



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI
JNANASAGARA CAMPUS, BALLARI-583 105

Department of Studies in Computer Science

*SEP: Credits Structure under Choice based Credit System
[CBCS]*

Syllabus of I & II Semester

**Bachelor of Computer Applications
in
Data Science**



With effect from 2025-26 Onwards

Approved in the BOS dated



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Jnanasagara campus, Ballari.-583105

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VSKUB SEP Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Scheme for the Three Years B.C.A. in Data Science Undergraduate Programme with effect from 2025-26

Semester	Major 1 (A)	Major 2 (B)	Major 3 (C)	Elective /Optional	Language	Compulsory / Skill Courses	Total Credits
1	Problem Solving using C (L:T:P = 4:0:2=6)	Data Structures (L:T:P = 4:0:2=6)	Statistics for Data Science (L:T:P = 4:0:0=4)	-	L1 (3) (L:T:P = 4:0:0) L2 (3) (L:T:P = 4:0:0)	Constitutional Values (2) (L:T:P = 3:0:0)	24
2	DBMS (L:T:P = 4:0:2=6)	Introduction to Data Science (L:T:P = 4:0:2=6)	Data Mining and Data Warehousing (L:T:P = 4:0:0=4)	-	L1(3) (L:T:P = 4:0:0) L2 (3) (L:T:P = 4:0:0)	Environmental Studies (2) (L:T:P = 3:0:0)	24
3	Python for Data Science (L:T:P = 4:0:2=6)	Data Analytics (L:T:P = 4:0:2=6)	Cloud Computing (L:T:P = 4:0:0=4)	-	L1 (3) (L:T:P = 4:0:0) L2 (3) (L:T:P = 4:0:0)	SEC-1 (2) Web Technologies (L:T:P = 1:0:2)	24
4	Data Preparation and Cleaning (L:T:P = 4:0:2=6)	R Programming (L:T:P = 4:0:2=6)	Software Engineering (L:T:P = 4:0:0=4)	-	L1 (3) (L:T:P = 4:0:0) L2 (3) (L:T:P = 4:0:0)	SEC-2 (2) ETL Tool (L:T:P = 1:0:2)	24
5	Working with IIoT Data (L:T:P = 4:0:2=6)	Big Data Technologies (L:T:P = 4:0:2=6)	Machine Learning (L:T:P = 4:0:2=6)	Cyber Security/ Information Retrieval System/ Internet of Things (L:T:P = 4:0:0=4)	-	SEC-3 (2) Elementary Research Methodology (L:T:P = 2:0:0)	24
6	Data Visualiation with PowerBI (L:T:P = 4:0:2=6)	Deep Learning Fundamentals (L:T:P = 4:0:2=6)	Data Privacy & Security (L:T:P = 4:0:0=4)	Bioinformatics/ Robotics and Automation/ Soft Computing (L:T:P = 4:0:0=4)	-	Internship/ Research Project (4)	24
Total	36	36	26	08	24	14	144
Total 144 Credits							

Note:

1. The Curriculum for Languages L1 & L2 will be framed by respective Board of Studies (BOS) (Example Kannada/ English/ Hindi/ Sanskrit/ Telugu etc.).
2. The curriculum for Constitutional values will be framed by Board of Studies (BOS) in Political Science.
3. The curriculum for Environmental Science will be framed by special/common Board of Studies (BOS) set up by the University.
4. The curriculum for Elementary Research Methodology will be set by special/common Board of Studies (BOS - Faculty of Science & Applied Science) set up by the University.

VSKUB SEP Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Scheme for the Three Years B.C.A in Data Science Undergraduate Programme with effect from 2025-26 (Three Major Combination)

1st Semester

Course Code	Title of the Course	Marks			Teaching hours/week			Credit	Duration of SEE (Hrs)
		IA	SEE	Total	L	T	P		
25LGCC1L1	Language 1	20	80	100	4	0	0	3	03
25LGCC1L2	Language 2	20	80	100	4	0	0	3	03
25BCADS1L1	Problem Solving using C	20	80	100	4	0	0	4	03
25BCADS1P1	Problem Solving using C Lab	10	40	50	0	0	4	2	03
25BCADS1L2	Data Structures	20	80	100	4	0	0	4	03
25BCADS1P2	Data Structures Lab	10	40	50	0	0	4	2	03
25BCADS1L3	Statistics for Data Science	20	80	100	4	0	0	4	03
25CVCM1L	Constitutional Values	10	40	50	3	0	0	2	1.5*
TOTAL		130	520	650	23	0	8	24	-

*** 40 Multiple Choice Questions for 40 Marks (OMR Based)**

Course Code Description:

25– Year of Curriculum Implementation / Revision

BCA-Bachelor of Computer Applications

DS- Data Science

LG – Language, CV – Constitutional Values

CM – Common Course

1 – Semester Number

L – Lecture, P - Practical

**VSKUB SEP Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Scheme for the
Three Years B.C.A in Data Science Undergraduate Programme with effect from 2025-26**

2nd Semester

Course code	Title of the Course	Marks			Teaching hours/week			Credit	Duration of SEE (Hrs)
		IA	SEE	Total	L	T	P		
25LGCC2L1	Language 1	20	80	100	4	0	0	3	03
25LGCC2L2	Language 2	20	80	100	4	0	0	3	03
25BCADS2L1	DBMS	20	80	100	4	0	0	4	03
25BCADS2P1	DBMS Lab	10	40	50	0	0	4	2	03
25BCADS2L2	Introduction to Data Science	20	80	100	4	0	0	4	03
25BCADS2P2	Introduction to Data Science Lab	10	40	50	0	0	4	2	03
25BCADS2L3	Data Mining and Data Warehousing	20	80	100	4	0	0	4	03
25ESCM2L	Environmental Science	10	40	50	3	0	0	2	1.5*
TOTAL		130	520	650	23	0	8	24	-

*** 40 Multiple Choice Questions for 40 Marks (OMR Based)**

Course Code Description:

25 – Year of Curriculum Implementation / Revision

BCA-Bachelor of Computer Applications

DS- Data Science

LG – Language, ES – Environmental Science

CM – Common Course

2 – Semester Number

L – Lecture, P - Practical

**VSKUB SEP Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Scheme for the
Three Years B.C.A in Data Science Undergraduate Programme with effect from 2025-26
3rd Semester**

Course code	Title of the Course	Marks			Teaching hours/week			Credit	Duration of SEE (Hrs)
		IA	SEE	Total	L	T	P		
25LGCC3L1	Language 1	20	80	100	4	0	0	3	03
25LGCC3L2	Language 2	20	80	100	4	0	0	3	03
25BCADS3L1	Python for Data Science	20	80	100	4	0	0	4	03
25BCADS3P1	Python for Data Science Lab	10	40	50	0	0	4	2	03
25BCADS3L2	Data Analytics	20	80	100	4	0	0	4	03
25BCADS3P2	Data Analytics Lab	10	40	50	0	0	4	2	03
25BCADS3L3	Cloud Computing	20	80	100	4	0	0	4	03
25SCBCADS3L1	Web Technologies	10	40	50	1	0	2	2	1.5*
TOTAL		130	520	650	21	0	10	24	-

*** 40 Multiple Choice Questions for 40 Marks (OMR Based)**

Course Code Description:

25 – Year of Curriculum Implementation / Revision

BCA-Bachelor of Computer Applications

DS- Data Science

LG – Language

3 – Semester Number

L – Lecture, P – Practical, S - Skill

**VSKUB SEP Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Scheme for the
Three Years B.C.A in Data Science Undergraduate Programme with effect from 2025-26**

4th Semester

Course code	Title of the Course	Marks			Teaching hours/week			Credit	Duration of SEE (Hrs)
		IA	SEE	Total	L	T	P		
25LGCC4L1	Language 1	20	80	100	4	0	0	3	03
25LGCC4L2	Language 2	20	80	100	4	0	0	3	03
25BCADS4L1	Data Preparation and Cleaning	20	80	100	4	0	0	4	03
25BCADS4P1	Data Preparation and Cleaning Lab	10	40	50	0	0	4	2	03
25BCADS4L2	R Programming	20	80	100	4	0	0	4	03
25BCADS4P2	R Programming Lab	10	40	50	0	0	4	2	03
25BCADS4L3	Software Engineering	20	80	100	4	0	0	4	03
25SCBCADS4L1	ETL Tool	10	40	50	1	0	2	2	1.5*
TOTAL		130	520	650	21	0	10	24	-

*** 40 Multiple Choice Questions for 40 Marks (OMR Based)**

Course Code Description:

25 – Year of Curriculum Implementation / Revision

BCA-Bachelor of Computer Applications

DS- Data Science

LG – Language

4 – Semester Number

L – Lecture, P – Practical, S - Skill

**VSKUB SEP Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Scheme for the
Three Years B.C.A in Data Science Undergraduate Programme with effect from 2025-26
5th Semester**

Course code	Title of the Course	Marks			Teaching hours/week			Credit	Duration of SEE (Hrs)
		IA	SEE	Total	L	T	P		
25BCADS5L1	Working with IIoT Data	20	80	100	4	0	0	4	03
25BCADS5P1	Working with IIoT Data Lab	10	40	50	0	0	4	2	03
25BCADS5L2	Big Data Technologies	20	80	100	4	0	0	4	03
25BCADS5P2	Big Data Technologies Lab	10	40	50	0	0	4	2	03
25BCADS5L3	Machine Learning	20	80	100	4	0	0	4	03
25BCADS5P3	Machine Learning Lab	10	40	50	0	0	4	2	03
25BCA5EA1 25BCA5EB1 25BCA5EC1	Cyber Security Information Retrieval System Internet of Things	20	80	100	4	0	0	3	03
25SCBCADS5L1	Elementary Research Methodology	10	40	50	2	0	0	2	1.5*
TOTAL		120	480	600	18	0	12	24	-

* 40 Multiple Choice Questions for 40 Marks (OMR Based)

The curriculum for Elementary Research Methodology will be set by special/common Board of Studies (BOS - Faculty of Science & Applied Science) set up by the University.

Course Code Description:

25 – Year of Curriculum Implementation / Revision

BCA-Bachelor of Computer Applications

DS- Data Science

LG – Language, RM – Research Methodology

BS – Bachelor of Science

4 – Semester Number, L – Lecture, P – Practical, S – Skill, E – Elective Course

**VSKUB SEP Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Scheme for the
Three Years B.C.A in Data Science Undergraduate Programme with effect from 2025-26**

6th Semester

Course code	Title of the Course	Marks			Teaching hours/week			Credit	Duration of SEE (Hrs)
		IA	SEE	Total	L	T	P		
25BCADS6L1	Data Visualiation with PowerBI	20	80	100	4	0	0	4	03
25BCADS6P1	Data Visualiation with PowerBI Lab	10	40	50	0	0	4	2	03
25BCADS6L2	Deep Learning Fundamentals	20	80	100	4	0	0	4	03
25BCADS6P2	Deep Learning Fundamentals Lab	10	40	50	0	0	4	2	03
25BCADS6L3	Data Privacy & Security	20	80	100	4	0	0	4	03
25BCADS6EA1 25BCADS6EB1 25BCADS6EC1	Bioinformatics Robotics and Automation Soft Computing	20	80	100	4	0	0	3	03
25BCADS6R1	Internship/Research Project	10	40	50	0	0	8	2	03
TOTAL		110	440	550	16	0	16	24	-

**** Internally conducted based on project report and presentation. The evaluation scheme will be provided by respective BOS.**

Course Code Description:

25 – Year of Curriculum Implementation / Revision

BCA-Bachelor of Computer Applications

DS- Data Science

LG – Language, CM – Common Course,

6 – Semester Number

L – Lecture, P – Practical, E – Elective Course, R – Research Project

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. CBCS is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the university:
One credit (01) = One Theory Lecture (L) period of one (1) hour;
One credit (01) = One Tutorial (T) period of one (1) hour;
One credit (01) = One practical (P) period of two (2) hours.
One Credit (01) = One Field Study (F) period of one (1) hour
3. Students shall select any two languages during 1-IV semesters.
4. Student shall select Elective course from any one of the major courses opted one in each in 5th and 6th semesters.
5. Elementary Research Methodology Course is common for B.Sc., in Data Science & BCA in AI & ML.
6. Student shall undertake Internship/Research Project in any one of the major courses opted during course.

Abbreviation Explanations:

1. SEC: Skill Enhancement Course;
2. L1: Language One
3. L2: Language One
4. L= Lecture; T= Tutorial; P=Practical; S= Skill; E = Elective; R = Research Project
5. LG – Language
6. RM – Research Methodology
7. CM – Common Course

NOTE:

1. FOR A THEORY COURSE WITH 4 CREDITS, SYLLABUS HAS TO SET FOR TOTAL OF 52-56 HOURS.
2. FOR A THEORY COURSE WITH 3 CREDITS, SYLLABUS HAS TO SET FOR TOTAL OF 40-42 HOURS.
3. FOR A THEORY COURSE WITH 2 CREDITS, SYLLABUS HAS TO SET FOR TOTAL OF 26-28 HOURS.
4. FOR A LAB COURSE/RESEARCH PROJECT WITH 2 CREDITS, SYLLABUS HAS TO SET FOR TOTAL OF 52-56 HOURS.
5. FOR A SKILL COURSE WITH 1 HOUR THEORY AND 2 HOUR LAB OF 2 CREDITS, SYLLABUS HAS TO BE SET FOR 40-42 HOURS.

Department Name: BCA
Semester – I

Course Title: Problem Solving using C	Course Code: 25BCADS1L1
Total Contact Hours: 56	No. of Credits: 4
L:T:P= 4:0:2	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

Upon completion of the course the student should be able to

CO1: Understand fundamental programming concepts, including software types, modular programming, and structured programming.

CO2: Develop proficiency in writing algorithms and designing flowcharts for problem-solving.

CO3: Implement C programming concepts such as data types, operators, decision-making statements, loops, and functions.

CO4: Apply arrays, strings, structures, pointers, and memory allocation techniques for efficient program development.

Unit	Description	Hours
1	Introduction to Programming Concepts: Software, Classification of Software, Modular Programming, Structured Programming, Algorithms and Flowcharts with examples. Overview of C Language: History of C, Character set, Tokens, Identifiers, Keywords, Data types, Variables, Constants, Symbolic Constants, Operators in C, Hierarchy of Operators, Expressions, Type Conversions and Library Functions.	12
2	Managing Input and Output Operation: Formatted and Unformatted I/O Functions, Decision making, branching and looping: Decision Making Statements-if Statement, if-else statement, nesting of if-else statements, else-if ladder, switch statement,?: operator, Looping - while, do-while, for loop, Nested loop, break, continue, and goto statements.	11
3	Functions: Function Definition, prototyping, types of functions, passing arguments to functions, Nested Functions, Recursive functions.	11
4	Arrays: Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays, Multi Dimensional Arrays - Passing arrays to functions. Strings: Declaring and Initializing strings, Operations on strings, Arrays of strings, passing strings to functions. Storage Classes -Automatic, External, Static and Register Variables.	11
5	Structures: Declaring and Initializing, Nested structure, Array of Structure, Passing Structures to functions, Unions, typedef, enum, Bit fields. Pointers – Declarations, Pointer arithmetic, Pointers and functions, Call by value, Call by reference, Pointers and Arrays, Arrays of Pointers, Pointers and Structures. Meaning of static and dynamic memory allocation, Memory allocation functions.	11

References:

1. Yashwant Kanetkar, "Let Us C", 13th Edition, PHP, 2013.
2. Ashok N.Kamthane et.al., "Computer Programming and IT", Pearson Education, 2011
3. Mahapatra, "Thinking In C", PHI Publications, 1998.

Course Title: Problem solving using C Lab	Course Code: 25BCADS1P1
L:T:P= 0:0:2	No. of Credits: 02
Internal Assessment Marks: 10	
Semester End Exam Marks: 40	Duration of SEE: 03 Hours

Course Outcomes (COs):

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

CO1: Develop problem-solving skills by implementing algorithms for number manipulation, string processing, and matrix operations.

CO2: Apply control structures, functions, and recursion to create efficient and optimized C programs.

CO3: Understand and implement concepts of arrays, pointers, structures, and unions for data handling in C programming.

CO4: Demonstrate the ability to write, debug, and execute structured C programs for real-world applications.

List of Experiments / Programs (For a Lab Course)

Sl. No.	Experiment / Program
1	Printing the reverse of an integer.
2	Generate first N prime numbers.
3	Get a string and convert the lowercase to uppercase and vice-versa without using library functions.
4	Find the occurrence of a particular character in a string.
5	Input a string and find the number of each of the vowels which appear in the string.
6	Accept N words and make it as a sentence by inserting blank spaces and a full stop at the end.
7	Print the reverse of a string.
8	Find the first N terms of Fibonacci series using arrays.
9	Declare 3 pointers variables to store a character, a character string and an integer respectively. Input values into these variables. Display the address and the contents of variables.
10	Program to demonstrate structure and union.
11	Recursive program to find the factorial of an integer.
12	Find the maximum of 4 numbers by defining a macro for the maximum of two numbers.
13	Arranging N numbers in ascending and in descending order using bubble sort.
14	Checking whether the given matrix is an identity matrix or not.
15	Addition and subtraction of two matrices.

Course Title: Data Structures	Course Code: 25BCADS1L2
Total Contact Hours: 56	No. of Credits: 04
L:T:P= 4:0:2	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

CO1: Understand fundamental data structures, their classification, and the complexity analysis of algorithms.

CO2: Implement stack, queue, and linked list operations using static and dynamic memory allocation.

CO3: Apply tree and graph data structures for problem-solving, including traversal and searching algorithms.

CO4: Develop efficient algorithms for sorting, searching, and hashing to optimize data management.

Unit	Description	Hours
1	Introduction to Data Structures: Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion.	12
2	Stacks and Queue:- Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue.	11
3	Linked Lists: Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List.	11
4	Trees: Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree B Tree, B+ Tree.	11
5	Graphs, Searching, Sorting and Hashing Graphs: Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. Searching and Sorting: Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort.	11

References:

- Balagurusamy, "Data Structures Using C"., Publisher, McGraw-Hill Education (India), 2013. ISBN, 1259029549, 9781259029547.
- Seymour Lipschutz, "Data Structures with C", Schaum'soutLines, Tata McGraw-Hill, 2011.
- Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2013.
- Forouzan, "A Structured Programming Approach using C", 2nd Edition, Cengage Learning India, 2008.

Course Title: Data Structures Lab	Course Code: 25BCADS1P2
L:T:P= 0:0:2	No. of Credits: 02
Internal Assessment Marks: 10	
Semester End Exam Marks: 40	Duration of SEE: 03 Hours

Course Outcomes (COs):

CO1: Develop proficiency in recursion, pointers, and linked lists through problem-solving exercises such as Fibonacci series, Towers of Hanoi, and linked list creation.

CO2: Implement advanced data structure concepts like stacks, queues, and binary search trees using pointer-based techniques.

CO3: Apply array and string manipulation techniques, including insertion, deletion, concatenation, and substring extraction, without relying on built-in functions.

CO4: Enhance algorithmic thinking by implementing searching, sorting, and memory management operations using C programming constructs.

List of Experiments / Programs

Sl. No.	Experiment / Program
1	Use a recursive function to find the Fibonacci series.
2	Use pointers to find the length of a string and to concatenate two strings.
3	Use pointers to copy a string and to extract a substring from a given string.
4	Use a recursive function for the towers of Hanoi with three discs.
5	Insert an integer into a given position in an array.
6	Deleting an integer from an array.
7	Write a program to create a linked list and to display it.
8	Pointer implementation of stacks.
9	Pointer implementation of queues.
10	Creating a binary search tree and traversing it using in order, preorder and post order.

Course Title: Statistics for Data Science	Course Code: 25BCADS1L3
Total Contact Hours: 56	No. of Credits: 04
L:T:P= 4:0:2	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

CO1: Understand the fundamental concepts of data types, population, samples, and scales of measurement.

CO2: Organize and present data effectively using frequency distributions, diagrams, and graphs.

CO3: Apply statistical methods to calculate measures of central tendency, dispersion, skewness, and kurtosis.

CO4: Analyze relationships between variables using correlation and regression techniques for data-driven decision-making.

Unit	Description	Hours
1	Introduction: Population and sample, Types of data – Qualitative, Quantitative, Univariate, Multivariate, Cross sectional, Time, Series, Discrete, Continuous, Primary, Secondary, Scales of measurement – Nominal, Ordinal, Interval, Ratio, Variables and attributes,	12
2	Organization and presentation of data: Construction of frequency distributions (univariate and bivariate), Presentation of data through diagrams (bar and pie) and graphs (frequency curve, histogram, cumulative frequency curves), Stem and leaf plot.	11
3	Measures of Central Tendency: Measures of location or central tendency – Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean – Properties, Positional averages or quartiles – Quartiles, Deciles and Percentiles.	11
4	Measures of Dispersion: Measures of dispersion – Absolute measures – Range, Mean deviation, Quartile deviation, Standard deviation – Statement of properties, Coefficient of variation, Skewness and Kurtosis – Concept and measures. Discussions on the suitability of the different measures in practical situations.	11
5	Correlation and Regression: Linear correlation – Scatter diagram, Product moment correlation coefficient – Properties, Spearman’s rank correlation coefficient, Simple regression, Prediction.	11

References:

1. Freund, Ronald, E. Walpole, Mathematical Statistics, Fourth Edition (1987), Prentice Hall of India, New Delhi.
2. B.L. Agarwal, Basic Statistics (2009), New Age Publishers.
3. J. Medhi, Statistical Methods – An Introductory Text, New Age Publishers.
4. A.M. Goon, M.K. Gupta and B. Das Gupta, Fundamentals of Statistics, Vol. 1, Sixth Edition, World Press, Calcutta.
5. Gupta and Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons.

II Semester

Course Title: DBMS	Course Code: 25BCADS2L1
Total Contact Hours: 56	No. of Credits: 04
L:T:P= 4:0:2	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

CO1: Understand the fundamental concepts of database systems, including architecture, data models, and database interfaces.

CO2: Apply Entity-Relationship (E-R) modeling and relational algebra to design and manipulate relational databases.

CO3: Develop SQL queries for data definition, manipulation, and retrieval using normalization techniques.

CO4: Explore storage mechanisms, file organization, and database indexing for efficient data retrieval and management.

Unit	Description	Hours
1	Introduction, Database Systems: Introduction, Database Systems Characteristics of DB Approach, Advantages of DBMS, Database Users, DB Languages, Applications of Database.	12
2	Data Model Concepts: Data Model Concepts, Database System Architecture-Centralized, Client/Server: Two- tier, Three-tier, Three-Schema Architecture-Physical Data Independence and Logical Data Independence, Different types of data models, Database Interfaces.	11
3	E-R Model concepts: E-R Model concepts-Entities, Attributes, Relationship, E-R model constraints, E-R diagrams, Relational model concepts, Characteristics of relations, constraints on relations, Relational Algebra-Unary and Binary operations.	11
4	SQL: DDL - Create table/views, Drop, Alter commands, DML - Insert, Delete, Update, Select, queries, sub-queries, nested queries, Joins – equijoin, nonequijoin, Built-in functions of SQL & grouping. Concept of Functional dependency, Normalization – 1NF, 2NF, 3NF.	11
5	Secondary Storage device: Secondary Storage devices, Buffering of Blocks, Files on disk, Operations on files, File organization: Ordered files, Hashed files, Indexed files, Heap files, RAID organization.	11

References:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts" 6th Edition, McGraw Hill, 2012.
3. C.J. Date, "Introduction to database systems", 8th Edition, Addison Wesley

Course Title: DBMS Lab	Course Code: 25BCADS2P1
L:T:P= 0:0:2	No. of Credits: 02
Internal Assessment Marks: 10	
Semester End Exam Marks: 40	Duration of SEE: 03 Hours

Course Outcomes (COs):

CO1: Develop hands-on experience in implementing SQL commands, including DDL and DML operations, for database management.

CO2: Apply SQL functions, operators, and joins to retrieve and manipulate data efficiently.

CO3: Demonstrate proficiency in advanced SQL concepts such as indexing, constraints, subqueries, views, and transactions.

CO4: Implement database security mechanisms, backup & recovery processes, and user management techniques for secure database administration.

List of Experiments / Programs

Sl. No.	Experiment / Program
1	Implementation of DDL commands of SQL with suitable examples. • Create table • Alter table • Drop Table
2	Implementation of DML commands of SQL with suitable examples. • Insert • Update • Delete
3	Implementation of different types of function with suitable examples. • Number function • Aggregate Function • Character Function • Conversion Function • Date Function.
4	Implementation of different types of operators in SQL. • Arithmetic Operators • Logical Operators • Comparison Operator • Special Operator • Set Operation.
5	Implementation of different types of Joins. • Inner Join • Outer Join • Natural Join etc..
6	Study and Implementation of • Group By & having clause • Order by clause • Indexing
7	Study & Implementation of • Sub queries • Views
8	Study & Implementation of different types of constraints.
9	Study & Implementation of Database Backup & Recovery commands. Study & Implementation of Rollback, Commit, Savepoint.
10	• Creating Database /Table Space • Managing Users: Create User, Delete User • Managing roles:-Grant, Revoke.

Course Title: Introduction to Data Science	Course Code: 25BCADS2L2
Total Contact Hours: 56	No. of Credits: 04
L:T:P=4:0:0	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

Upon completion of the course, students will be able to

CO1: Understand the fundamental concepts of data science.

CO2: Evaluate the data analysis techniques for applications handling large data and demonstrate the data science process.

CO3: Understand concept of machine learning used in the data science process.

CO4: Visualize and present the inference using various tools.

CO5: Learn to think through the ethics surrounding privacy, data sharing.

Unit	Description	Hours
1	Introduction, Toolboxes: Python, fundamental libraries for data Scientists. Integrated development environment (IDE). Data operations: Reading, selecting, filtering, manipulating, sorting, grouping, rearranging, ranking, and plotting.	11
2	Descriptive statistics: Data preparation, Exploratory Data Analysis data summarization, data distribution, measuring asymmetry. Sample and estimated mean, variance and standard score. Statistical Inference frequency approach, variability of estimates, hypothesis testing using confidence intervals, using p-values	12
3	Supervised Learning: First step, learning curves, training-validation and test. Learning models generalities, support vector machines, random forest. Examples	10
4	Regression: linear regression simple linear regression, multiple & Polynomial regression, Sparse model. Unsupervised learning, clustering, similarity and distances, quality measures of clustering, case study.	12
5	Network Analysis: Graphs, Social Networks, centrality, drawing centrality of Graphs, PageRank, Ego-Networks, community Detection	11

References:

1. Introduction to Data Science a Python approach to concepts, Techniques and Applications, Igual, L; Seghi', S. Springer, ISBN:978-3-319-50016-4
2. Data Analysis with Python A Modern Approach, David Taieb, Packt Publishing, ISBN-9781789950069
3. Python Data Analysis, Second Ed., Armando Fandango, Packt Publishing, ISBN: 9781787127487.

Course Title: Data Science Lab	Course Code: 25BCADS2P2
L:T:P= 0:0:2	No. of Credits: 02
Internal Assessment Marks: 10	
Semester End Exam Marks: 40	Duration of SEE: 03 Hours

Course Outcomes (COs):

CO1: Develop proficiency in Python programming and its essential libraries for data science applications.

CO2: Implement data operations, descriptive statistics, and hypothesis testing to analyze datasets effectively.

CO3: Apply machine learning techniques, including supervised and unsupervised learning, for data-driven insights.

CO4: Perform network analysis using graph-based models to explore relationships and centrality measures in datasets.

List of Experiments / Programs

Sl. No.	Experiment / Program
1	Introduction to Python & IDEs <ul style="list-style-type: none"> Install Python and set up an Integrated Development Environment (IDE) (Jupyter Notebook, PyCharm, or VS Code). Write a simple Python program to demonstrate basic syntax.
2	Data Operations in Python <ul style="list-style-type: none"> Read data from a CSV file and display the first few rows. Perform selection, filtering, sorting, grouping, and ranking on a dataset. Implement data visualization using Matplotlib and Seaborn.
3	Descriptive Statistics & Data Preparation <ul style="list-style-type: none"> Compute mean, median, mode, variance, standard deviation, and percentiles. Create histograms, boxplots, and stem-leaf plots. Analyze data distribution and measure asymmetry.
4	Statistical Inference & Hypothesis Testing <ul style="list-style-type: none"> Perform confidence interval estimation for a sample. Conduct hypothesis testing using t-tests, chi-square tests, and ANOVA.
5	Supervised Learning – Classification & Regression <ul style="list-style-type: none"> Implement a Support Vector Machine (SVM) classifier on a dataset. Apply a Random Forest model for classification. Perform linear and multiple regression analysis.
6	Unsupervised Learning – Clustering <ul style="list-style-type: none"> Implement K-Means clustering and analyze the results. Apply hierarchical clustering and visualize the dendrogram. Evaluate clustering quality using Silhouette Score.
7	Network Analysis <ul style="list-style-type: none"> Create and visualize a graph using NetworkX. Calculate centrality measures (Degree, Betweenness, PageRank). Detect communities using the Louvain method.

Course Title: Data Mining and Warehousing	Course Code: 25BCADS2L3
Total Contact Hours: 56	No. of Credits: 04
L:T:P=4:0:2	
Internal Assessment Marks: 20	Duration of SEE: 03 Hours
Semester End Exam Marks: 80	

Course Outcomes (COs):

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

CO1: Understand the concepts of data pre-processing

CO2: Understand the methodologies related to design, construction and usage of data warehouse

CO3: Characterize the kinds of patterns that can be analysed by association rule mining.

CO4: Understand various kinds of classification and clustering models through real life examples

Unit	Description	Hours
1	Introduction: Introduction to data mining, Kinds of data, Data Warehouse, Kinds of Patterns, Technologies Used, Applications, Major Issues	10
2	Data Warehouse Building Blocks, Dimensional Modeling - Star Schema, Updates to the Dimension Tables, Miscellaneous Dimensions, Snowflake Schema, Aggregate Fact Tables, Families of Stars, ETL - Overview, Data Extraction, Data Transformation, Data Loading, Data Quality - Challenges, Tools, Initiative, OLAP – Major Features and Functions, OLAP Models, Implementation Considerations, Case Study	12
3	Data Pre-Processing: Descriptive Data Summarization, Data cleaning and Transformation, Data Integration, Data reduction, Case Study	11
4	Mining Frequent Patterns, Associations and Correlations: Basic concepts and a road map, Apriori Algorithm for finding frequent item sets with candidate generation, Improving Efficiency of Apriori, FP – Growth without generating candidate generation, Frequent Itemsets from Vertical Data Format, Pattern Evaluation Methods, Case Study.	12
5	Classification: Basic Concepts, Classification by Decision Tree Induction, Pruning Technique, Bayesian classification, Rule-Based classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Model Evaluation and Selection, Techniques to improve Classification Accuracy, Case Study	11

References:

1. Jiawei Han and Micheline Kamber, Data Mining- Concepts and Techniques,(3e), Morgan Kaufmann Publishers, 2011
2. Paulraj Ponniah, Data Warehousing, (2e), Wiley India Pvt. Ltd., 2010
3. Galit Shmueli, Nitin R. Patel, Peter C. Bruce, Data Mining for Business Intelligenc, (2e), Wiley, 2010
4. Ian H Witten, Eibe Grank, Mark A Hall, Data Mining, Practical Machine Learning Tools and Techniques, (3e), Morgan Kaufmann Publishers, 2011

BCA Degree Examination, SEP
– QP - Pattern

Time: 3 Hours

Max. Marks: 80

Section – A

Note: Answer all sub questions
Each question carries TWO Mark.

(10 x 2 = 20)

1.

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

Section – B

Note: Answer any Four questions
Each question carries FIVE marks.

(4 x 5 =20)

- 2.**
- 3.**
- 4.**
- 5.**
- 6.**
- 7.**

Section – C

Note: Answer any Four questions
Each question carries TEN marks.

(4 x 10 =40)

- 8.**
- 9.**
- 10.**
- 11.**
- 12.**
- 13.**

- Note:**
- 1. For Section –A, Two questions from each Unit.**
 - 2. For Section – B, One question from each Unit, and Q-7 must be from Unit 2 to 5.**
 - 3. For Section – C, One question from each Unit, and Q-13 must be from Unit 2 to 5.**

BCA Degree Examination, SEP – Scheme for Practical Examination

1. Writing Two Programs : 14 Marks (for each 7 marks)
2. Execution of Two programs : 16 Marks (for each 8 marks)
3. Practical record : 05 Marks
4. Viva Voce : 05 Marks Total : 40 Marks

**QUESTION PAPER PATTERNS FOR ALL SKILL PAPERS IS 40
MULTIPLE CHOICE QUESTIONS.**