	4	3 hrs.	10	40	50
	DSC-18	Theory	C4BCA1T2	Database Management System	4	4	3 hrs.	20	80	100
	DSC-19	Practical	C4BCA1P2	DBMS Lab (using My SQL)	2	4	3 hrs.	10	40	50
	DSC-20	Theory	C4BCA1T3	Data Communications	4	4	3 hrs.	20	80	100

BCA

Sem.	Type of Course	Theory/ Practical	Course Code	Subject Title	Credits	No. of hour per week Theory / Practical	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
V	DSC-21	Theory	C5BCA1T1	Introduction to Machine Learning	4	4	3 hrs.	20	80	100
	DSC-22	Practical	C5BCA1P1	Machine Learning Lab (using python)	2	4	3 hrs.	10	40	50
	DSC-23	Theory	C5BCA1T2	Cryptography and Information Security	4	4	3 hrs.	20	80	100
	DSC-24	Practical	C5BCA1P2	Cryptography and Information Security Lab	2	4	3 hrs.	10	40	50
	DSC-25A DSC-26A	Theory	C5BCA2T1 C5BCA2T2	1. Software Engineering 2. Block Chain Technologies	4	4	3 hrs.	20	80	100
	DSC-27	Theory	C5BCA1T3	Research Methodology	3	3	3 hrs.	20	80	100
	Elective- 1	Theory	C5BCA5T1	Computer Concepts and Office Automation	3	3	3 hrs.	20	80	100

BCA

Sem.	Type of Course	Theory/ Practical	Course Code	Subject Title	Credits	No. of hour per week Theory / Practical	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
VI	DSC-28	Theory	C6BCA1T1	Introduction to Artificial Intelligence	4	4	3 hrs.	20	80	100
	DSC-29	Practical	C6BCA1P1	Artificial Intelligence Lab	2	4	3 hrs.	10	40	50
	DSC-30	Theory	C6BCA1T2	Operating System Concepts	4	4	3 hrs.	20	80	100
	DSC-31A DSC-32A	Theory	C6BCA2T1 C6BCA2T2	1. Cloud Computing 2. Internet of Things	4	4	3 hrs.	20	80	100
	DSC-33	Internship/ Industrial Project	C6BCA7P1	Internship / Industrial Project	6	--	---			150
	Elective- 2		C6BCA5T1	Cyber Security And Cyber Laws	3	3	3 hrs.	20	80	100
IV	Skills	Practical	C4BCA6T1	Java Script programming	2	4	3 hrs.	10	40	50

* Student shall either DSC 25A or DSC in V semester. Similarly, DSC 31A and DSC 32A in VI semester.

** Student shall study Skill of this subject either in IV/ V / VI but not in all the semester.

Haveri University, Haveri
BCA
Programme Specific Outcomes (PSO):

On completion of the 03 years Degree in Computer Applications students will be able to:

- Demonstrate, solve and understand the major concepts in all the disciplines of Computer Applications.
- Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.
- To apply standard methodology to the solutions of problems in Computer Applications.
- Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.
- Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
- Employ critical thinking and the scientific knowledge to design, carry out, record and analyse the results of Computer Applications.
- To build confidence in the candidate to be able to work on his own in industry and institution of higher education.
- To develop an independent and responsible work ethics.

BCA Semester –I

Subject Title (Theory): Computer Fundamentals & C-Programming

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C1BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

Course Outcome (CO): After completion of course (Theory), students will be able to:
CO 1: Familiarize with fundamental concepts and computer programming.
CO 2: Learn fundamental concepts of programming by developing and executing programs in C.
CO 3: Focuses on the structured program.
CO 4: Various constructs and their syntax.

Total Hrs.: 60

Unit I **15 hrs.**

Computer Fundamentals: History & Evolution of Computers. Characteristics, Types and Generations of Computers. System logical Organization: Von - Neumann concept of computer with block diagram: Components of Computer & their functions. Input Devices, Output Devices, Storage Devices. Processor & Main Memory: Central Processing Unit: ALU & CU. Architecture of Processor & Main Memory, Processor Registers, Main Memory: Organization of Main Memory, Main Memory Capacity. RAM, ROM, PROM, EPROM, EEPROM, Cache Memory.

Computer Software: Types of Software: System Software & Application Software. Translators: Compiler, Interpreter Linker, Loader and Editor. Computer Languages: Machine Level, Assembly Level & High Level, Their Merits & Demerits. Planning a Computer Program: Algorithm, Flowchart and Pseudo code.

Unit II **15 hrs.**

Introduction to C: Over View of C: Introduction. Importance and Features of C. Structure of a C Program. Sample C Programs. Creating and Executing a C Program. Block diagram of execution of C program. Basic Concepts: C Character Set. C tokens: keywords, identifiers, constants and variables. Data types. Declaration & initialization of variables. Symbolic constants. Formatted I/O functions: *printf* and *scanf*: control stings and escape sequences, output specifications with *printf* functions. Unformatted i/o functions to read and display single character and a string: *getchar, putchar, gets* and *puts* functions.

Operators & Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, increment & decrement operators, bitwise operators, conditional operator and special operators. Computational Problems, Operator Precedence and Associatively. Evaluation of arithmetic expressions, Type conversion.

Unit III **15 hrs.**

Control Structures (Branching & Looping): Decision making with *if* statements: *simple if, if_else* statements, *nested if_else* and *else_if ladder*. *Switch case* Statement. *goto, break* & *continue* statements. Looping Statements: Entry controlled and Exit controlled, *while, do-while* & *for* loops. Nested loops.

Arrays and Strings: One Dimensional arrays: Declaration, Initialization and Memory representation. Two Dimensional arrays: Declaration, Initialization and Memory representation. Declaring & Initializing string variables. String handling functions: *strlen, strcmp, strcpy and strcat.* Character handling functions: *toascii*, *toupper, tolower*, *isalpha, isnumeric* etc.

Unit IV **15 hrs.**

User Defined Functions: Need for user defined functions. Format of C user defined functions. Components of user defined functions: return type, name, parameter list, function body, return statement and function call. Categories of User defined functions: with and without parameters and return type.

Structures & Unions: Definition of Structure & Union. Declaring structure variables, Accessing structure members, Structure members initialization, Difference between structure and union.

Text Books:

1. P. K. Sinha & Priti Sinha: Computer Fundamentals (BPB)
2. V. Rajaraman: Computer Fundamentals
3. E. Balguruswamy: Programming in ANSI C (TMH)
4. V. Rajaraman: Programming in C (PHI – EEE)
5. Yashwant Kanitkar: Let us C
6. P.B. Kottur: Programming in C (Sapna Book House)

Reference Books:

1. Moris mano: Computer Organization & Architecture
2. Norton: Computer Applications
3. Kamthane: Programming with ANSI and TURBO C (Pearson Education)
4. S. Byron Gottfried: Programming with C (TMH)
5. Kernighan &Ritche: The C Programming Language. (PHI)

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): C – Programming Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C1BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcome (CO): After completion of course (Practical), students will be able to:

CO 1: Understand the basics of programming by executing the simple programming
CO 2: Be able to design & execution of code.
CO 3: Have practical knowledge of arrays, strings & functions

List of Experiments:

1. Find the area of a circle and area of a triangle given three sides.
2. Largest of three numbers.
3. Reversing the digits of an integer.
4. GCD of two integers.
5. Generating prime numbers.
6. Computing nth Fibonacci numbers.
7. Finding Even and Odd numbers.
8. Exchanging the values of two variables.
9. Counting: Print number from 100 to 200 which are divisible by 7 and display their sum and count using for loop.
10. Summation of set of Numbers.
11. Factorial Computation.
12. Generation of Fibonacci sequence.
13. Array Order Reversal.
14. Finding the Maximum Number in a Set.
15. Removal of Duplicates from an Ordered Array.
16. Partitioning an Array.
17. Finding the k^{th} Smallest Element.
18. Read N (minimum 5) students marks and find number of students passed and fail depending on the marks.
19. Count the number of vowels, consonants and special characters in a given sentence.
20. To find the addition and subtraction of two matrices using function.

Subject Title (Theory): Introduction to Algorithms

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C1BCA1T2	Paper-2	Theory	04	04	3hrs	20	80	100

Course Outcome (CO): After completion of course (Theory), students will be able to:
CO 1: Argue the correctness of algorithms using inductive proofs.
CO 2: Explain important algorithmic design paradigms.
CO 3: Compare between different data structures and pick an appropriate data structure for a design situation.
CO 4: Analyze String matching algorithms.

Total Hrs.: 60

Unit I: **15 hrs.**

Introduction to computer problem solving: Introduction, the problem-solving aspects, Top-down design, Implementation of Algorithms, program verification, The Efficiency and Analysis of Algorithm.

Fundamentals of Algorithms: Exchanging the values of two variables, Counting, Summation of set of Numbers, Factorial Computation, Sine function computation, Generation of Fibonacci Sequence, Reversing the Digits of an Integer, Base conversion, character to number conversion

Unit II: **15 hrs.**

Factoring Methods: Finding the Square Root of a Number, The Smallest Divisor of an Integer, The Greatest Common Divisor of two Integers, Generating Prime Numbers, Computing the Prime Factors of an Integer, Generation of Pseudo-Random Numbers, Raising a Number to a Large Power, Computing n^{th} Fibonacci number.

Unit III: **15 hrs.**

Array Techniques: Array Order Reversal, Array Counting, Finding the Maximum Number in a Set, Removal of Duplicates from an Ordered Array, Partitioning an Array, Finding the k^{th} Smallest Element.

Unit IV: **15 hrs.**

Merging, Sorting, Searching: The two-way Merge, Sorting by Selection, Sorting by Exchange, Sorting by Insertion, Sorting by Partitioning, Linear Search, Binary Search.

Text Books:

1. R.G. Dromey: How to Solve it by Computer, Pearson Education.

Reference Books:

1. N. Writh: Algorithms and Data Structures, Oberon version, 2004.
2. Alan Gibbons: Algorithmic Graph Theory, Cambridge University Press.

3. M.C. Goulmbic: Algorithmic Graph Theory and Perfect Graphs, 2nd edition, Elsevier, 2004

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Theory): Algorithms Lab (Using C)

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C1BCA1P2	Paper-2	Practical	02	04	3hrs	10	40	50

Course Outcome (CO): After completion of course (Practical), students will be able to:

CO 1: Understand the basics of programming by executing the simple programming
CO 2: Be able to design & execution of code.
CO 3: Have practical knowledge of arrays, strings & functions

List of Experiments:

1. Write a C program to generate Nth Fibonacci number.
2. Write a C program to Reverse the given Decimal number.
3. Write a C program to convert binary number to decimal number.
4. Write a C program to calculate sin(x) value without using in-built function.
5. Write a C program to calculate cos(x) value without using in-built function.
6. Write a C program to calculate e^x value without using in-built function.
7. Write a C program to calculate the GCD of two numbers.
8. Write a C program to generate Prime numbers.
9. Write a C program to find square root of number without in-built function.
10. Write a C program to convert character to ASCII code.
11. Write a C program to partition an array.
12. Write a C program to remove Duplicate elements from an array.
13. Write a C program to count Duplicate elements from an array.
14. Write a C program to calculate prime factors of a number.
15. Write a C program to reverse an array.
16. Write a C program to calculate kth smallest number in an array.
17. Write a C program to implement merge sort.
18. Write a C program to find Minimum and Maximum among given set.
19. Write a C program to perform Quick sort.
20. Write a C program for array counting using Histogram.

Subject Title (Theory): Discrete Mathematical Structure

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C1BCA1T3	Paper-3	Theory	04	04	3hrs	20	80	100

Course Outcome (CO): After completion of course (Theory), students will be able to:

- **CO 1 :** Define basic concepts of preposition logic and proofs.
- **CO 2 :** Define sets, sequences, sum and summation.
- **CO 3 :** Solve problems using counting techniques.
- **CO 4** : Solve problems using advance counting technique.
- **CO 5** : Introduction to induction & recursion and writing algorithms using recursion.
- **CO 6** : Studying the properties of relations.
- **CO 7** : Describe the origin of graph theory, illustrate different types of graphs.
- **CO 8** : Categorize trees.

Total Hrs.: 60

Unit I: 15 hrs.

The Foundations: Logic and proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

Basic Structures: Sets, Functions, Sequences, Sums, and Matrices: Sets, Set operations, Functions, Sequences and Summations, matrices.

Unit II: 15 hrs.

Counting: Basics of counting, Pigeonhole principle, Permutation and Combination, Binomial Coefficient and Combinations, Generating Permutation and Combination.

Advanced Counting Techniques: Applications of Recurrence Relations, Solving Linear Recurrence, Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating functions, Inclusion-Exclusion, Applications of Inclusion.

Unit III: 15 hrs.

Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Corrections.

Relation: Properties of relation, Composition of relation, Closer operation on relation, Equivalence relation and partition. Operation on relation, Representing relation.

Unit IV: 15 hrs.

Graphs: Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.

Trees: Introduction to Trees, Applications of Trees, Tree traversal, Spinning Trees, Minimum Spanning Trees.

Text Books

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition, 2012.

References

1. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross, 2003.
2. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI 1986.
3. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5 Edition.
4. Discrete Mathematical Structures, Trembley and Manobar.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

BCA Semester –II

Subject Title (Theory): Data Structures using C

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C2BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

Course Outcome (CO): After completion of course (Theory), students will be able to:

- **CO 1 :** To impart the basic concepts of data structures and algorithms.
- **CO 2 :** To familiar with data structural algorithms such as sorting & searching, stack & queue, linked list and trees.
- **CO 3 :** To be familiar with some graph algorithms such as binary tree representation of tree and operations on trees.
- **CO 4 :** To understand the basic concepts of tree traversal.
- **CO 5** : How to use basic data structure for program implementation.

Total Hrs.: 60

Unit I: **15 hrs.**

Introduction to Data Structure: Structure Definition, Initialization, Array as structure, Array within structure, Union. Understanding pointers, Declaring and initializing pointers, accessing a variable through its pointer, static and dynamic memory allocation.
Definition of Data Structure, Classification of Data Structure: Primitive and Non-Primitive, Operations on Data Structure, Review of Array.

Unit II: **15 hrs.**

Searching and Sorting: Searching Definition, Searching Techniques: Sequential search, Binary search. Comparison Between sequential and binary searching. Sorting Definition, Sorting Techniques: Bubble sort, Merge sort, Selection sort, Quick sort, Insertion Sort.

Unit III: **15 hrs.**

Stack and Queue: Definition of stack, Array Representation of Stack, Linked List Representation of stack, Operation Performed on Stack, Infix, Prefix, Postfix notations, Conversion of arithmetic expressions, Application of stack. Definition of Queue, Array Representation of Queue, Types of Queues: Simple queue, Circular queue, Double ended queue, Priority queue, Operations on all types of queues.

Unit IV: **15 hrs.**

Linked List: Definition, Representation of linked lists in Memory, Types of linked list: Singly linked list, Doubly linked list and Circular linked list. Operations on linked list: Creation, Insertion, Deletion, Search, Display and Traversing. Advantages and disadvantages of linked list.

Trees: Definitions, Tree terminology, Binary tree, Complete binary tree. Operations on Binary Trees, Representation of binary tree.

Text Books

1. Kamthane: Introduction to Data Structure in C. Pearson education 2005.
2. Fundamentals of Data structures in C, 2nd Edition, Horowitz, S. Sahni and Susan Anderson-Freed, Universities Press.

References

1. Data Structures using C, A.M. Tanenbaum, Y. Langsam, M.J. Augenstein, Pearson.
2. Data structures and Program Design in C, 2nd edition, R. Kruse, C.L. Tondo and B. Leung, Pearson.
3. Data structures A Programming Approach with C, D.S. Kushwaha and A.K. Misra, PHI.
4. E. Balaguruswamy, Programming in ANSI C, Tata Mc Graw-Hill.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Data Structures Lab (using C)

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C2BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcome (CO): After completion of course (Practical), students will be able to:

CO 1 : Be able to design & implement list data structure using
- i. Stack & Queue
- ii. Linked list
- iii. Singly & doubly linked list

CO 2 : Design & implement searching and sorting by applying various operations.

CO 3 : Design & implement basic operation on trees.

List of the Experiments for 52 hrs / Semesters

1. Write a Program to create, Initialize and access a pointer variable.
2. Write a Program to Calculate the length of the string using a pointer.
3. Write a Program to swap numbers using pointer.
4. Write a program in C to print all permutations of a given string using pointers.
5. Write a Program to store n students information using structure.
6. Write Program to implement Push, Pop and Traverse operation on STACK.
7. Write Program to convert infix notation to postfix notation.
8. Write Program to convert Infix notation to prefix notation.
9. Write a program to convert Prefix notation to postfix notation.
10. Write Program to perform the operation Insert, Delete and Display on Queue.
11. Write Program to implement Circular queue.
12. Write Program to implement Double ended queue.
13. Write Program to implement Priority queue.
14. Write a Program to search an element using Linear search.
15. Write a Program to sort given Array using Insertion sort technique.
16. Write a Program to sort given Array using Bubble sort technique.
17. Write a Program to sort given Array using Quick sort technique.
18. Write a Program to sort given Array using selection sort technique.
19. Write Program to implement Singly Linked List.
20. Write Program to implement Double Linked List.

Subject Title (Theory): Object Oriented Programming using JAVA

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C3BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

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

CO 1: Explain the object-oriented concepts using JAVA.
CO 2: Write JAVA programs using OOP concepts like Abstraction, Encapsulation,
CO 3: Inheritance and Polymorphism.
CO 4: Implement Classes and multithreading using JAVA.
CO 5: Demonstrate the basic principles of creating Java applications with GUI.

Unit I: 15 hrs.

Introduction to JAVA: JAVA Evolution: Java History, Java Features, How Java differs from C and C++, Java and Internet, Java and World Wide Web, Web browsers, Hardware and software requirements, Java Support Systems, Java Environment. Overview of JAVA Language: Introduction, Simple Java Program, More of Java, An Application with Two Classes, Java Program Structure, Java Tokens, Java Statements, Implementing a Java Program, Java Virtual Machine, Command Line Arguments, Programming Style. Constants, Variables, and Data Types: Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Values to Variables, Scope of Variables, Symbolic Constants, Type Casting, Getting Values of Variables, Standard Default Values. Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Procedure of Arithmetic Operators, Type Conversion and Associativity, Mathematical functions. Decision Making and Branching: Introduction, Decision Making with if statement, simple if statement, if...else statement, Nesting of if.... else statements, the else if Ladder, the switch statement, the?: Operator. Decision Making and Looping: The while statement, The do statement, The for statement, Jumps in Loops, Labelled Loops.

Unit II: 15 hrs.

Classes, Arrays, Strings and Vectors: Classes, Objects and Methods: Introduction, Defining a class, Adding Variables, Adding Methods, Creating Objects, Accessing class members, Constructors, Methods Overloading, Static Members, Nesting of Methods. Inheritance: Extending a class, Overriding Methods, Final Variables and Methods, Finalizer Methods, Abstract Methods and Classes, Visibility Control. Arrays, Strings and Vectors: Arrays, One-dimensional Arrays, Creating an array, Two-dimensional Arrays, Strings, Vectors and Wrapper Classes.

Unit III: 15 hrs.

Interfaces, Packages, and Multithreaded Programming: Interfaces: Multiple Inheritances: Introduction, Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables. Packages: Putting Classes together: Introduction, Java API Packages, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes. Multithreaded Programming: Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a thread, Life Cycle of a thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the Runnable Interface.

Unit IV: **15 hrs.**

Managing Exceptions, Applet Programming: Managing Errors and Exception: Introduction, Types of Errors, Exceptions, Syntax of Exception Handling Code, Multiple Catch Statements, Using Finally Statement, Throwing Our Own Exceptions, Using Exceptions for Debugging. Applet Programming: Introduction, How Applets Differ from Applications, Preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, More about Applet Tag, Passing Parameters to Applets, Aligning the Display, More About HTML Tags, Displaying Numerical Values, Getting Input from the user. Graphics Programming, Input/Output: Graphics Programming: Introduction, The Graphics class, Lines and rectangles, circles and ellipses, Drawing Arcs, Drawing Polygons, Line Graphs, Using Control Loops in Applets, Drawing Bar Charts.

Text Books:

1. Shishir Gundavaram, CGI Programming on the World Wide Web, O'Reilly and Associates, (1996). (Chapter 1-7)
2. E. Balaguruswamy, Programming with JAVA, A Primer, 2nd Edition. TMH (1999), (Chapter 2-16)

Reference Books:

1. Thomas Boutel, CGI Programming in C and Perl, Addison—Wesley, (1996).
2. Jefry Dwight et al, Using CGI, (Second Edition), Prentice Hall, India, (1997).
3. Darrel Ince & Adam Freeman, Programming the Internet with Java, Addison—Wesley, (1997).
4. Ken Arnold & James Gosling, The Java Programming Language, Addison—Wesley, (1998).
5. Patrick Naughton & Herbert Schildt, JAVA 2: The Complete Reference, 3rd Edition, TMH, (1999).

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): JAVA Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C3BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcome (CO): After completion of course (Practical), students will be able to:

CO 1: Solve real world problems using OOP techniques.

CO 2: Understand the use of abstract classes.

CO 3: Solve problems using java collection framework and I/O classes.

CO 4: Develop multithreaded applications with synchronization.

CO 5: Develop applets for web applications.

CO 6: Design GUI based applications.

Programs List:

1. Display Fibonacci series up to n terms using command line arguments.
2. Demonstrate single inheritance.
3. Sort n elements using an array.
4. Implement constructor overloading by passing different number of parameters of different types.
5. Demonstrate string methods.
6. Demonstrate vector methods.
7. Demonstrate concept of interface.
8. Demonstrate concept of creating, accessing and using a package.
9. Demonstrate multithreaded programming.
10. Demonstrate thread priority.
11. Create an applet to draw a human face.
12. Demonstrate simple banner applet.
13. Program to count number of strings, integers and float values through command line arguments.
14. Program to accept a message from the keyboard and display the no. of words and non-alphabetical characters.
15. Demonstrate creation of list using an applet.
16. Demonstrate concept of event handling.
17. Program to demonstrate different types of fonts
18. Create an applet to tokenize the string.
19. Design a simple calculator using java applets. 20. Implement static and dynamic stack using interface using abstract class.

Subject Title (Theory): Probability and Statistics

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C2BCA1T3	Paper-3	Theory	04	04	3hrs	20	80	100

Course Outcome (CO): After completion of course (Theory), students will be able to:
CO 1: Calculate the expectation and moments of random variables.
CO 2: Identify the applications of various moment inequalities.
CO 3: Explain the concept of convergence and check for the convergence of a given sequences of random variables.
CO 4: Find the expressions for the characteristic function of a random variable and verify its properties.

Unit I: **15 hrs.**

Probability: Sample space and Events - Probability -The Axioms of probability - some Elementary Theorems - Conditional probability -Baye's Theorem - Random variables – Discrete and continuous probability distributions. Distributions Binomial, Poisson and normal Distributions, related properties. Sampling Distributions – Sampling Distribution of means.

Unit II: **15 hrs.**

Estimation Point Estimation - Interval Estimation – Introduction to student's t-distribution - Confidence interval for Single Mean and Single Proportion (Large and Small samples).

Unit III: **15 hrs.**

Testing of Hypothesis-I: Testing of hypothesis-Introduction- Null Hypothesis-Alternative hypothesis- Type I and Type II errors – Critical region. Test of hypotheses for Single Mean (Large and small samples) - Test of hypotheses for Single Proportion (Large and small samples). **Testing of Hypothesis-II:** Tests of hypotheses for difference of Means (Large and Small samples) - Tests of hypotheses for difference of proportions (Large samples) – Introduction to Chi-Square distribution and Goodness of Fit.

Unit IV: **15 hrs.**

Correlation & Regression: Coefficient of correlation- Regression Coefficient- The lines of regression- The rank correlation.

Textbooks:

1. A first course in Probability & Statistics, B.L.S. Prakasa Rao, 1ed, World Scientific,2010
2. Probability & Statistics for Engineers, G.S.S. Bhishma Rao, 2ed, Scitech Publications, 2005

References

1. Probability & Statistics, T.K.V. Iyengar, B. Krishna Gandhi & Others,3ed, S. Chand& Co,2011
2. Probability & Statistics, D. K. Murugesan, P. Guru Swamy, 1ed, Anuradha Publications,2011

3. Probability & Statistics for Engineers, Miller, John E. Freund, 8ed, Prentice Hall of India,2010

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

BCA Semester –III

Subject Title (Theory): Python Programming

Course code	Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C3BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

Course Outcome (CO): After completion of course (Practical), students will be able to:

CO 1: Explain the basic concepts of Python Programming.

CO 2: Demonstrate proficiency in the handling of loops and creation of functions.

CO 3: Identify the methods to create and manipulate lists, tuples and dictionaries.

CO 4: Discover the commonly used operations involving file handling.

CO 5: Interpret the concepts of Object-Oriented Programming as used in **Python**

Total 60 hrs.

Unit I: **10 hrs.**

Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program.

Python Basics: Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples.

Python Control Flow: Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range () and exit () functions.

Unit-II **20 hrs.**

Exception Handling: Types of Errors; Exceptions; Exception Handling using try, except and finally.

Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions.

Strings: Creating and Storing Strings; Accessing Sting Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String Methods.

File Handling: File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator.

Unit-III **10 hrs.**

Lists: Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists.

Dictionaries: Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.

Tuples and Sets: Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods.

Unit-IV **20 hrs.**

Object Oriented Programming: Classes and Objects; Creating Classes and Objects; Constructor Method; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Inheritance- Single and Multiple Inheritance, Multilevel and Multipath Inheritance; Encapsulation- Definition, Private Instance Variables; Polymorphism- Definition, Operator Overloading.

GU Interface: The tkinter Module; Window and Widgets; Layout Management- pack, grid and place.

Data Analysis: NumPy- Introduction to NumPy, Array Creation using NumPy, Operations on Arrays

Data Visualization: Introduction to Data Visualization; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart and Histogram and Pie chart.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Python Programming Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C3BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcome (CO): After completion of course (Practical), students will be able to:

CO1: To demonstrate different number data types in Python.

CO2: Perform different Arithmetic Operations on numbers in Python.

CO3: Ability to explore python especially the object-oriented concepts, and the built in objects of Python

CO4: To be able to introduce core programming basics and program design with functions using Python programming language

Program List:

1. a. Write a python program to print "Hello Python" b. Write a python program to do arithmetical operations
2. Write a python program to find the area of a triangle
3. Write a python program to solve quadratic equation
4. Write a python program to swap two variables
5. Write a python program to convert Celsius to Fahrenheit
6. Write a python Program to Check if a Number is Odd or Even
7. Write a python Program to Print all Prime Numbers in an Interval
8. Write a python Program to Find the Factorial of a Number
9. Write a python Program to Display the multiplication Table
10. Write a python Program to Multiply Two Matrices
11. Write a python Program to Find LCM & GCD using functions
12. Write a python program to read a word and print the number of letters, vowels in the word.
13. Write a python program to input an array of n numbers and find separately the sum of positive numbers and negative numbers.
14. Write a python program to search an element using linear equation.
15. Write a python program to search an element using binary search
16. Write a python program to insert a number in a sorted array.
17. Write a python program to stimulate stack operation.
18. Write a python program to draw shapes & GUI controls.
19. Write a python program to using the built-in methods of the string, list, and dictionary classes.
20. Write a python program to demonstrate exception handling

Subject Title (Theory): Web Technologies

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C3BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

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

CO 1: Be acquainted with elements, Tags and basic structure of HTML files.

CO 2: Develop the concept of basic and advanced text formatting.

CO 3: Practice the use of multimedia components in HTML documents.

CO 4: Designing of webpage-Document Layout, Working with List, Working with Tables.

CO 5: Practice Hyper linking, Designing of webpage-Working with Frames, Forms and Controls.

CO 6: Prepare creating style sheet, CSS properties, Background, Text, Font and styling etc.

CO 7: Working with List, HTML elements box, Positioning and Block properties in CSS.

Total Hrs.: 60

Unit I: 15 hrs.

Web Design Principles: Basic principles involved in developing a web site, Planning process, Five Golden rules of web designing, Designing navigation bar, Page design, Home Page Layout, Design Concept.

Basics in Web Design: Brief History of Internet, what is World Wide Web, Why create a web site, Web Standards, Audience requirement.

Unit II: 15 hrs.

Introduction to HTML: What is HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags.

Elements of HTML: Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

Unit III: 15 hrs.

Introduction to Cascading Style Sheets: Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color, Creating page Layout and Site Designs.

Unit IV: 15 hrs.

XML: Introduction to XML, Defining XML tags, their attributes and values,

Document type definition, XML Schemas, Document Object model, XHTML Parsing XML Data - DOM and SAX parsers in java.

Introduction to Web Publishing or Hosting: Creating the Web Site, Saving the site, working on the web site, creating web site structure, Creating Titles for web pages, Themes-Publishing web sites.

Text Books:

1. Kogent Learning Solutions Inc, HTML 5 in simple steps, Dreamtech Press, A beginner's guide to HTML, NCSA,14th May,2003
2. Murray,Tom/Lynchburg , Creating a Web Page and Web Site College,2002
3. Murray,Tom/Lynchburg, Creating a Web Page and Web Site, College,2002

Reference Books:

1. Web Designing & Architecture-Educational Technology Centre, University of Buffalo
2. Steven M. Schafer HTML, XHTML, and CSS Bible, 5ed, Wiley India
3. John Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wiley India
4. Ian Pouncey, Richard York, Beginning CSS: Cascading Style Sheets for Web Design ,Wiley India
5. Kogent Learning, Web Technologies: HTML, Javascript, Wiley India

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Web Technologies Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C3BCA1P2	Paper-2	Practical	02	04	3hrs	10	40	50

Course Outcome: At the end of the course (practical), students will be able to:

CO 1: Develop webpages using HTML, DHTML and Cascading Stylesheets.

CO 2: Build and consume web services.

CO 3: Develop a Program using XML.

Programs List:

1. Acquaintance with elements, Tags and basic structure of HTML files.
2. Practicing basic and advanced text formatting.
3. Practicing use of multimedia components (Image, Video & Sound) in HTML document.
4. Designing of webpage-Document Layout.
5. Designing of webpage-Working with List.
6. Designing of webpage-Working with Tables.
7. Practicing Hyper linking of webpages.
8. Designing of webpage-Working with Frames.
9. Designing of webpage-Working with Forms and Controls.
10. Acquaintance with creating style sheet, CSS properties and styling.
11. Working with Background, Text and Font properties.
12. Working with List properties
13. Working with HTML elements box properties in CSS
14. Working with Positioning and Block properties in CSS
15. Designing with cascading stylesheet-Internal stylesheet
16. Designing with cascading stylesheet-External stylesheet

Subject Title (Theory): System Programming

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C3BCA1T3	Paper-3	Theory	04	04	3hrs	20	80	100

Course Outcomes (CO's): At the end of the course, students will be able to:

CO1. Understand System Design concepts

CO2. Explain how system software are designed and work

CO3. Articulate the challenges building system software

Total Hrs.: 60

UNIT 1: 15 Hrs.

Background: Machine Structure, Evolution of the Components of a Programming System, Assembler, Loaders, Macros, Compilers, Formal Systems.

Machine Structure: General Machine Structure, Instruction format, Representation of 360/370 instructions, Machine Language and Assembly Language.

UNIT 2: 10Hrs.

Assemblers: General design procedure, design of Assembler, statement of problem, data Structure, Format of Date bases, Algorithm for pass 1 and pass 2, look for modularity. Explanation along with flowcharts for both pass 1 and pass 2 (detail flowchart). **Table Processing**: Searching & Sorting - Linear and binary search, comparison, examples. Interchange sort, shell sort, bucket sort, radix exchange sort, address calculation sort, Random entry searching

UNIT 3: 10Hrs

Macro Language and The Macro Processor: Introduction, Macro instructions, Features of macro facility-macro instruction arguments, Conditional macro Expansion, Macro calls within macro, Macro instruction defining macro implementation: statement of problem, Specification of databases and specification of database format, Algorithm and flowchart for processing macro definitions and macro expansion.

UNIT 4: 13 Hrs

Loaders: Introduction, Loader schemes-compile and go loader scheme, general loader, Absolute loader, Sub routine linkage, Relocating loader, Direct linking loader, overlays, Dynamic loading.

UNIT 5: 12Hrs

Compilers: Introduction, Statement of problem, Phases of compiler, Lexical phase, syntax phase, interpretation phase optimization phase, storage assignment phase, code generation phase, Assembly phase, passes of compiler. Data Structures: statement of problem, storage classes and its use.

Text Books:

1. John J. Donowon, System Programming, TATA McGraw Hill.
2. Beck: System Software, 3/e Pearson Education.
3. System Software – Leland L. Beck, Third edition, Addison Wesley 1997

Reference Books:

1. Dhamdhere: System Programming and Operating System TMH Laudon & Laudon, Management Information Systems, 8/e Pearson Education

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

BCA Semester –IV

Subject Title (Theory): Computer Graphics

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C4BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
CO2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
CO3. Use of geometric transformations on graphics objects and their application in composite form.
CO4. Extract scene with different clipping methods and its transformation to graphics display device.
CO5. Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.

Total Hrs.: 60

Unit I: 15 hrs.

Graphics system: Introduction of Computer Graphics, Applications of CG. Video Display Devices: Cathode-Ray Tube, Raster-Scan Displays, Random-Scan Displays, Color CRT monitors, Flat-Panel Displays. Three-Dimensional viewing Devices. Raster-Scan Systems and Random-Scan Systems. Hard copy devices, input devices.

Unit I: 15 hrs.

Output Primitives: Points and lines, Line drawing algorithm: Digital Differential Analyzer (DDA), Bresenham's line algorithms, Circle generating algorithms. Ellipses (Example Problems). Attributes of output primitives: Line type, Line Width, Line color, Area filling, scan line algorithm**.**

Unit III: 15 hrs.

Two dimensional transformations: Basic transformation: translation, scaling and Rotation. Matrix representation and homogeneous co-ordinates, composite transformation: translation, scaling and rotations. Other Transformations. Transformations Between Coordinate Systems. Roster methods for transformation.

Two-Dimensional Viewing and clipping: The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-To-Viewport Coordinate Transformation. Clipping algorithms: line clipping, area clipping, Polygon clipping.

Unit IV: 15 hrs.

Interactive Input Methods: Physical input devices: Keyboard, touch panels, light pen, Graphics tablets, joysticks, mouse, trackball, interactive picture construction techniques.

Three Dimensional concepts: Three-dimensional co-ordinate systems, three-dimensional display techniques, perspective and parallel projections, polygon surfaces, curved surfaces, Quadric Surfaces, Bezier Curves and Surfaces octrees.

Text books:

1. Donald Hearn & M. Pauline Baker, Computer Graphics C Version, Pearson education/PHI.
2. Computer Graphics-Steven Harrington, McGH.

References:

1. Principles of Interactive Computer Graphics-Newman and Sproull, McGraw Hill
2. Graphics Under C-Yeshwant Kanetkar, BPB publications.
3. James D foley, Adries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Addison Wesley,1997.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Computer Graphics Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C1BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcomes (COs): At the end of the course (practical), students will be able to:

CO1. Understand the basics concepts of computer graphics.
CO2. Design scan conversion problems using c.

Programs List:

Implement all the programs using C

1. Create a chess board.
2. Draw line using DDA.
3. Draw line using Bresenham's Algorithm.
4. Draw a circle.
5. Draw a rectangle.
6. Draw ellipse.
7. Draw various shapes.
8. Move a car.
9. Create Smiling face animation.
10. Draw a pie chart.
11. Draw Bezier Surface.
12. Display circles in circles.
13. Demonstrate countdown.
14. Demonstrate traffic light program.
15. Restrict mouse pointer in a circle.

Subject Title (Theory): Database Management System

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C4BCA1T2	Paper-2	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO 1: Explain the various database concepts and the need for database systems.
CO 2: Identify and define database objects, enforce integrity constraints on a database using DBMS.
CO 3: Demonstrate a Data model and Schemas in RDBMS.
CO 4: Identify entities and relationships and draw ER diagram for a given real-world problem.
CO 5: Convert an ER diagram to a database schema and deduce it to the desired normal form.
CO 6: Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.
CO 7: Explain the transaction processing and concurrency control techniques

Total Hrs.: 60

Unit I: 15 hrs.

Introduction: Database and Database Users, Characteristics of the Database Approach, Different People behind DBMS, Implication of Database Approach, Advantages of Using DBMS, When not to use a DBMS.

Database System concepts and Architecture: Data Models, Schemas and Instances, DBMS Architecture and Data Independence, Data Base Languages and interfaces, The Database System environment, Classifications of Database Management Systems.

Data Modeling Using The Entity Relation Model: High Level Conceptual Data Models for Database Design With an Example, Entity Types Entity sets, Attributes, and Keys, ER-Model Concepts, Notations for ER Diagrams, Proper Naming of Constructs, Relationships Types of Degree than two.

Unit II: 15 hrs.

Relational Data Model and Relational Algebra: Relational Model Concepts, Relational Model Constraints and Relational Database Schema, Defining Relations, Update Operations on Relations and constraint violations, Basic Relational Algebra Operations, Additional Relational Operations. Queries in relational algebra using all the operations.

Unit III: 15 hrs.

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relational Schemas, Functional Dependencies, Normal Forms Based on primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Relational Database Language: Data definition in SQL-Queries in SQL, INSERT, DELETE, UPDATE Statements SQL,

Data Types in SQL: Number Types, Character Type, NSL Character Types.

Unit IV: **15 hrs.**

Components of SQL: Data Definition Language (DDL), Data Manipulation Language (DML), Query Language (QL), Data Control Language (DCL), **Set Operations:** Union, Intersection, Minus, Renaming of Tables. **SQL Operations:** Logical Operators (NOT IN, ALL, ANY, EXIST, NOT EXIST, LIKE, NOT LIKE, IS NULL, IS NOT NULL, AND, OR, NOT) **SQL Functions:** Number Functions, Character Functions, Date Functions, Aggregate Functions. **Integrity Constraints:** Advantages of Integrity Constraints, Primary Key, Unique Key, Super Key, Candidate Key, Composite Key, Foreign Key, Domain Constraint, Key Constraints VIEWS in SQL, Specifying general Constraints and assertions.

Text Books:

1. Elmasri & Navathe, Fundamentals of Database System (4ed), Pearson Education, 2003.
2. Sundarraman, Oracle 9i Programming a Primer, (1ed), Pearson Education.

Reference Books:

1. Kahate, Introductions to Database Management Systems, Pearson Education, 2004.
2. Abrahamsisilberschatag, Henry. F. Korth, S. Sudarshan, Database Systems Concepts, McGraw Hill.
3. Jefry. D. Ullaman, Principles of Database System. Oracle Press: ORACLE-Complete Reference.
4. C.J. Date, Introductions to Database Systems, (6ed) Addison Wesley, 1995.
5. Raghu Ram Krishnan, Database Management Systems, Second Edition, Mc. Graw Hill.2000.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Database Management System Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C1BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcomes (COs): At the end of the course(practical), students will be able to:

CO1.Design a database schema for a given problem domain.
CO2. Employ SQL DDL/DML commands to create, secure, populate, maintain, and query a database.
CO3. Create query using SQL commands as solutions to a broad range of query and data update problems.
CO4: Employ integrity constraints on a database design.

Programs List:

1. A) Create the following relation for the student:

Student (regno: string, name: string, class: string, bdate: date, marks1:int, marks1:int, marks2:int, marks3:int)

i. Enter at least five tuples of the above relation
ii. Demonstrate the usage of following clauses for the above relation
   a. Where c. Having
   b. Order By d. Group By
iii. Demonstrate the usage of following clauses for the above relation
   a. Sum c. Count e. Between
   b. Avg d. Like f. Max & Min
iv. Demonstrate the rollback and commit command for the above relation

B) Consider the following database that maintain information about employees & Departments.

Employee (empid: int, ename: string, age:int, salary:int, #deptno:int)
Department (deptno:int, dname: string, #manager-id: int)

i. Create the above tables by properly specifying the primary keys & foreign keys.
ii. Enter at least 5 tuples for each relation.
iii. Display emp-id & emp name whose salary lies between 10,000 and 50,000.
iv. List empname& salary for all the employee working for CS Dept.
v. Display empname&deptname for all the managers.

2. Consider the following schema for OrderDatabase:
SALESMAN (Salesman_id, Name, City, Commission)
CUSTOMER (Customer_id, Cust_Name, City, Grade,Salesman_id)
ORDERS (Ord_No, Purchase_Amt, Ord_Date, #Customer_id, Salesman_id)
Write SQL queries to
   i. Count the customers with grades above Bangalore'saverage.
   ii. Find the name and numbers of all salesmen who had more than one customer.

iii. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)
iv. Create a view that finds the salesman who has the customer with the highest order of a day.
v. Demonstrate the DELETE operation by removing salesman with id 1000. All hisorders must also bedeleted.

3. Consider the Insurances database given below. The primary keys are underlined and the data types are specified.

PERSON (DRIVER-ID#: string, name: string, address: string)
CAR (Regno: string, model: string, year: int)
ACCIDENT (report-number: int, date: date, location: string)
OWNS (#driver-id: string, #Regno: string)
PARTICIPATED (#driver-id: string, #Regno: string, #report-number: int, Damage amount: int)

i. Create the above tables by property specifying the primary keys and the foreign keys.
ii. Enter at least five tables for each relation.
iii. Demonstrate how you

a. Update the damage amount for the car with a specific Regno in the accident with report number 12 to 25000.
b. Add a new accident to the database.

iv. Find the total number of people who owned cars that were involved in accidents in 2002.
v. Find the total number of accidents in which cars belonging to a specific model were involved

4. The following tables are maintained by a book dealer.

AUTHOR (author-id: int, name: string, city: string, country: string)
PUBLISHER (publisher-id: int, name: string, city: string, country: string)
CATALOG (book-id: int, title: string, author-id#: int, publisher-id#: int, category-id#: int, year: int, price: int)
CATEGORY (category-id: int, description: string)
ORDER-DETAILS (order-no: int, #book-id: int, quantity: int)

i. Create the above tables by properly specifying the primary keys and the foreign keys.
ii. Enter at least five tuples for each relation.
iii. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog.
iv. Find the author of the book, which has maximum sales.
v. Demonstrate how you increase the price of books published by a specific publisher by 10%.

5. Consider the following database of student enrolment in courses and books adopted each course.

STUDENT (regno: string, name: string, major: string, bdate: date)
COURSE (course: int, cname: string, dept: string)
ENROLL (#regno: string, course#: int, sem: int marks: int)

TEXT (book-ISBN: int, book-title: string, publisher: string, author: string)
BOOK_ADOPTION (course#: int, sem: int, book-ISBN#: int)

1. Create the above tables by properly specifying the primary keys and the foreign Keys.

i. Enter at least five tuples for each relation.

ii. Demonstrate how you add a textbook to the database and make this book be adapted by some department.

iii. Produce list of textbooks (include Course#, Book-ISBN, Book-title) in the alphabetical order for courses offered by the CS department that use more than two books.

iv. List any department that has its adopted books published by a specific publisher.

6. Consider the following database for library management system

BOOK (Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS (#Book_id, Author_Name)
PUBLISHER (Name, Address, Phone)
BOOK_COPIES (#Book_id, #Branch_id, No-of_Copies)
BOOK_LENDING (#Book_id, #Branch_id, Card_No, Date_Out, Due_Date)
LIBRARY_BRANCH (Branch_id, Branch_Name, Address)

Write SQL queries to

i. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.

ii. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun2017

iii. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.

iv. Create a view of all books and its number of copies that are currently available in the library.

7. Consider the schema for CompanyDatabase:

EMPLOYEE (SSN, Name, Address, Sex, Salary, #SuperSSN, DNo)
DEPARTMENT (DNo,DName, MgrSSN, MgrStartDate)
DLOCATION (#DNo,DLoc)
PROJECT (PNo, PName, PLocation, #DNo) WORKS_ON (#SSN,#PNo, Hours)

Write SQL queries to

i. Make a list of all project numbers for projects that involve an employee whose last name is ‘Scott’, either as a worker or as a manager of the department that controls theproject.

ii. Show the resulting salaries if every employee working on the ‘IoT’ project is given a 10 percentraise.

iii. Find the sum of the salaries of all employees of the ‘Accounts’ department, as well as the maximum salary, the minimum salary, and the average salary in this department.

iv. Create a view with columns dept name and dept location. Display name of dept located in ‘Dharwad’ on this view.

Note : 1. All the experiments are to be carried out using MySql.
2. Draw ER diagram and Schema diagram for each lab program.

Subject Title (Theory): Data Communication

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C4BCA1T3	Paper-3	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Students understand and explore the basics of Computer Networks and Various Protocols.

CO2. Student able to explain how noise, attenuation, and distortion affect signal transport.

CO3. Understand the use of LAN components and the backbone networks.

CO4. Analyze the transmission errors with respect to IEEE standards.

Unit I: **15 hrs.**

Introduction: Data Communication: Components, Representation, Data flow. Networks: Network Criteria, Network Topology, Physical structure, Network Classification, The Internet, Protocols and Standards, Switching: Message, Packet and Circuit switching.

Network Models: Layered architecture, The OSI model, TCP/IP Protocol suite, ARPANET.

Unit II: **15 hrs.**

Digital transmission and physical layer: Digital Representation of Information**,** Analog and Digital signals, **Digital transmission:** Line coding, Modulation, Transmission modes, Multiplexing: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Wavelength Division Multiplexing (WDM). SONET**.**

Transmission Media: Guided media: Twisted Pair, Co-axial Cable, Optical fiber. Un-guided media. Cellular Telephones Generation of networks: 1G,2G,3G,4G,5G.

Unit III: **15 hrs.**

Datalink Layer: Datalink Layer Design Issues**,** ARQ Protocols: Stop and Wait, GO – Back - N, Selective Repeat Protocols. Efficiency of ARQ Protocols. Flow control, Sliding window flow control. Data link control: HDLC, PPP. Statistical Multiplexing. Error detection, Parity bit, Two-dimensional parity checks, Internal checksum, Polynomial codes.

Unit IV: **15 hrs.**

Medium access Control Protocols: Multiple access communication. Local Area Network-LAN Structure, MAC Sublayer, Logical link control layer. Random Access Protocol-ALOHA, Slotted ALOHA, CSMA, CSMA/CD. Scheduling Approaches to medium access control- Reservation Systems, Polling, Token Passing ring. Channelization-FDMA, TDMA, CDMA.

LAN Standards: Ethernet and IEEE 802.3 LAN Standard, Token Ring and IEEE 802.5 LAN Standard, FDDI, Wireless LAN's and IEEE 802.11 LAN Standard.

Textbooks:

1. Alberto Leon-Garcia & Indra Widjaja, Communication Networks- Fundamental Concepts & Key Architecture, Mc. Graw Hill.
2. Behrouz Farozan, introduction to Data Communications & Networking TMH.
3. Stalling, Data and Computer Communications, 7/e, Pearson Education.

References:

1. Andrew S Tanenbaum, Computer Networks, 4/e, Pearson Education.
2. S. Keshav, An Engineering Approach to Computer Networks. Pearson Education.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Theory): Java Script Programming

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C4BCA6T1	Skill	Practical	02	04	3hrs	10	40	50

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Evaluate the concepts of web programming and analyze their impact on problem solving and program

CO2. implementation, demonstrate concepts by building web pages generated by JavaScript programming.

Unit I: **15 hrs.**

What is JavaScript General overview of JavaScript, what is JavaScript? JavaScript history, Relation between JavaScript and ECMAScript, Versions of JavaScript .JavaScript Core Syntax, Variables, Values, Data Types Syntax review, Keywords and reserved words, Variable declaration, Variable scope, Block scope. Data Types Primitive values, Reference values, Types, Type conversion. Expressions and Operators Expressions (arithmetic, relational, logical, assignment and others), Operators overview.

Unit II: **15 hrs.**

Control structures Flow control and conditionals, Loops and iteration. Jumps Error handling Throwing errors, Error handling. Numbers Number literals, Number object, Number methods, Math object Date object Working with Numbers. Strings String literals, String object, string methods, Working with Strings. Arrays Creating and populating Arrays, Array methods, Working with Arrays. Functions Defining functions, Calling functions, Functions as values, Arguments and parameters, Function scope, Closures, Arrow functions. Indexed Collections Set object type Map object type

Unit III: **15 hrs.**

JSON Iterators and generators Working with Iterators Working with Generators Modules Promises Regular Expressions Creating regular expressions, RegExp object and its methods, String methods for matching patterns. Objects Creating object, Properties, Methods, Build-in JavaScript objects. Prototype based Object Oriented Programming Defining Constructors, Prototypes, Inheritance, Classes Metaprogramming Proxy, Reflection Server-side JavaScript General overview of server-side JavaScript Java Script engines, Basics of server-side solutions. JavaScript in Browser JavaScript in Web browser Embedding JavaScript in HTML, Execution of JavaScript code.

Unit IV: **15 hrs.**

Browser Object Model The window object, Dialog boxes, Timers, the location object, The navigator object, Browsing history. Document Object Model, Document structure, selecting document elements and query selectors, moving thorough DOM tree, HTML

elements and attributes, Creating, changing, and deleting nodes. Handling Events, Event propagation, Event handlers registering and invocation, Event object, Types of events. Ajax JavaScript and HTTP communication, Synchronous and asynchronous requests. Graphics Multimedia basics, Canvas API basics. Data Storage Cookies, Web Storage, IndexedDB. Security Filesystem security, The Same Origin Policy Plugins Cross-Site Scripting

Text Books:

1. JavaScript for Impatient Programmers by Axel Rauschmayer by 2022 edition.
2. JavaScript from Beginner to Professional by Laurence Lars Svekis, Maaike van Putten, Codestars by Rob Percival – 2021
3. JavaScript Bible By Danny Goodman · 2007
4. Pro JavaScript Techniques by John Resig

List of Programs

1. Write a JavaScript program to check whether the given number is perfect, abundant, or deficient. Use alert box to display the output.
2. Design a JavaScript program to display the multiplication table by accepting the number and limit.
3. Write a Java Script program to store different colors in an array and change the background color of the page using these array elements.
4. Write a Java Script program to change the text color and back color of a Textbox using on focus and On Blur event.
5. Write a Java Script function to display current date and time.
6. Write a Java Script program that calculates the squares and cubes of the numbers 0 to 10 and outputs HTML texts that displays the resulting values in a HTML table format.
7. Design a student registration form and apply validation on it by using external Java Script.
8. Design a simple calculator by using html, css and Java script.
9. Write a Java Script program to calculate factorial of any number by using html.
10. Write a JavaScript function to check whether a given value is IP value or not

BCA Semester –V

Subject Title (Theory): Introduction to Machine Learning

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Understand the features of machine learning to apply on real world problems.
CO2. Characterize the machine learning algorithms as supervised learning and unsupervised learning.
CO3. Have a good understanding of the fundamental issues and challenges of machine learning:
CO4. Learn the concepts in Bayesian analysis.
CO5. Model evaluation and model selection.

Unit I: **15 hrs.**

Introduction, What Is Machine Learning? Examples of Machine Learning Applications, 12 Hours Supervised Learning: Learning a Class from Examples Vapnik-Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

Unit II: **15 hrs.**

Bayesian Decision Theory: Introduction, Classification, Losses and Risks, Discriminant Functions, Utility Theory, Value of information, Bayesian Networks, Influence Diagrams, Association Rules.

Unit III: **15 hrs.**

Parametric Methods: Introduction, Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias Variance Dilemma, Model Selection Procedures.

Unit IV: **15 hrs.**

Multivariate Methods: Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Discrete Features, Multivariate Regression. Dimensionality Reduction: Introduction, Subset Selection, Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis.

Clustering: Introduction, Mixture Densities, k-Means Clustering, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the Number of Clusters.

Text Books:

1. Ethem Alpaydin, 2004, ‘Introduction to machine Learning’, PHI.

Reference:

1. Tom M Mitchell, 1996, Machine Learning McGraw Hill Publications.
2. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
3. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer.
4. Machine Learning by Tom Mitchell, McGraw Hill Education.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Machine Learning Lab (using Python)

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Appreciate the importance of visualization in the data analytics solution.
CO2. Apply structured thinking to understanding problems.
CO3. Understand a very broad collection of machine learning algorithms and problems.
CO4. Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory.
CO5. Develop an appreciation for what is involved in learning from data.

Programs List:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .*CSV* file.
2. For a given set of training data examples stored in a .*CSV* file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based 1D3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a CSV file. Compute the accuracy of the classifier, considering few test data sets.
5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
6. Write a program to construct a Bayesian network considering medical data Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file
8. Use the .CSV file data set for clustering using k-Means algorithm
9. Write a program to implement k-Nearest Neighbour algorithm to classify the IRIS data set. Print both correct and wrong predictions
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Subject Title (Theory): Cryptography and Information Security

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA1T2	Paper-2	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Identify basic security attacks and services
CO2. Use symmetric and asymmetric key algorithms for cryptography
CO3. Design a security solution for a given application
CO4. Analyze Key Management techniques and importance of number Theory.
CO5. Understanding of Authentication functions the manner in which Message Authentication
Codes and Hash Functions works.
CO6. To examine the issues and structure of Authentication Service and Electronic Mail Security

Unit I: **15 hrs.**

Introduction: Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security.

Classical Encryption Techniques: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography.

Unit II: **15 hrs.**

Block Cipher and Data Encryption Standards: Block Cipher Principles, Data Encryption Standards, the Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles.

Advanced Encryption Standards: Evaluation Criteria for AES, the AES Cipher.

More on Symmetric Ciphers: Multiple Encryption, Triple DES, Block Cipher Modes of Operation, Stream Cipher and RC4.

Introduction to Number Theory: Prime Numbers, Fermat's and Euler's Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete logarithms.

Unit III: **15 hrs.**

Public Key Cryptography and RSA: Principles Public key crypto Systems, Diffie Hellman Key Exchange, the RSA algorithm, Key Management, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

Message Authentication and Hash Functions: Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs.

Hash and MAC Algorithm: Secure Hash Algorithm, Whirlpool, HMAC, CMAC.

Digital Signature: Digital Signature, Authentication Protocol, Digital Signature Standard.

Unit IV: **15 hrs.**

Authentication Application: Kerberos, X.509 Authentication Service, Public Key Infrastructure.

Email Security: Pretty Good Privacy (PGP) and S/MIME.

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Text Books:

1. William Stallings (2006), Cryptography and Network Security: Principles and Practice, 4th edition, Pearson Education, India.
2. William Stallings (2000), Network Security Essentials (Applications and Standards), Pearson Education, India.

References:

1. Charlie Kaufman (2002), Network Security: Private Communication in a Public World, 2nd edition, Prentice Hall of India, New Delhi.
2. Atul Kahate (2008), Cryptography and Network Security, 2nd edition, Tata Mc Grawhill, India.
3. Robert Bragg, Mark Rhodes (2004), Network Security: The complete reference, Tata Mc Grawhill, India.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Cryptography and Information Security Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA1P2	Paper-2	Practical	02	04	3hrs	10	40	50

Course Outcomes (COs): At the end of the course (Practical), students will be able to:

CO1. Identify basic security attacks and services.
CO2. Use symmetric and asymmetric key algorithms for cryptography
CO3. Design a security solution for a given application.

Programs List:

1. Write a C program that contains a string (char pointer) with a value\Hello World. The programs should XOR each character in this string with 0 and display the result.

2. Write a C program that contains a string (char pointer) with a value \Hello World. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms:

- Ceaser Cipher
- Substitution Cipher
- Hill Cipher

4. Write a Java program to implement the DES algorithm logic.

5. Write a C/JAVA program to implement the Blowfish algorithm logic

6. Write a C/JAVA program to implement the Rijndael algorithm logic

7. Write the RC4 logic in Java Using Java Cryptography, encrypt text “Hello world” using Blowfish Create your own key using Java key tool.

8. Write a Java program to implement RSA Algorithm.

9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.

10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA

11. Calculate the message digest of a text using the MD5 algorithm in JAVA

Subject Title (Theory): Software Engineering

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA2T1	Specializa iton-1	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1: How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment.
CO2: An ability to work in one or more significant application domains.
CO3: Work as an individual and as part of a multidisciplinary team to develop and deliver quality software.
CO4: Demonstrate an understanding of and apply current theories models, and techniques that provide a basis for the software lifecycle.
CO5: Demonstrate an ability to use the techniques and tools necessary for engineering practice.

Unit I: 15 hrs.

The Product and The Process: Evolving role of software, software characteristics and components, Crisis, Software Myths, Software Engineering-A Layered Technology, Software process, linear sequential model, Prototyping model, RAD model, Evolutionary software process model.

Project Management Concepts: The Management Spectrum, The People, The Product, The Process, and The Project.W5HH Principle.

Software Process and Project Metrics: Measures, Metric Indicators, Metric in process and the Project Domains, Software Measurement, Metrics for software quality.

Unit II: 15 hrs.

Software Project Planning: Project Planning Objectives, Software Project Estimation, decomposition Techniques, Empirical Estimation Models.

Risk Analysis and Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement and Risk Mitigation, Monitoring, and Management.

Unit III: 15 hrs.

Analysis Concepts and Principles: Requirement analysis, communication techniques, analysis principles, software prototyping and specification.

Analysis Modeling: Elements of analysis model, data modeling, functional modeling, behavioral modeling, the mechanics of structured analysis, data dictionary, other classical analysis methods.

Unit IV: 15 hrs.

Design Concepts and Principles: Software design and software engineering design process, design principles, design concepts, design methods, data design, architectural design and process, transform and transaction mappings, design post processing, architectural design optimization, interface design, procedural design.

Software Testing Techniques and Strategies: Fundamentals, Test case design, White box testing, Basis path testing, Control structure testing, Black box testing, Software testing strategies.

Text Books:

1. Software Engineering, Fifth Edition, Roger - Pressman, McGraw Hill.
2. Software Engineering, Ian Sommerville, International Computer Science, Series

References*:*

1. Software Engineering, Schooma, McGraw Hill
2. Object Oriented Design and Analysis, Booch, Benjamin / Cummings,
3. Software Engineering: A Practitioner's Approach 7th Edition, Roger – Pressman, Tata McGraw - Hill Education (2010)

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Theory): Block Chain Technologies

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA2T1	Specializa iton-2	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Describe the basic concepts and technology used for blockchain.

CO2.Describetheprimitives of the distributed computing and cryptography related to blockchain.

CO3. Illustrate the concepts of Bitcoin and their usage.

CO4. Implement Ethereum blockchain contract.

CO5. Apply security features in blockchain technologies.

CO6. Use smart contract in real world applications.

Unit I: **15 hrs.**

Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

Basic Distributed Computing & Crypto primitives: Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems.

Unit II: **15 hrs.**

Bitcoin basics: Bit coin block chain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bit coin consensus, Bit coin scripting language and their use.

Unit III: **15 hrs.**

Ethereum basics: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript.

Unit IV: **15 hrs.**

Privacy, Security issues in Blockchain: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algor and; Sharding based consensus algorithms to prevent the seattacks.

Textbooks:

1. Mastering Blockchain by Imran Bashir, Publisher: Packt Publishing.
2. Blockchain Fundamental by Dr. Ravindra Vadapalli
3. Blockchain technology from theory to practice by Sudeep Tanwar.

References:

1. Narayanan, Bonneau, Felten, Millerand Goldfeder, “Bitcoin and Cryptocurrency Technologies –A Comprehensive Introduction,” Princeton University Press.
2. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming,’ CreateSpace Independent Publishing Platform,2017.
3. Imran Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained,” Packt Publishing.
4. Merunas Grincalaitis, “Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols”, Packt Publishing.
5. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, “Blockchain Architecture Design And Use Cases ”[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Theory): Research Methodology

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA1T3	Paper-3	Theory	03	03	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Students who complete this course will be able to understand and comprehend the basics in research methodology and applying them in research/ project work.

CO2. This course will help them to select an appropriate research design.

CO3. With the help of this course, students will be able to take up and implement a research project/ study.

CO4. The course will also enable them to collect the data, edit it properly and analyze it accordingly. Thus, it will facilitate students' prosperity in higher education.

CO5. The students will develop skills in qualitative and quantitative data analysis and presentation.

CO6 Students will be able to demonstrate the ability to choose methods appropriate to research objectives.

Unit I: **15 hrs.**

Introduction-Meaning, Objectives, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.

Unit II: **15 hrs.**

Research Design- Meaning, Need for Research Design, Features of a Good Design, Important Concepts relating to Research Design, Different Research Designs. Cluster Analysis: Introduction, distance measures Clustering algorithms, agglomerative clustering.

Scientific Body in Research: Ethical, legal, social and scientific issues in research. A brief idea about the funding agencies such as DST (Department of Science and Technology), DBT (Department of Biotechnology), ICMR (Indian Council of Medical Research), CSIR (Council of Scientific & Industrial Research) and UGC (University Grants Commission). Role of IPR (Intellectual Property Rights) in Research and Development.

Unit III: **15 hrs.**

Data Collection-Introduction, Experiments and surveys, Collection of Primary and Secondary Data, selection of appropriate method for data collection, case study method.

Data Preparation: Data Preparation process, Some problems in preparation process, Missing values and Outliers, types of Analysis, Statistics in research.

Unit IV: **15 hrs.**

Testing of Hypothesis- Hypothesis, Basic Concepts Concerning Testing the Hypotheses, Test Statistic and Critical region, critical value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing.

Interpretation and Report Writing- Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Textbooks:

1. Research Methodology: A step-by-step guide for beginners, Ranjit Kumar, Sage publications.
2. Engineering Research Methodology a Practical Insight for Researchers by Dipankar Deb, Rajeeb Dey, Valentina E. Balas.
3. Kothari C.K. (2004) 2/e, Research Methodology – Methods and Techniques (New Age International, New Delhi).
4. Montgomary, Douglas C. (2007) 5/e, Design and Analysis of Experiments (Wiley India).

References:

1. Montgomary, Douglas C. & Runger, George C. (2007) 3/e, Applied Statistics & probability for Engineers (Wiley India).
2. MLA (Modern Language Association) Handbook for Writers of Research Papers, 7th edition, 2009.
3. How to Write and Publish a Scientific Paper, Cambridge University Press.
4. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
5. Citation Analysis in Research Evaluation (Information Science and Knowledge Management) by Henk F. Moed.

Subject Title (Theory): Computer Concepts & Office Automation

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C5BCA5T1	Elective-1	Theory	03	03	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1.Provide knowledge of different units of computer like processing unit, IO unit, and storage unit.

CO2.To earn knowledge of different types of memory.

CO3. Understand and apply the basic concepts of electronic spreadsheet software.

Co4. To make students well familiar with computer and networking fundamentals.

Unit I: **15 hrs.**

Basics: History and generations of Computer, Types of Computers, Organization of Computer System, Hardware, and Software Components,

Memory unit: Types of memory, ROM, RAM, types of RAM & ROM, Introduction to cache and virtual memory.

Unit II: **15 hrs.**

Number system: Binary Octal, Hexa-decimal, Number base conversion, Binary addition, Subtraction, One's and Two's compliment, Character codes – ASCII, EBCDIC.

Unit III: **15 hrs.**

Operating System: Types of operating system, Functions, Introduction to DOS and WINDOWS operating system.

Software: Types of languages, Types of software (System and Application software).

Unit IV: **15 hrs.**

Network and Internet: History and evolution of Computer Network, Types of networks (LAN, MAN & WAN), Internet and its applications.

Office Automation: Working with MS-Word, MS-Excel and MS-POWER POINT.

References:

1. Computer Concepts & C Programming, P.B.Kottur, Sapna Book House Bangalore 2009
2. Computer Fundaments, V. Rajaraman, Prentice Hall of India,2008
3. Computer Fundamental P.K. Sinha, Prentice Hall of India, 6th Edition,1992
4. Fundamentals of Information Technology second edition, Alexis Leon,2009
5. Microsoft Office-Complete reference, Curt Simmons, Mc Graw Hill,2003

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

BCA Semester –VI

Subject Title (Theory): Introduction to Artificial Intelligence

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C6BCA1T1	Paper-1	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1.To develop semantic-based and context-aware systems to acquire, organize process, share and use the knowledge embedded in multimedia content.
CO2. Research will aim to maximize automation of the complete knowledge lifecycle and achieve semantic interoperability between Web resources and services.
CO3. The field of Robotics is a multi-disciplinary as robots are amazingly complex system comprising mechanical, electrical, electronic H/W and S/W and issues germane to all these.

Unit I: 15 hrs.

AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing,

Unit II: 15 hrs.

A*, AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions**.**
Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules-based deduction systems. Reasoning under uncertainty, review of probability, Baye's probabilistic interferences and dempster Shafer theory.

Unit III: 15 hrs.

First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

Unit IV: 15 hrs.

Expert systems: Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge

acquisition methods of knowledge acquisition, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty representing uncertainty.

Reference:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
4. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Practical): Artificial Intelligence Lab

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C6BCA1P1	Paper-1	Practical	02	04	3hrs	10	40	50

Course Outcomes (COs): At the end of the course (practical), students will be able to:

CO1. Apply the good programming skills to formulate the solutions for computational problems.

CO2. Design and develop solutions for informed and uninformed search problems in AI.

CO3. Utilize advanced package like NLTK for implementing artificial intelligence.

CO4. Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area

CO5. Develop a minor project in multidisciplinary areas to demonstrate team work through reports and presentation.

CO6. Design and develop an Expert System that operates in a realistic problem domain and communicate effectively in a team or individual and prepare reports.

Programs List:

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python.
5. Write a Program to Implement Water-Jug problem using Python.
6. Write a Program to Implement Travelling Salesman Problem using Python
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python.
9. Write a Program to Implement Alpha-Beta Pruning using Python.
10. Program to Implement 8-Queens Problem.

Subject Title (Theory): Operating System Concepts

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C6BCA1T2	Paper-2	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:
CO1: Outline various concepts and features of Operating systems.
CO2: Compare various operating systems with respect to characteristics.
CO3: Provide basic knowledge of computer operating system structures and functioning.
CO4: Implement algorithm of CPU Scheduling, Memory Scheduling and disk scheduling.

Unit I: 15hrs.

Introduction: Operating system concepts, types of operating system–Batch, interactive, time sharing, real time and distributed operating systems. Operating system services, system calls, system components, system programs.

Process Management: Processes-process scheduling, operation on processors, co-operating process, threads, inter process communication, concept of critical section problem and solution, semaphores and implementation.

Unit II: 15hrs.

CPU Scheduling: Scheduling criteria and scheduling algorithms, multiple processor scheduling.

Deadlock: Deadlock problem, characterization, prevention, avoidance, detection, recovery, combined approach to dead lock handling.

Unit III: 15 hrs.

Memory Management: Logical and physical address, swapping overlays, contiguous allocation, paging segmentation, segmentation with paging, virtual memory-demand paging page replacement algorithms.

Unit IV: 15 hrs.

Disk Scheduling: Physical characteristics FCFS, Shortest seek time first, SCAN scheduling, selection of disk scheduling algorithm.

File System: Files, access method, directory structure, protection and file system implementation, allocation methods.

Text books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition, Wiley India Private Limited, New Delhi.

References:

1. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.
2. Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.
3. Deitel & Deitel (2008), Operating systems, 3rd edition, Pearson Education, India.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Theory): Cloud Computing

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C6BCA2T1	Specialization -1	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:
CO1: Explain the core concept of the cloud computing paradigm.
CO2: Apply the fundamental concepts in data centers to understand the trade-offs in power.
CO3: Identify resource management fundamentals.
CO4: Analyze various cloud programming models and apply them to solve problems on cloud.

Unit I: **15 hrs.**

Cloud Computing Basics: Overview, Applications, Intranet and the Cloud, First Movers in the Cloud; The Use of Cloud Computing, Benefits, Security concerns, regulatory issues; Overview of different cloud computing applications that are implemented; Business case for implementing a Cloud: Cloud Computing Services, Applications help to the business, deleting the data center, Saleforce.com, Thomson Reuters.

Unit II: **15 hrs.**

Cloud Computing Technology: Hardware and Infrastructure: Clients, Security, Network, Services; Accessing the Clouds: Platforms, Web applications, Web APIs, Web Browsers.

Unit III: **15 hrs.**

Cloud Storage: Overview, Cloud Storage providers, Standards: Applications, Client, Infrastructure, Services.

Unit IV: **15 hrs.**

Cloud Computing at Work: Software as a service: Overview, Driving Forces, Company offerings, Industries; Software plus services: Overview, Mobile Device Integration, Providers, Microsoft Online; Developing Applications: Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development: Google, Sales Force, Azure.
Local Clouds and Thin Clients: Virtualization, server solutions, Thin Clients; Migrating to the clouds:

Text Books:

1. Cloud Computing a Practical approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, Tata McGraw-Hill, 2010 Edition.

Reference Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamari Selvi, McGraw Hill Education (India) Private Limited.
2. Distributed and Cloud Computing, Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Morgan Kaufmann Publishers 2012.
3. Cloud computing, Barrie Sosinsky, Wiley India.
4. Cloud Computing, Kumar Saurabh, 2nd Edition, Wiley, India

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Theory): Internet of Things

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C6BCA2T1	Specialization -2	Theory	04	04	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:
CO1: Understand the various concepts, terminologies and architecture of IoT systems.
CO2: Use sensors and actuators for design of IoT.
CO3: Understand and apply various protocols for design of IoT systems
CO4: Use various techniques of data storage and analytics in IoT
CO5: Understand various applications of IoT

Unit I: **15 hrs.**

Introduction: Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Unit II: **15 hrs.**

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

Unit III: **15 hrs.**

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Unit IV: **15 hrs.**

Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Srinivasa K G, "Internet of Things," CENGAGE Leaning India, 2017.

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Theory): Cyber Security and Cyber Law

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C6BCA5T1	Elective-2	Theory	03	03	3hrs	20	80	100

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Develop cyber security strategies and policies.
CO2. Knowledge of Cyber World and Cyber Law in general.
CO3. The various aspects of cybercrimes.
CO4. Understanding the problems relating to e-commerce transactions.
CO5. Intellectual Property issues in IT Act.

Unit I: 15 hrs.

Digital Crime: Overview of digital crime, criminology of computer crime. Information Gathering Techniques: Tools of the attacker, information and cyber warfare, scanning and spoofing, password cracking, malicious software, session hijacking.

Unit II: 15 hrs.

Risk analysis and Threat: risk analysis, process, key principles of conventional computer security, security policies, authentication, data protection, access control, internal vs external threat, security assurance, passwords, authentication, and access control, computer forensics and incident response.

Unit III: 15 hrs.

Introduction to Cryptography and Applications: Important terms, Threat, Flaw, vulnerability, exploit, attack, ciphers, codes, substitution cipher (caeser), Transposition cipher (Rail-Fence), Public key cryptography (definition only), Private key Cryptography (Definition and Examples), Cyber forensics, Stenography.

Unit IV: 15 hrs.

Safety Tools and Issues: Firewalls, logging and intrusion detection systems, Windows and windows XP/NT security, UNIX/LINUX security, ethics of hacking and cracking.

Cyber Laws to be covered as per IT 2008:

Digital Signature and Electronic Signature, Digital Certificate

i. [Section 43] Penalty and compensation for damage to computer etc.
ii. [Section 65] Tampering with computer source documents
iii. [Section 66A] Punishment for sending offensive messages through communication service etc.

iv. [Section 66B] Punishment for dishonestly receiving stolen computer resource or communication device
[Section 66C] Punishment for identity theft

v. [Section 66D] Punishment for cheating by impersonation by using computer resource vii. [Section 66E] Punishment for violation of privacy

vi. [Section 66F] Punishment for cyber terrorism

vii. [Section 67] Punishment for publishing or transmitting obscene material in electronic form

viii. [Section 67A] Punishment for publishing or transmitting of material containing sexually explicit act, etc. in electronic form

ix. [Section 67B] Punishment for publishing or transmitting of material depicting children in sexually explicit act, etc. in electronic form

x. [Section 72] Breach of confidentiality and privacy.

References:

1. Merkow, M., & Breithaupt, J. (2005) Information Security Principles and Practices. 5th edition.

2. Snyder, G.F. (2010). Network Security, Cengage Learning.

3. Basta, A., & Halton, W., (2010) Computer Security: Concepts, Issues and Implementation, Cengage Learning India.

4. Anderson, R. (2008) Security engineering: A guide to building dependable Distributed Systems. 2nd edition. John Wiley & Sons.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	20
Formative Assessment as per guidelines	

Subject Title (Project): Internship / Industrial Project

Course code	Type of Course	Theory / Practical	Credits	Instruction hour per week	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
C6BCA7P1	Project		06					150