GAYATRI VIDYA PARISHAD
College for Degree and PG Courses (Autonomous)
(Affiliated to Andhra University)
Visakhapatnam

Department of Computer Applications

BACHELOR OF COMPUTER APPLICATIONS

DATA SCIENCE

Syllabus

With effect from 2021-22 admitted batch

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
BACHELOR OF COMPUTER APPLICATIONS– DATA SCIENCE Under CBCS
Course Structure and Scheme of Examination w.e.f. 2021-22

I Semester

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA1.1.1	First Language-English-I	4	75	25	100	3
BCA1.1.2	Second Language-Hindi/Sanskrit-I	4	75	25	100	3
BCA1.1.3	Life Skill Course – I (Human Values & Professional Ethics)	2	50	0	50	2
BCA1.1.4	Skill Development Course – I (Plant Nursery)	2	50	0	50	2
BCA1.1.5	Computer Essentials for Data Science	4	75	25	100	4
BCA1.1.6	Computer Essentials for Data Science Lab	2	50	0	50	1
BCA1.1.7	Problem Solving and Programming Using "C"	4	75	25	100	4
BCA1.1.8	Problem Solving and Programming Using "C" Lab	2	50	0	50	1
BCA1.1.9	Numerical and Statistical Methods	4	75	25	100	4
BCA1.1.10	Numerical and Statistical Methods Lab	2	50	0	50	1
Total		**30**	**625**	**125**	**750**	**25**

II Semester

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA1.2.1	First Language-English-II	4	75	25	100	3
BCA1.2.2	Second Language-Hindi/Sanskrit-II	4	75	25	100	3
BCA1.2.3	Life Skill Course – II - Personality Enhancement and Leader Ship	2	50	0	50	2
BCA1.2.4	Life Skill Course – III - Analytical Skills	2	50	0	50	2
BCA1.2.5	Skill Development Course – II- Solar Energy	2	50	0	50	2
BCA1.2.6	Skill Development Course – III – Food Adulteration	2	50	0	50	2
BCA1.2.7	Data Structures	4	75	25	100	4
BCA1.2.8	Data Structures Lab	2	50	0	50	1
BCA1.2.9	Database Management Systems	4	75	25	100	4
BCA1.2.10	Database Management Systems Lab	2	50	0	50	1
BCA1.2.11	Statistical Methods & their Applications	4	75	25	100	4
BCA1.2.12	Statistical Methods & their Applications Lab	2	50	0	50	1
Total		**34**	**725**	**125**	**850**	**29**

III Semester

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA2.1.1	First Language-English-III	4	75	25	100	3
BCA2.1.2	Second Language-Hindi/Sanskrit –III	4	75	25	100	3
BCA2.1.3	Life Skill Course – IV- E.E	2	50	0	50	2
BCA2.1.4	Skill Development Course – IV Di.Mgt	2	50	0	50	2
BCA2.1.5	Object Oriented Programming Through Java	4	75	25	100	4
BCA2.1.6	Object Oriented Programming Through Java Lab	2	50	0	50	1
BCA2.1.7	Operating Systems	4	75	25	100	4
BCA2.1.8	Operating Systems Lab	2	50	0	50	1
BCA2.1.9	Advanced Excel	4	75	25	100	4
BCA2.1.10	Advanced Excel Lab	2	50	0	50	1
Total		**30**	**625**	**125**	**750**	**25**

IV Semester

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA2.2.1	Tablue	4	75	25	100	4
BCA2.2.2	Tablue Lab	2	50	0	50	1
BCA2.2.3	Data Mining and Data ware Housing	4	75	25	100	4
BCA2.2.4	Data Mining and Data ware Housing Lab	2	50	0	50	1
BCA2.2.5	Web Programming	4	75	25	100	4
BCA2.2.6	Web Programming Lab	2	50	0	50	1
BCA2.2.7	Design and Analysis of Algorithms	4	75	25	100	4
BCA2.2.8	Design and Analysis of Algorithms Lab	2	50	0	50	1
BCA2.2.9	Introduction to Data Science with R-Programming	4	75	25	100	4
BCA2.2.10	Introduction to Data Science with R-Programming Lab	2	50	0	50	1
BCA2.2.11	Object Oriented software Engineering	4	75	25	100	4
BCA2.2.12	Object Oriented software Engineering Lab	2	50	0	50	1
Total		**36**	**750**	**150**	**900**	**30**

V Semester

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA3.1.1	Big Data Analytics	4	75	25	100	4
BCA3.1.2	Big Data Analytics Lab	2	50	0	50	1
BCA3.1.3	Python Programming	4	75	25	100	4
BCA3.1.4	Python Programming Lab	2	50	0	50	1
BCA3.1.5	Statistical Package for Social Science	4	75	25	100	4
BCA3.1.6	Statistical Package for Social Science Lab	2	50	0	50	1
BCA3.1.7	Elective_ I[Theory] Deep Learning Data Science Applications	4	75	25	100	4
BCA3.1.8	Elective_ I[Lab] Deep Learning Lab Data Science Applications Lab	2	50	0	50	1
BCA3.1.9	Elective_ II[Theory] Information Storage Management Social Network Analytics	4	75	25	100	4
BCA3.1.10	Elective_ II[Lab] Information Storage Management Lab Social Network Analytics Lab	2	50	0	50	1
BCA3.1.11	Elective_ III[Theory] Cloud Computing Mobile Computing	4	75	25	100	4
BCA3.1.12	Elective_ III[Lab] Cloud Computing Lab Mobile Computing Lab	2	50	0	50	1
Total		**36**	**750**	**150**	**900**	**30**

VI Semester

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA3.2.1	FIRST and SECOND PHASES (2 spells) of APPRENTICESHIP between 1st and 2nd year and between 2nd and 3rd year (two summer vacations).				APPRENTICESHIP between 1st and 2nd year (1Spell)	4
BCA3.2.2	THIRD PHASE of APPRENTICESHIP Entire 5th / 6th Semester				APPRENTICESHIP between 2nd and 3rd year (2Spell)	4
BCA3.2.3	**Main Project**					12
Total		**--**	**--**	**--**	**--**	**20**
Grand Total		**166**	**3475**	**675**	**4150**	**159**

BACHELOR OF COMPUTER APPLICATIONS
DATA SCIENCE

Syllabus

With effect from 2021-22 admitted batch

Chairman

Board of Studies

(2021-22)

Department of Computer Applications

Gayatri Vidya Parishad College for Degree and PG Courses (A)

(Affiliated to Andhra University)

Visakhapatnam

BACHELOR OF COMPUTER APPLICATIONS

DATA SCIENCE

Syllabi

With effect from 2021-22 admitted batch

I YEAR I SEMESTER

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA1.1.1	First Language-English-I	4	75	25	100	3
BCA1.1.2	Second Language-Hindi/Sanskrit-I	4	75	25	100	3
BCA1.1.3	Life Skill Course – I (Human Values & Professional Ethics)	2	50	0	50	2
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BCA1.1.6	Computer Essentials for Data Science Lab	2	50	0	50	1
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BCA1.1.10	Numerical and Statistical Methods Lab	2	50	0	50	1
Total		**30**	**625**	**125**	**750**	**25**

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A. DATA SCIENCE -Semester I
COMPUTER ESSENTIALS FOR DATA SCIENCE

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

The Computer Essentials module sets out basic ideas and abilities identifying with the utilization of use of devices, computer organization, data representations, databases and data science.

Provide abilities to oversee PCs, gadgets, and information safely and viably.

	SYLLABUS	
UNIT I:		(12 hrs)
Digital Fundamentals: Number Systems-Binary, Hexadecimal, Octal, Conversion, Data encoding, Operations on Binary number system, representation of positive and negative integer, compliment operations, real number system, Boolean Algebra, Logic Gates, SOP and POS K map Simple arithmetic circuits, Combinational circuits- Sequential circuits		
UNIT II:		(12 hrs)
Basic Computer Organization: Registers, Instruction Formats, Types of instructions, Execution of a Complete Instruction, Bus Organization, Control Unit Organizations-Hard-wired Control, and Micro programmed Control. Input Out organizations Central processing units and different CPU organizations Subroutines -Memory Memory Hierarchy- Types		
UNIT III:		(8hrs)
Introduction to Database Management Systems-Database, DBMS, Why Database -File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL, TCL		
UNIT IV:		(10hrs)
Data representation, Data organization, Data models using UML, Types of Data, structured, unstructured, semi structured, examples of real world data, data collection techniques, data interpretation mechanisms. Data storage mechanisms, Hierarchy of storage, Characteristics of storage, Storage media, storage related technologies, online and offline storage mechanisms		
UNIT V:		(8hrs)
Introduction to Data Science - Steps Skills Data Datasets Existing data sources data models, Applications		
Outcomes:		
1. Understand the fundamental concepts of electronic communication and their use in computer applications, the basic structure and operation of a digital computer, identify the logic gates and their functionality, perform Number Conversions from one System to another System, Design basic electronic Circuits (combinational circuits), and understand the Construction of Memory. 2. Understand the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main components and understand contemporary microprocessor designs and identify various design techniques employed		

3. Understand the role of a database management system in an organization, use of Structured Query Language (SQL) and learn SQL syntax, needs of database processing and learn techniquesfor controlling the consequences of concurrent data access.

4. Understand the concept of a database transaction and related database facilities, including concurrency control, backup and recovery, locking and related protocols. Importance of modeling in the software development life, the UML notation and symbols. Identify classes/entities of data, their attributes, and relationships. Design the logical and physical structure of a relational database for efficient data storage

5. Understanding the flow of a data science process, and the skill sets needed to be a data scientist, significance of exploratory data analysis in data science

References:		

1. The Unified modelling language Reference Manual, Grady Booch, James Rumbaugh,Ivar Jacobson.

2. Computer Organization   Carl Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition,McGraw Hill.

3. Computer Systems Architecture   M.Moris Mano, IIIrd Edition, Pearson/PHI

Text Books:

1. J. Glenn Brookshear,"Computer Science: An Overview", Addision-**Wesley, Twelfth Edition, 2014.**

2 Fundamentals of Database Systems, 7th Edition, Ramez Elmasri, U. Shamkant B. Navathe.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester I
COMPUTER ESSENTIALS FOR DATA SCIENCE LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:
1. To Create a document in Microsoft Word with formatting
2. To Write functions in Microsoft Excel to perform basic calculations and to convert number to text and text to number
3. To create a presentation in Microsoft PowerPoint that is interactive and legible content.

	SYLLABUS	
Usage of Word, excel and PowerPoint

Usage of Word, excel and PowerPoint

PC Assembly Data representation and operations on Binary data

SQL-Create: Table and column level constraints- Primary key, Foreign key, Null/ Not null, Unique, Default. Check, Alter, Drop, Insert, Update, Delete, Truncate, Select: using WHERE,AND, OR, IN, NOT IN

Data collection and interpretation Data

storage mechanism and tools

Outcomes:		

1. Provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint. Completion of the assignments will result in MS Office applications knowledge andskills.

2. Understand the functional components of a computer system (processor, storage andinput/output) in terms of assembly language commands. Understand the relationship between high level programming languages and machine level implementation. Understand computer architecture and its relationship to higher level machine abstractions. Also able to how torepresent integers, real numbers, and character data, representation of negative numbers, storage capacity and its effect on numeric magnitude. Perform arithmetic operations on binary and hexadecimal notations. Convert numbers between decimal, binary and hexadecimal notations.

3. Must be able to construct simple and advanced database queries using Structured Query Language (SQL)

4. Understand the concept Identify Business Requirements. Entity Relationship Data Modeling, Normalization, Advanced Data Modeling Concepts, Transform a Data Model into a Functional Database. Create conceptual models of relational databases based on requirement specification documents

5. Understand the data storage concepts, data storage equipment's that are used to storethe user / computer generated data.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester I
PROBLEM SOLVING AND PROGRAMMING USING "C"

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

1. Provides knowledge on Algorithms, Flow chart and different programming languages.
2. To train the students with basic concepts of programming using C.
3. Provides complete knowledge of C language.
4. Helps to develop logics which will help them to create program and applications in C.
5. Learning the basic programming constructs, they can easily switch over to any other language in future.

	SYLLABUS	
UNIT I:		

Introduction to Algorithms and Programming Languages: Algorithm – Key features of Algorithms, Flow Charts, Programming Languages – Generations of Programming Languages

Introduction to C: Introduction – Structure of C Program – Writing the first C Program – Files used in C Program – Compiling and Executing C Programs - Programming Example

UNIT II:		

C Fundamentals: Keywords – Identifiers – Basic Data Types in C – Variables – Constants – I/O Operators in C – I/O Statements (scanf, printf)

Decision Control Statements: Introduction to Decision Control Statements – Conditional Branching Statements: simple if, if..else, nested if, switch statements – Programming Examples

UNIT III:		

Iterative Control Statements: Iterative Statements – Nested Loops – Break and Continue Statement - Goto Statement

Arrays: Introduction – Declaration of Arrays – Accessing elements of the Array – Storing Values in Array – one dimensional array for inter-function communication – Two dimensional Arrays – two dimensional arrays for inter-function communication

Strings: Introduction – String operations – String functions

UNIT IV:		

Functions: Introduction – using functions – Function declaration/ prototype – Function definition – function call – return statement – Passing parameters – Scope of variables – Storage Classes – Recursive functions.

Structure and Unions: Introduction – Nested Structures – Arrays of Structures – Structures and Functions – Unions – Arrays of Unions Variables

UNIT V:		

Pointers: Introduction to Pointers – declaring Pointer Variables – Passing Arguments to Functions using Pointer – Pointer and Arrays – Dynamic Memory Allocation

File Handling: Introduction to Files, File modes, File operations, Reading Data from Files, Writing Data from Files, Detecting the End-of-file

Outcomes:		

Upon successful completion of this course, students will be able to-

1. Understand the basic terminology used in computer programming.
2. Write, compile and debug programs in C language.
3. Use different data types in a computer program.
4. Design programs involving decision structures, loops and functions.
5. Understand the dynamics of memory by the use of pointers and Structures.
6. Apply different operations in File handling.

References:		

1. E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008, ISBN 978-0-07-066909-3.
2. Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson Edition Publ, 2002.
3. Yashavant Kanetkar - Let Us 'C' – BPB Publications.

4. Brain W Kernighan and Dennis M Ritchie - The 'C' Programming language - Pearson publications.
Text Books:
Computer Fundamentals and Programming in C by Reema Thareja from Oxford University Press

B.C.A. DATA SCIENCE -Semester I

PROBLEM SOLVING AND PROGRAMMING USING "C" LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:

1. To implement decision making and arrays.
2. To develop programs for pointers and structures.
3. To write C programs using Files.

	SYLLABUS	

1. Write a C program to calculate the expression: $((a*b)/c)+(a+b-c)$.
2. Write a C program to calculate $(a+b+c)^3$.
3. Write a C program to check whether the given number is Prime or Not.
4. Write a C program to find the sum of individual digits of a given number .
5. Program to convert Hours into seconds.
6. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
7. Write a program to check whether given number is Palindrome or Not.
8. Write a C program to check whether a given 3-digit number is Armstrong number or not.
9. Write a C program to print the numbers in triangular form.

          1

          1 2

          1 2 3

          1 2 3 4

10. Program to display number of days in given month using Switch – Case.
11. Write a C program to perform the following:
    i.   Addition of two matrices.
    ii.   Multiplication of two matrices.
12. Write a C program to determine if the given string is a palindrome or not.
13. Write C program to find the factorial of a given integer using recursive function.
14. Write a C program to concatenate two strings using pointers.
15. Write a C program to find the length of string using pointers.
16. Program to display Student Details using Structures.
17. Write a C program to
    iii.   Write data into a File.
    iv.   Read data from a File.

Outcomes:		

After Completion of the course student should able to
1. Student will be able to Know concepts in problem solving.
2. Ability to do programming in C language.
3.To write diversified solutions using C language.
4. ability to write programming with pointers and structures.
5. Ability to write c programming with files.

B.C.A. DATA SCIENCE -Semester I
NUMERICAL AND STATISTICAL METHODS

Credits: 4	Theory: 4 HOURS	TUTORIALS: -
Max Marks: 100	External: 75 Marks	Internal: 25

Course Objectives:

1. To learn how to perform error analysis for arithmetic operations.
2. To demonstrate working of various numerical methods and matrix methods
3. To provide a basic understanding of the derivation and use of methods of interpolation and numerical integration.
4. To impart knowledge of various statistical techniques.
5. To develop students understanding through laboratory activities to solve problems related to above stated concepts.

	SYLLABUS	
Unit I:		

Numerical Integration, Finite Difference and Interpolation
Numerical Integration:
1. Trapezoidal rule 2. Simpson's 1/3 rule 3. Simpson's 3/8 rule
Finite Difference and Interpolation:
Finite Differences - Forward Differences - Backward differences.
Newton's forward interpolation formula - Newton's backward interpolation formula

Unit II:		

Matrix Algebra
Matrix Algebra: Types of matrices -Matrix addition and subtraction - Matrix Multiplication-Transpose of a matrix, row matrix, column matrix, Symmetric and skew symmetric matrices.

Unit III:		

Linear Equations
Ad joint of a square matrix- Inverse of square matrix by using Adj A 3 order only and Rank of a Matrix.
Solution of Linear Equations
Cramer's Rule
Matrix Inverse method
Statistical Methods

Unit IV:		

Basic concepts and definition of statistics: measures of central tendency, Mean, Median and Mode, Standard deviation, coefficient of variation Skewness, Karl pearson's coefficient of skewness, Bowley's Coefficient of skewness,

Unit V:		

Correlation: Karl Pearson correlation coefficient, Rank correlation and illustrated examples.
Probability: Basic concepts and definition of probability, probability axioms, conditional
probability, addition and multiplication theorem of probability (Based on set theory concepts), Only
Statements, Problems and applications.
Note: 1. Concentration on numerical problems only.
    2. Proofs of theorems and Derivations of expressions are omitted.

Outcomes:		

1. Skill to choose and apply appropriate numerical methods to obtain appropriate solutions to difficult mathematical problems.
2. Ability to apply various statistical techniques such as Measures of Central Tendency and Dispersion.
3. Skill to execute programs of various Numerical Methods and Statistical techniques for solving mathematical problems.
4. Ability to find the solution of algebraic and transcendental equations.
5. Familiarize with Newton's backward and forward interpolation formulae.

Text Books:		
1. Mathematical Methods by Dr.T.K.V. Iyengar, Dr.B.Krishna Gandhi, Dr. S.Ranganatham, and Dr.M.V.S.S.N. Prasad by S.Chand publications 6th revised edition 2011.		
2. Quantitative Techniques by C.Satyadevi by S.Chand Company		
References:		
1. Higher Engineering Mathematics by Dr.B.S.Grewal by Karna publisher"s 34th edition.		
2. Statistical Methods – Snedecor G.W. & Cochran W.G. Oxford & + DII.		
3. Elements of Statistics – Mode. E.B. - Prentice Hall.		
4. Statistical Methods – Dr. S.P. Gupta – Chand & Sons.		

B.C.A. DATA SCIENCE -Semester I
NUMERICAL AND STATISTICAL METHODS LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives: This lab course will provide opportunity to the learners to implement the concepts and techniques learned in Numerical and Statistical Techniques course in C/C++ Language and/or in MS-Excel

	SYLLABUS	

1. Problem on Trapezoidal rule.
2. Problem on Simpsons 1/3rd rule.
3. Problem on Simpsons 3/8rd rule.
4. Forward and backward difference Tables.
5. Problem on Newton's forwards interpolation formula.
6. Problem on Newton's backward interpolation formula.
7. Problem on Matrix addition, Subtraction and multiplications.
8. Problems on Symmetric and Skew Symmetric Matrices.
9. To find adjoint of a square Matrices.
10. To find Inverse of a Square Matrices.
11. Solution of linear equations by Cramer and Inverse Methods.
12. To find Mean, Median and Mode for grouped data.
13. To find Standard deviation.
14. To find correlation.
15. To find rank correlation.

Outcomes:		

After Completion of the course student should able to
1. Student will be able to Know concepts in problem solving.
2. Ability to do programming in C language.
3.To write diversified solutions using C language.
4. ability to write programming with pointers and structures.
5. Ability to write c programming with files.

BACHELOR OF COMPUTER APPLICATIONS

DATA SCIENCE

Syllabi

With effect from 2021-22 admitted batch

I YEAR II SEMESTER

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA1.2.1	First Language-English-II	4	75	25	100	3
BCA1.2.2	Second Language-Hindi/Sanskrit-II	4	75	25	100	3
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BCA1.2.4	Life Skill Course – III - Analytical Skills	2	50	0	50	2
BCA1.2.5	Skill Development Course – II- Solar Energy	2	50	0	50	2
BCA1.2.6	Skill Development Course – III − Food Adulteration	2	50	0	50	2
BCA1.2.7	Data Structures	4	75	25	100	4
BCA1.2.8	Data Structures Lab	2	50	0	50	1
BCA1.2.9	Database Management Systems	4	75	25	100	4
BCA1.2.10	Database Management Systems Lab	2	50	0	50	1
BCA1.2.11	Statistical Methods & their Applications	4	75	25	100	4
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Total		**34**	**725**	**125**	**850**	**29**

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester II
DATA STRUCTURES

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. The objective of the course is to make a student to implement data structures and organize data based on data structures for efficient access.		
	SYLLABUS	
UNIT I:		
Introduction to Data Structure: Definition, Data Types, Abstract Data Types (ADT), classification of data structure - primitive & non-primitive data structures, Linear and Non-linear data structures **Arrays:** Definition, one dimensional array, two dimensional arrays, Applications, pointers. **Linked List:** Definition, linked list ADT, single linked list, double linked list, circular linked list, comparison of linked list with Arrays.		
UNIT II:		
STACKS: Definition, Stack as an ADT & Operations on stack, Applications of stack, Representation of stack. **QUEUES:** Definition, Queue as an ADT & Operations on Queue, Application of Queues, Representation of Queues, Various Queue Structures: circular Queue, DE Queue.		
UNIT III:		
TREES: Definition, Basic Tree Terminology. **Binary Tree** – Definition, Properties of Binary Trees, Types of Binary Trees, Representation of Binary Tree, Binary Tree Traversals. **Binary Search Tree (BST)** – Definition, Operations on a Binary Search Tree, Examples of BST.		
UNIT IV:		
GRAPHS: Definition, Basic Graph Terminology, Representation of Graphs, Graph Traversal – DFS and BFS. Topological sort, Shortest Path problem, Minimum Spanning Tree.		
UNIT V:		
SORTING: Definition, Sorting methods - Bubble Sort, Selection Sort, Quick Sort, Insertion Sort, and Merge Sort.**SEARCHING**: Definition, searching methods - Linear or Sequential Search, Binary Search.		
Outcomes:		
1. Identify data structures suitable to solve problems. 2. Developing algorithms. 3. Identifying the use of Time and Space Complexity. 4. Implementing different sorting & searching techniques.		
References:		
1. Data structures by Lipschutz, McGraw Hill Education 2. Fundamentals of Data Structures in C by Sahni Horowitz, University Press 3. Data Structures and Algorithms by Alfred V Aho and John E Hopcroft and Jeffrey D Ullman, Pearson Education 4. **"Data Structures through C", Yashavant Kanetkar, BPB Publications**		
Text Books:		
1. "Classic Data Structures", by Debasis samantha 2nd edition, phi publications, 2009 2. "Data structures and algorithms", by Narasimha karumanchi , careermonk publications , 2017		

DATA STRUCTURES LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:

The course is designed to develop skills to design and analyze and implement simple linear and non - linear data structures in java. It strengthens the ability to the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures

	SYLLABUS	

1. Program to generate Fibonacci series using recursion

2. Program for implementation of stack using arrays.

3. Program for implementation stack using linked list.

4. Program for implementation queue using array.

5. Program for implementation queue using linked list.

6. Program for implementation of circular queue.

7. Program for linear searching.

8. Program for binary searching.

9. Program for Binary search tree operations.

10. Program to implement Graph traversal using DFS

11. Program to implement Graph traversal using BFS

12. Program for bubble sort

13. Program for selection sort

14. Program for insertion quick sort

15. Program for merge sort

Outcomes:		

After completion of course, student will be able to:
1. Implement linked list data structure.
2. Implement various sorting algorithms.
3. Implement various data structure such as stacks, queues, trees, graphs using java-programming language.
4. Implement tree and graph traversals.
5. implement graph traversal algorithms.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A. DATA SCIENCE -Semester II

DATA BASE MANAGEMENT SYSTEM

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. The objective of the course is to introduce the design and development of databases for data science with analytical features in relational databases.		
	SYLLABUS	
UNIT I:		
Introduction to Database Management System: Introduction to data, information, database, database management systems, file-based system, Drawbacks of file-Based System, Classification of Database Management Systems, advantages and disadvantages of database approach, services of database systems, Components of Database Management System		
UNIT II:		
The Relational Database Model: Various Data Models, Relational Database model, Keys used in Relational model, Relational Data Integrity, Relational set operators, Relationships within the Relational Database, Codd's relational database rules. **Entity–Relationship Model:** Introduction, The components of an ER model, entities, attributes, relationships, Classification of Entity Sets, Attribute Classification, Relationship Degree, Relationship Classification		
UNIT III:		
Introduction to SQL: Structured Query Language (SQL) – Introduction - SQL data types - SQL literals , SQL operators: Arithmetic Operators - Comparison Operators - Logical Operators - Set Operators - Operator Precedence **Types of SQL commands:** DDL, DML, TCL, DCL **Tables:** Creating tables – Altering tables – dropping tables – displaying structure of table. Inserting, updating, and deleting: INSERT statement – Bulk inserts of data – UPDATE statement – DELETE statement		
UNIT IV:		
Queries and Subqueries : **using SELECT statement** Aggregate Functions – **Introduction – COUNT( ), COUNT(*), SUM( ), AVG( ), MAX( ) and MIN( ) functions.** Multiple table processing: **Joins and Unions**TCL commands: **COMMIT, ROLLBACK, and SAVEPOINT statements** DCL commands: **Privileges and roles – Granting and Revoking privileges and roles GRANT and REVOKE statements.**		
UNIT V:		
PL/SQL: Introduction, Structure of PL/SQL program, PL/SQL Data Types, operators used in PL/SQL, variables, declaring variables in PL/SQL, Creating and running a PL/SQL Program, **Control Structures:** Conditional control statements, Iterative Control statements, **Cursors:** Types of cursors, Steps to create a Cursor, using cursors in PL/SQL program		
Outcomes:		

Upon successful completion of the course, a student will be able to:

1. Gain knowledge of Database, DBMS and SQL.
2. Learn SQL as best analysis tool for extract data in different ways
3. Create a small database using SQL.
4. Able to construct SQL queries to Store, Retrieve data in database
5. Model database using ER Diagrams and design database schemas based on the model.

References:

1. Elimasri / Navathe, Fundamentals of Database Systems, Fifth Edition, Pearson Addison Wesley (2007).
2. Database Principles, Programming, and Performance, P.O'Neil, E.O'Neil, 2nd ed., ELSEVIER.
3. SQL: The Ultimate Beginners Guide by Steve Tale.
4. Database System Concepts by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGrawhill
5. Database Management Systems by Raghu Ramakrishnan, McGrawhill

Text Books:

1. Database management Systems, Alexis Leon and Mathews Leon, Vikas Publications 2002
2. Peter Rob, Carlos Coronel, Database Systems Design, Implementation and Management, Seventh Edition, Thomson (2007)
3. SQL, PL/SQL the Programming Language of Oracle, Ivan Bayross, BPB publications

B.C.A. DATA SCIENCE -Semester II
DATA BASE MANAGEMENT SYSTEM LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:
The major objective of this lab is to provide a strong formal foundation in database concepts, technology and practice to the participants to groom them into well-informed database application developers.

	SYLLABUS	

1. Illustrate the creation of a table with constraints
2. Creation of college database and establish relationships between tables
3. Employee database

    An enterprise wishes to maintain a database to automate its operations. Enterprise divided into certain departments and each department consists of employees. The following two tables describes the automation schemas

    Dept (deptno, dname, loc)

    Emp (empno, ename, job, mgr, hiredate, sal, comm, deptno)

     Generate the following queries using data of above tables.

    i.   List out all employees details
    ii.   Display empno, ename, job and sal columns of all employees
    iii. Display employee details who are working as 'CLERK'
    iv.   Find out number of employees working in each department
    v.   Find out job wise total salaries and number of employees.
    vi.   Calculate HRA as 30% and DA as 65% of salary
4. Demonstrate the use of GRANT and REVOKE commands to provide authorization

    PL/SQL PROGRAMS

5. Write a PL/SQL program to check the given number is armstrong or not.
6. Write a PL/SQL program to check the given string is palindrome or not.
7. Writ a PL/SQL program to generate multiplication tables
8. Write a PL/SQL code to find the factorial of any number.
9. Write a PL/SQL program to check the given number is palindrome or not.
10. Write a PL/SQL program to display to 10 rows in Emp table based on their job and salary.
11. Write a PL/SQL program to raise the employee salary by 10% for department number 30 people
12. Write a procedure to update the salary of Employee, who are not getting commission by 10%.

Outcomes:		

1. Able to apply the basic commands of SQL – DDL, DML.
2. Able to create the tables at different levels.
3. Able to create different databases with primary key, foreign keys and insert values for DDL and DML operations.
4. Able to solve the queries using PL/SQL.

Able to write procedures.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester II
STATISTICAL METHODS & THEIR APPLICATIONS

Credits: 4	Theory: 6 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. To understand the scope and limitations of statistical methods. 2. To understand the Arithmetic mean, median, mode, geometric mean and Harmonic mean and their properties. 3. Apply the Measures of dispersion techniques to find deviations central tendency. 4. Find the differences between Karl Pearson's, Bowley's and Kelly's measures of skewness. 5. To understand the use of linear regression analysis to develop an empirical model of experimental data.		
	SYLLABUS	
Unit I:		
Introduction - scope and limitations of statistical methods - classification of data - Tabulation of data - Diagrammatic and graphical representation of data - Graphical determination of percentiles and quartiles.		
Unit II:		
Measures of location: Arithmetic mean, median, mode, geometric mean and Harmonic mean and their properties.		
Unit III:		
Measures of dispersion: range, Quartile deviation, mean deviation, standard deviation, combined standard deviation, co-efficient of variation.		
Unit IV:		
Measures of Skewness Karl Pearson's, Bowley's, Kelly's and co-efficient of skewness and kurtosis based on moments.		
Unit V:		
Correlation - Karl Pearson -spearman's rank correlation - concurrent deviation method. Regression Analysis: Simple Regression Equations.		
Outcomes:		
1. Evaluate the probabilities and conditional probabilities. 2. Evaluate expectations and conditional expectations of random variables. 3. Approximate the distribution of sum of random variables using CLT. 4. Construct point estimators using the method of maximum likelihood. 5. Calculate the number of samples needed to construct confidence levels on the mean and variance of a normal distribution.		
Reference Books:		
1. Fundamental of mathematical Statistics - S.C.Gupta&V.K.Kapoor- Sultan Chand 2. Statistical Methods - Snedecor G.W. & Cochran W.G. oxford & +DII 3. Elements of statistics - Mode. E.B. -Prentice Hall 4. Statistical Methods - Dr.S.PGupta - Sultan chand& sons.		

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester II
STATISTICAL METHODS & THEIR APPLICATIONS LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives: This lab course will provide opportunity to the learners to implement the concepts and techniques learned in Statistical Techniques course in C/C++ Language and/or in MS-Excel

	SYLLABUS	
Session 1 : Frequency distribution, central tendency and dispersion		
Session 2: Hypothesis testing, t distribution, chi square distribution, f distribution, normal distribution		
Session 3 : Regression and correlation coefficient-univariate, multivariate		
Session 4 : Anova test		
Session 5 : Central charts		
Session 6 : Time series		
Session 7 : Sampling for a problem domain and analyze –Case Study		

Outcomes:		
1. Skill to choose and apply appropriate statistical methods to obtain appropriate solutions to difficult mathematical problems. 2. Ability to apply various statistical techniques such as Measures of Central Tendency and Dispersion. 3. Skill to execute programs of various Statistical techniques for solving mathematical problems. Familiarize with various types of charts.		

BACHELOR OF COMPUTER APPLICATIONS

DATA SCIENCE

Syllabi

With effect from 2021-22 admitted batch

II YEAR I SEMESTER

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA2.1.1	First Language-English-III	4	75	25	100	3
BCA2.1.2	Second Language-Hindi/Sanskrit -III	4	75	25	100	3
BCA2.1.3	Life Skill Course – IV- E.E	2	50	0	50	2
BCA2.1.4	Skill Development Course – IV Di. Mgt	2	50	0	50	2
BCA2.1.5	Object Oriented Programming Through Java	4	75	25	100	4
BCA2.1.6	Object Oriented Programming Through Java Lab	2	50	0	50	1
BCA2.1.7	Operating Systems	4	75	25	100	4
BCA2.1.8	Operating Systems Lab	2	50	0	50	1
BCA2.1.9	Advanced Excel	4	75	25	100	4
BCA2.1.10	Advanced Excel Lab	2	50	0	50	1
Total		**30**	**625**	**125**	**750**	**25**

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. Object Oriented Programming (OOP) has become the predominant technique for writing software in the past decade. Many other important software development techniques are based upon the fundamental ideas captured by object-oriented programming.		
	SYLLABUS	
UNIT I:		
Fundamentals of OOP : Introduction, Object Oriented paradigm, Basic Concepts of OOP **Overview of Java Language**: Introduction, Java features, Java program structure, Java tokens, Implementing a Java Program, Java Virtual Machine (JVM), Command line arguments. **Constants, Variables & Data Types:** Introduction, Constants, Data Types, Variables, Declaration of Variables, Giving Value to Variables, Scope of variables, Type casting, operators		
UNIT II:		
Input and Output in Java: Reading Input with Java.util.Scanner Class, Displaying Output with System.out.println( ), **Control Statements in Java:** Conditional control statements, Iterative control statements, break Statement, continue Statement, return Statement, **Classes, Objects & Methods:** Introduction, Defining a class, Adding methods, Creating objects, Accessing class members, Constructors, Method overloading, Static members		
UNIT III:		
Arrays, Strings: Arrays, One-dimensional arrays, Creating an array, Two – dimensional arrays, Strings, Wrapper classes, **Inheritance**: Introduction, Types of inheritance, Overriding methods, Final variables and methods, Final classes, Abstract methods and classes		
UNIT IV:		
Interfaces: Defining interfaces, Extending interfaces, Implementing interfaces, Accessing interface variables, Multiple Inheritance using interfaces, **Exceptions:** Types of errors: Compile-time errors, Run-time errors, Exceptions, Exception handling, Multiple Catch Statements		
UNIT V:		
Multithreaded Programming: Introduction, Lifecycle of a Thread, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, **Applet Programming:** Definition, Local and remote applets, Applet Life cycle: Initialization state, Running state, Idle or stopped state, Dead state, Display state, Building Applet code, **Packages:** Introduction, Java API Packages, Creating Packages, Accessing a Package		
Outcomes:		
The student would become competent enough to write, debug, and document well-structured java applications		

1. Understand the concept and underlying principles of Object-Oriented Programming
    2. Understand how object-oriented concepts are incorporated into the Java programming language
    3. Develop problem-solving and programming skills using OOP concept		

4. Understand the benefits of a well-structured program		
5. Develop the ability to solve real-world problems through software development in high-level programming language like Java		
6. Develop efficient Java applets and applications using OOP concept		

Text Books:

1. E.Balaguruswamy, Programming with JAVA, A primer 3e, TATA McGraw-Hill Company

References:

1. Programming in Java by Sachin Malhotra, OXFORD University Press
2. Core Java: An Integrated Approach, Authored by Dr. R. Nageswara Rao &Kogent Learning Solutions Inc.
3. John R. Hubbard, Programming with Java, Second Edition, Schaum"s outline Series, TATA McGraw-Hill Company.

4. Deitel & Deitel. Java TM: How to Program, PHI (2007)
5. Java Programming: From Problem Analysis to Program Design- D.S Mallik
6. Object Oriented Programming Through Java by P. Radha Krishna, Universities Press (2008)

B.C.A. DATA SCIENCE -Semester III
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:
1. To build software development skills using java programming for real world applications.
2. To implement object-oriented concepts of java.
3. To implement classical problems using java programming.

	SYLLABUS	

1.   WAP to find whether a number is prime or not
2.   WAP to demonstrate the factorial of a number.
3.   WAP to display a number is even or odd
4.   WAP to find a sub string in the given string.
5.   WAP to arrange the given strings in Alphabetic Order.
6.   WAP to search an element using arrays
7.   WAP to implement Addition and multiplication of two Matrices.
8.   WAP to demonstrate the use of Constructor.
9.   WAP to demonstrate the use of overriding Method.
10.   WAP for single Inheritance.
11.   WAP for implementing Interface.
12.   WAP on Multiple Inheritance.
13.   WAP for to implement Thread
14.   WAP to demonstrate Exception handling.
15.   WAP to demonstrate Applet program.

Outcomes:

1. Student can write programs using concepts of OOP.
2. Able to write programs on method overloading and overriding techniques.
3. Able to implement programs by reusing the properties of existing classes.
4. Acquire knowledge on how to handle multiple requests and process them using multithreading.
Able to write client-side application development using applets.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A. DATA SCIENCE -Semester III

OPERATING SYSTEMS

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

1	To know the basic Structure, Components and Organization of Operating System.
2	To learn the notation of a Process-a Program in Execution, Management, Scheduling and Classic Problems of Synchronization.
3	To gain knowledge in various Memory Management Techniques.
4	To understand Various File operations.

	SYLLABUS	
UNIT I:		

Operating System Introduction: Operating Systems Objectives and functions, Computer System Architecture, OS Structure, Evolution of Operating Systems (Simple Batch, Multi programmed, Distributed Systems, Real-Time Systems), Operating System services, System Calls, Types of System Calls

UNIT II:		

Process and CPU Scheduling - Process concepts - The Process, Process State, Process Control Block, Process Scheduling - Schedulers, Non-Preemptive (FCFS, SJF) and preemptive Scheduling algorithms (RR), **Threads**: Definition, uses of threads, types of threads

UNIT III:		

File System Interface – **Files**: Introduction to files, File types, basic operations on files, file attributes, File Access methods, File Sharing, Protection, File System Structure, **Directories**: Introduction to directories, Directory Structure, **Mass Storage Structure** - Overview of Mass Storage Structure, Disk Structure, Disk Attachment

UNIT IV:		

Deadlocks - System Model, Deadlock Characterization, **Methods for Handling Deadlocks**: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

UNIT V:		

Memory Management and Virtual Memory - Logical & physical Address Space, Swapping, Contiguous Allocation, Paging, Structure of Page Table. Segmentation, Segmentation with Paging

Outcomes:		

The students will be able to:

1. Understand the main components and Structure of Operating System& their functions.
2. Analyze various ways of Process Management & CPU Scheduling Algorithms.
3. Evaluate various device and resources like Memory, Time and CPU Management techniques in distributed systems.
4. Apply different methods for Preventing Deadlocks in a Computer System.

Text Books:		

1. Operating system Concepts: Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 8th Edition, Wiley.
2. Operating systems - Internals and Design Principles, W. Stallings, 6th Edition, Pearson.

References:

1. Principles of Operating Systems by Naresh Chauhan, OXFORD University Press

2. Operating systems - Internals and Design Principles, W. Stallings, 6th Edition, Pearson.

3. Modern Operating Systems, Andrew S Tanenbaum 3rd Edition PHI.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A. DATA SCIENCE -Semester III
OPERATING SYSTEMS LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:
1. To familiarize the students with the Architecture of UNIX Operating System.
2. To learn the mechanisms of CPU Scheduling and Deadlock Detection algorithms.
3. To learn mechanisms of Processes synchronization using semaphores.

	SYLLABUS	

1. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
2. Developing applications using Inter Process Communication (using shared memory)
3. Implement any two memory management schemes
4. Implement file allocation techniques (Linked)
5. Implement Deadlock prevention algorithm.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Round robin. Compute and print the average waiting time and average turnaround time.
7. Implement file allocation techniques (Indexed)
8. Implement file allocation techniques (Contiguous)
9. Developing applications using Inter Process Communication (pipes)
10. Developing applications using Inter Process Communication (message queues)
11. Implement Deadlock detection algorithm.
12. Implement Deadlock avoidance algorithm.

Outcomes:		

1. Students are able to differentiate difference between MS-DOS, Windows and UNIX OS.
2. Students are able to write programming by using system calls (read, write, fclose, fork, perror, pipe, sysconf) using vi editor.
3. Learn the role of CPU Scheduling algorithms and memory management using page replacement algorithms.
4. Students are familiar with basic UNIX commands.
5. Be familiar with shell programming and shell commands.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A-DS-Semester III
ADVANCE EXCEL

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:
1. To discuss about use a range of lookup and reference functions.
2. To understand protect data in worksheets and workbooks and create summaries in your spreadsheets using subtotals.
3. To explain the concepts of construct and operate PivotTables using some of the more advanced techniques and create and edit a PivotChart.
4. To understand use goal seeking to determine the values required to reach a desired result group cells and use outlines to manipulate the worksheet.

	SYLLABUS	
UNIT I:		**9 Classes**
Excel Introduction- An overview of the screen, navigation, and basic spreadsheet concepts- Various selection techniques- Shortcut Keys. -**Using Basic Functions-** Using Functions – SUM, AVERAGE, MAX, MIN, COUNT, COUNTA- ABSOLUTE, MIXED AND RELATIVE Referencing.		
UNIT II:		**9 Classes**
Mathematical Functions- SumIf, SumIfs CountIf, CountIfs AverageIf, AverageIfs, Nested IF, IFERROR Statement, AND, OR, NOT. **Date and Time Functions-** Today, Now- Day, Month, Year- Date, Date if, DateAdd- EOMonth, Weekday. **Advanced Paste Special Techniques-** Paste Formulas, Paste Formats- Paste Validations- Transpose Tables.		
UNIT III:		**11 Classes**
Advance Excel Analysis - Goal Seek- Scenario Analysis- Data Tables (PMT Function)- Solver Tool- **Data Validation-** Number, Date & Time Validation- Text and List Validation- Custom validations based on the formula for a cell- Dynamic Dropdown List Creation using Data Validation – Dependency List.		
UNIT IV:		**10 Classes**
Lookup Functions- Vlookup / HLookup- Index and Match- Creating Smooth User Interface Using Lookup- Nested VLookup- Reverse Lookup using Choose Function- Worksheet linking using Indirect- Vlookup with Helper Column- **Pivot Tables-** Creating Simple Pivot Tables- Basic and Advanced Value Field Setting- Classic Pivot table- Choosing Field- Filtering PivotTables- Modifying PivotTable Data.		
UNIT V:		**11 Classes**
Charts and slicers - Various Charts i.e. Bar Charts / Pie Charts / Line Charts - Using SLICERS, Filter data with Slicers - Manage Primary and Secondary Axis - **Excel Dashboard-** Planning a Dashboard- Adding Tables and Charts to Dashboard - Adding Dynamic Contents to Dashboard.		
Outcomes:		

1. Use advanced functions and productivity tools to assist in developing worksheets
2. Manipulate data lists using Outline, Autofilter and PivotTables
3. Use Consolidation to summarise and report results from multiple worksheets
4. Record repetitive tasks by creating Macros
5. Use Hyperlinks to move around worksheets.

Text Books:

1. Step by Step Microsoft Excel 2010 by Curtis D.Frye.

References:

1. https://support.microsoft.com/en-us/office/formulas-and-functions-294d9486-b332-48ed-b489-abe7d0f9eda9#ID0EBBD=Formulas

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)

B.C.A-DS-Semester III
ADVANCE EXCEL LAB

Credits: 1.5	Lab: 3 Hours	Tutorials: -
Max Marks: 100	External: 50 Marks	Internal: 50 Marks

Course Objectives:

1. To discuss about use a range of lookup and reference functions.
2. To understand protect data in worksheets and workbooks and create summaries in your spreadsheets using subtotals.
3. To explain the concepts of construct and operate PivotTables using some of the more advanced techniques and create and edit a PivotChart.
4. To understand use goal seeking to determine the values required to reach a desired result
   - group cells and use outlines to manipulate the worksheet.

SYLLABUS

Lab 1: Calculations with Data Sets

      Basic Arithmetic

      Other Mathematical Operations

Lab 2: Date and Time Functions

Lab 3: Create an excel sheet to show time table of your class

Lab 4: Create a pay slip with details of employee salary

Lab 5: Create an excel sheet for student results and grades calculation

Lab 6: Prepare an excel sheet for creating a pie chart for budget analysis

Lab 7: Create a new worksheet with a list of possible month choices. Give the block of cells a range name. Apply validation to cell B2 so that when you click on the cell you see and input message telling you what you can do Extend the validation so that when a user chooses a month that doesn't exist, they see this message.

Lab 8: Create an If function to calculate a bonus for each player based on the following criteria:

- If a players Goals Scored meets or exceeds his Goals Target he receives a bonus equal to £1000 for each goal he has scored
- Otherwise he receives an encouraging message
- Copy the formula down and check that it works

Lab 9 : Create a chart to compare the favourite films data for 15-25 year olds only (be careful not to include any unnecessary blanks rows or columns in your selected data).Format this chart so that it is a pie chart, with the Barbarella slice "exploded" and each segment labelled.

Lab 10 : Create a work sheet for "Reported Road Accidents Involving Animals". Insert some sparklines in column F to create tiny charts of the accident data in columns B:E.

    Use the sparkline tools Design tab to edit the sparklines. Change the accident figure for deer in 2010 to just 100 to see the effect it has on the sparklines.

Outcomes:

- Master Microsoft Excel and many of its advanced features
- Become one of the top Excel users in your team
- Carry out regular tasks faster than ever before
- Acquire financial modeling skills
- Create models with multiple scenarios
- Design professional and good-looking advanced charts
- Become a proficient user able to work with Excel functions, pivot tables, visualizations, and advanced features.

BACHELOR OF COMPUTER APPLICATIONS
DATA SCIENCE

Syllabi

With effect from 2021-22 admitted batch

II YEAR II SEMESTER

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA2.2.1	Tablue	4	75	25	100	4
BCA2.2.2	Tablue Lab	2	50	0	50	1
BCA2.2.3	Data Mining and Data ware Housing	4	75	25	100	4
BCA2.2.4	Data Mining and Data ware Housing Lab	2	50	0	50	1
BCA2.2.5	Web Programming	4	75	25	100	4
BCA2.2.6	Web Programming Lab	2	50	0	50	1
BCA2.2.7	Design and Analysis of Algorithms	4	75	25	100	4
BCA2.2.8	Design and Analysis of Algorithms Lab	2	50	0	50	1
BCA2.2.9	Introduction to Data Science with R-Programming	4	75	25	100	4
BCA2.2.10	Introduction to Data Science with R-Programming Lab	2	50	0	50	1
BCA2.2.11	Object Oriented software Engineering	4	75	25	100	4
BCA2.2.12	Object Oriented software Engineering Lab	2	50	0	50	1
Total		**36**	**750**	**150**	**900**	**30**

B.C.A. DATA SCIENCE -Semester IV
TABLUE

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:
1. In this course, you will be introduced to the field of data visualization and the various tools Tableau Public offers to get familiarized with Transmission media.
2. You will learn to identify datasets to connect to, explore, analyze, filter and structure your data to create your desired visualizations.

SYLLABUS		
UNIT I		
INTRODUCTION to TABLEAU: History and Overview of Tablue, Architecture, features of Tablue, Data Visualization, Environment setup, File Types & Extensions, Tools of Tablue **TABLEAU PRODUCTS:** Desktop, Server ,Publisher, Public, Reader, **Creating Your First visualization:** Getting started with Tableau Software, Installation of Tableau Desktop/Public, Data Terminology, Data file formats, design flow, file types, data types.		
UNIT II		
Data visualization: Data visualization using Tableau feature "show me", Connecting your Data to Tableau. **Formatting Visualizations:** Formatting Tools and Menus, Formatting specific parts of the view, Editing and Formatting Axes.		
UNIT III		
Tableau Calculations: Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields, Functions, Operators, Applying new data calculations to your visualization **Tableau Data Sources:** Text file**,** Microsoft Excel**,** Custom data view, Extracting data, fields operations, Data joining, Data blending.		
UNIT IV		
Manipulating Data in Tableau: Cleaning-up the data with the Data Interpreter, Structuring your data, Sorting and filtering Tableau data. **Organizing and Simplifying data:** Applying Filters, context Filters, condition Filters, Quick Filters, Sorting of Data		
UNIT V		
Distributing & Publishing Your Visualization: Tableau file types, Publishing to Tableau Online, Sharing your visualization. **Basic Data Visualization Graph:** Pivot table and Heat Map, Highlight Table, Bar Chart, Line Chart, Area Chart, Grant Chart, Histogram		
Outcomes:		
1. What is data 2. Where to find data 3. Foundations for building Data Visualizations		
Text Book:		
1. Tableau 10 for Beginners: Step by Step guide to developing visualizations in Tableau by Chandraish Sinha		

References:		

1. Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization, 4th Edition by Joshua N. milligan
2. The Tableau Workshop: A practical guide to the art of data visualization with Tableau by Sumit Gupta

B.C.A. DATA SCIENCE -Semester IV

TABLUE LAB

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

1. In this course, you will be introduced to the field of data visualization and the various tools Tableau Public offers to get familiarized with Transmission media.
2. You will learn to identify datasets to connect to, explore, analyze, filter and structure your data to create your desired visualizations.

	SYLLABUS	

Week 1: Tablue software download and install

    i)   Tablue vs Excel

    ii)   Power of Data Visualization and Components of Tableau

Week 2: i) Import excel data in tablue and data formatting in column, view data and sort data

    ii) format work sheets in tablue

Week 3: create text tables in tablue and table calculations in tablue

Week 4: number functions and string functions in tablue

Week 5: Data Preparation
    Connecting to different Data Source   i). Excel ii). CSV iii). SQL Serve

Week 6: Live vs Extract Connection

    i)   Creating Extract

    ii)   Refreshing Extract

    iii)   Increment Extract

    iv)   Refreshing Live

    v)   Data Source Editor

Week 7: Functions in Tableau Join, Union,Sort, Set, forecasting, Highlighting, Device Designer

Week 8: create Charts and Dashboard in tablue

    Bar Chart, Pareto Chart, Bullet Chart, Text Chart, Heat Map, Waterfall Chart, Gantt Chart, Pie Chart Scatter Plot

Outcomes:		

1. Understanding What is data
2. Understanding Where to find data
3. Foundations for building Data Visualizations

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A. DATA SCIENCE -Semester IV

DATA MINING AND DATA WARE HOUSING

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

1. Be familiar with mathematical foundations of data mining tools.
2. Understand and implement classical models and algorithms in data warehouses and data mining
3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
4. Master data mining techniques in various applications like social, scientific and environmental context. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

	SYLLABUS	
UNIT I:		

Introduction: What Motivated Data Mining? Why Is It Important?, So, What Is Data Mining? , Data Mining—On What Kind of Data?: Data Mining Functionalities—What Kinds of Patterns Can Be Mined? Data Preprocessing: Why Preprocess the Data?, Descriptive Data Summarization: Measuring the Central Tendency, Measuring the Dispersion of Data, Data Cleaning, Data Integration and Transformation, Data Reduction.

UNIT II:		

Data Warehouse and OLAP Technology: An Overview , What Is a Data Warehouse? , A Multidimensional Data Model, From Tables and Spreadsheets to Data Cubes, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional databases, Examples for Defining Star, Snowflake and Fact Constellation Schemas, Data Warehouse Architecture: Steps for the Design and Construction of Data Warehouses,

UNIT III:		

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and a Road Map, Efficient and Scalable Frequent Item set Mining Methods: The Apriori Algorithm: Finding Frequent Item sets Using Candidate Generation, Generating Association Rules from Frequent Item sets.

UNIT IV:		

Classification and Prediction: What Is Classification? What Is Prediction? , Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Decision Tree Induction, Attribute Selection Measures. Rule-Based Classification: Using IF-THEN Rules for Classification

UNIT V:		

Cluster Analysis: What is Cluster Analysis?, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods. Hierarchical Methods: Agglomerative and Divisive Hierarchical Clustering.

Outcomes:		

At the end of the course, the student will demonstrate the following. The students will be able to:

1. Examine the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.

2. Apply preprocessing statistical methods for any given raw data
3. Discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems, make predictions of outcomes
4. Comprehend the roles that data mining plays in various fields and manipulate different data mining techniques
5. Select and apply proper data mining algorithms to build analytical applications.
6. Evaluate and implement a wide range of emerging and newly-adopted methodologies and technologies to facilitate the knowledge discovery.

Text Books:

1. Data Mining: Concepts and Techniques Second Edition Jiawei Han University of Illinois at Urbana-Champaign Micheline Kamber
2. Data Warehousing by Reema Thareja, Oxford University Press

References:

1. Data Mining by Vikram Pudi, P. Radha Krishna, Oxford Universal Press
2. J. Han, M. Kamber and J. Pei, Data Mining: Concepts and Techniques, 3rd.Edition Morgan Kaufmann, 2011
3. Introduction to data mining –G. K. Gupta, PHI
4. Data mining, Data warehouse &Olap-Berson, Tata McGraw Hill

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester IV
DATA MINING AND DATA WARE HOUSING LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		

1. Be familiar with mathematical foundations of data mining tools.
2. Understand and implement classical models and algorithms in data warehouses and data mining
3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
4. Master data mining techniques in various applications like social, scientific and environmental context. Develop skill in selecting the appropriate data mining algorithm for solving practical problems

	SYLLABUS	

1. Demonstration of preprocessing on dataset student.arff.
2. Demonstration of preprocessing on dataset labor.arff.
3. Demonstration of Association rule process on dataset contactlenses.arff using Apriori algorithm.
4. Demonstration of Association rule process on dataset test.arff using Apriori algorithm.
5. Demonstration of classification rule process on dataset student.arff using j48 algorithm.
6. Demonstration of classification rule process on dataset employee.arff using j48 algorithm.
7. Demonstration of classification rule process on dataset employee.arff using id3 algorithm.
8. Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm.
9. Demonstration of clustering rule process on dataset iris.arff using simple k-means.
10. Demonstration of clustering rule process on dataset student.arff using simple k-means..

Outcomes:		

1. Examine the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. Apply preprocessing statistical methods for any given raw data
3. Discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems, make predictions of outcomes

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A. DATA SCIENCE -Semester IV

WEB PROGRAMMING

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. To provide knowledge on web architecture, web services, client side and server side scripting technologies to focus on the development of web-based information systems and web services. 2. To provide skills to design interactive and dynamic web sites.		
	SYLLABUS	
UNIT I:		
Introduction to Internet: Definition of Internet – History of Internet – Advantages & disadvantages of Internet – Tools of internet - How internet works. **Introduction to WWW:** Definition of WWW – WWW tools - Web Terminology – web browser – web server, **E-Mail :** Definition of e-mail – advantages & disadvantages of e-mail, message components		
UNIT II:		
Introduction to HTML: Basic HTML – HTML document structure – HTML tags – Basefont tag – title tag – body tag – Horizontal Rule Tag - Text formatting tags – Character tags - Character entities, **HTML Lists :** Ordered List , Unordered List & Definition List – Using colors – Using Images, **Hyperlinks**: Textual links, Graphical links, types of document links, anchor tag		
UNIT III:		
HTML Tables – table creations tags, Nested Tables, **Frames:** Frame introduction - frame creation tags – Nested Frames – **Forms:** Form Controls : textbox, button, password, checkbox, radio button, select, text area - Processing of forms		
UNIT IV:		
Introduction to Scripting: JavaScript Introduction - Simple Program - Obtaining User Inputs with Prompt Dialogs - variables – operators (arithmetic, relational, logical, increment and decrement). **JavaScript – Control Statements:** Introduction – conditional control statements (if, if…else, switch) – Repetitive statements (for, while, do…while) - break and continue Statements		
UNIT V:		
JavaScript Functions: Introduction - Program Modules in JavaScript - Programmer-Defined Functions - Function Definitions - Scope Rules - JavaScript Global Functions, **Advanced HTML : Cascading Style Sheets (CSS):** Introduction – Using Styles: As an attribute, tag & external file – Defining Your own styles – **Properties and values :** properties related to Fonts, Backgrounds & colors, text , boxes & borders		
Outcomes:		
1. To understand the web architecture and web services. 2. To practice latest web technologies and tools by conducting experiments. 3. To design interactive web pages using HTML and Style sheets. 4. To study the framework and building blocks of Integrated Development Environment. 5. To provide solutions by identifying and formulating IT related problems.		
Text Books:		
1. Chris Bates, Web Programming Building Internet Applications, Second Edition, Wiley.		

2. Deitel & Deitel , Goldberg "Internet and world wide web – How to program", pearson educations Asia

References:

1. Paul S.Wang Sanda S. Katila, An Introduction to Web Design Plus Programming,Thomson.

2. Robert W.Sebesta, Programming the World Wide Web, Third Edition, Pearson Education.

3. Joel Sklar, Principles of Web Design, Thomson.

4. Raj Kamal, Internet and Web Technologies, Tata McGraw Hill.

5. Gopalan & Akilandeswari, Web Technology: A Developer"s Perspective, PHI.

B.C.A. DATA SCIENCE -Semester IV
WEB PROGRAMMING LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:
1. To design and implement websites with good aesthetic sense of designing. 2. To learn how XML and its related technologies function

	SYLLABUS	

1. Create a simple HTML page which demonstrates all types of lists.
2. Create a letter head of your college using following styles
   i. image as background
   ii. use header tags to format college name and address
3. Create a web page, which contains hyper links like fruits, flowers, animals. When you click on hyper links, it must take you to related web page; these web pages must contain with related images.
4. Create a hyperlink to move around within a single page rather than to load another page.
5. Create a leave letter using different text formatting tags.
6. Create a table format given bellow using row span and colspan.

RNO	NAME	MARKS				
		M1	M2	M3	M4	M5

   Insert 5 records.
7. Create a table with different formats as given bellow.
   i.   Give different background and font colors to table header, footer and body.
   ii.   Use table caption tag.
8. Write java script to find factorial of a number
9. Write java script to find sum of digits of a number
10. Write java script to display student details in a web page
11.   Create a student Bio-Data, using forms.
12. Create a web page using following style sheets
   i.   Inline style sheets.
   ii. Embedded style sheets.
   iii. External style sheets

Outcomes:		

1. Students can able to understand lists, its types, header tags and image as background.
2. Students can able to create hyperlinks and the web page contains images. They can also use different types of tags.
3. Students can able to create tables using row span and column span. They can also divide a web page both horizontally and vertically.
4. Students can create their bio-data using forms. They can also create a web page using cascading styles.
5. Students are able to write java script programs by accepting values and can apply mathematical operations.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester IV
DESIGN AND ANALYSIS OF ALGORITHMS

Credits: 4	Theory: 5 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:
1. To learn mathematical background for analysis of algorithm.
2. To study various Divide and Conquer Methods.
3. To understand the differentiation between Greedy and Dynamic Algorithms.
4. To identify the solutions of difficulty and overlapping problems using dynamic programming.
5.To Explain and Implementation of backtracking Procedure and randomized algorithms.

	SYLLABUS	
Unit I:		
A simple example of design using insertion sort, pseudo code for insertion sort and analysis of time complexity. Performance Analysis - Space complexity and Time complexity (posterior testing, and a priori approach), Asymptotic Notations (O, Ω, Θ). Average, Best- and Worst-case complexity.		
Unit II:		
Introduction to Divide and Conquer Algorithms - Finding the Maximum and Minimum, Quick sort (Derivation of Average case analysis and Worst-case analysis), Binary Search (Derivation of Average case analysis), and Strassen's Matrix Multiplication.		
Unit III:		
Introduction to Greedy Algorithms - Fractional Knapsack problem, minimum cost spanning trees, Kruskal's and Prim's Algorithms, Optimal Merge patterns and Single-Source Shortest Paths		
Unit IV:		
Definition - All-pairs shortest paths, Traveling salesman problem, optimal parameterization for product of sequence of matrices and multistage graphs		
Unit V:		
Introduction- definition of backtracking, examples,4-Queens, Sum of Subsets, Random Number Generators and Primality Testing using randomized algorithms.		
Outcomes:		
1. Ability to understand the basic Characteristics of algorithms to calculate the efficiency of algorithms. 2.Attain the importance of Divide and Conquer algorithms 3. Learn the concepts of Greedy algorithms. 4. Gain the knowledge in Dynamic programming. 5. Understand the Back tracking and randomized algorithms.		
Text Book:		
1. Horowitz, Sahni, Rajasekaran, Fundamentals of Computer Algorithms, Universities Press Pvt Ltd, 2008.		
References:		
1. Donald E. Knuth, *The Art of Computer Programming Volume 3, Sorting and Searching*, 2ndEdition, Pearson Education, Addison-Wesley, 1997. 2. GAV PAI, *Data structures and Algorithms*, Tata McGraw Hill, Jan 2008.At the end of this course,		

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester IV
DESIGN AND ANALYSIS OF ALGORITHMS LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems**(Engineering knowledge).**
2. Identify, formulate, review research literature, and analyze complex engineering problems reaching, substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem analysis)**.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/development of solutions)**.

	SYLLABUS	

WEEK1 : Sort a given set of elements using the quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the 1st to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.

WEEK2 : Implement merge sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
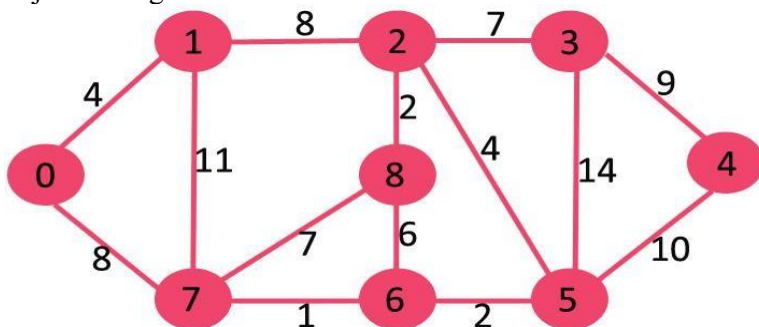
WEEK3:
a. Obtain the Topological ordering of vertices in a given digraph.
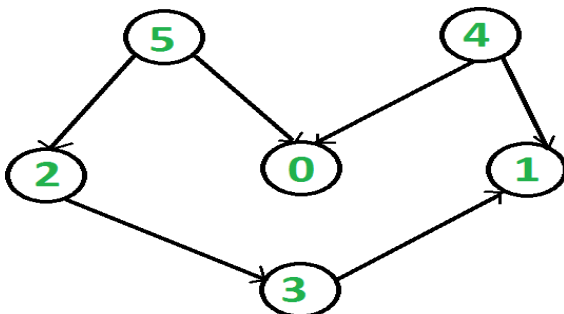

Compute the transitive closure of a given directed graph using Warshall's algorithm.

WEEK4: Implement 0/1 Knapsack problem using Dynamic Programming.
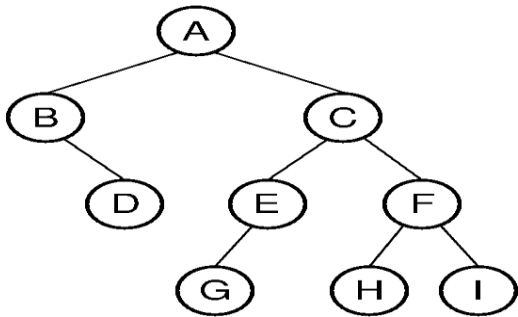WEEK5: From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm

WEEK6: **Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.**
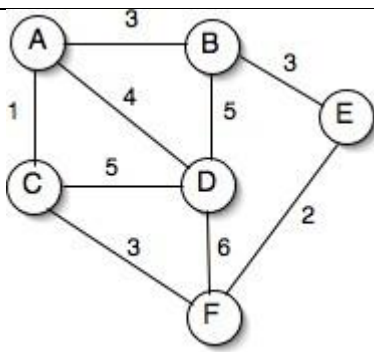
WEEK 7: Perform various tree traversal algorithms for a given tree.

WEEK 8: Find a subset of a given set S = {sl, s2,…, sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1, 2, 6} and {1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.

WEEK 9: Implement any scheme to find the optimal solution for the Traveling Sales Person problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

WEEK-10: Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
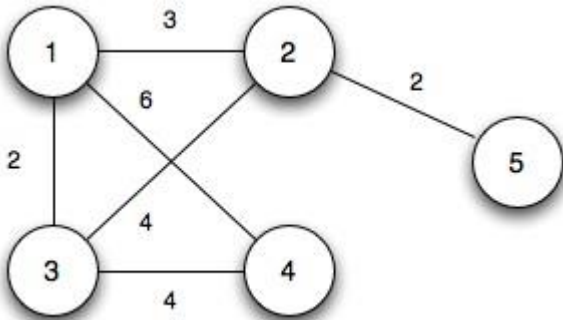
Outcomes:		
1. **Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity		
2. **Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.		

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A Data Science-Semester IV
INTRODUCTION TO DATA SCIENCE WITH R-PROGRAMMING

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

1. Exposure to theory as well as practical knowledge through R used in data analytics.
2. Fundamental basics of statistics used in analyzing the data
3. How to find the pattern in the given dataset
4. How to interpret the data graphically
5. How to apply different types of algorithms for the given dataset

	SYLLABUS	
UNIT I:		

Introduction to Data analytics: Overview of Bigdata, Need of Data Analytics, Applications of Data Analytics, Datasets, tools for data analytics

Basic Statistics**: Mean, Median, mode, Standard Deviation, Variance, Correlation.** Distribution: **normal, binomial.**

UNIT II:		

Basic Analysis Techniques: **Chi-Square Test, t-Test.** Data Analysis Techniques: **Linear and Logistic Regression.**

Introduction to R: R overview and history, Basic features of R, Installing R, packages in R, Getting started: Window section of RStudio, first interaction, command line versus scripts, comments. Variables in R: Naming variables, assigning values to variables, finding variables, removing variables, operators.

R Data Structures: Vectors, Character Strings, Matrices, Lists, Data Frames, and Classes.

UNIT III:		

Input of Data: input of data from terminal, input of data through R-objects. **Output functions:** print () function, cat () function. **In-Built functions in R:** Mathematical functions, String functions. **User defined functions** – function without arguments, function with arguments.

Decision making structure: simple if statement, if-else statement, switch statement. **Loops:** while loop, for loop, Repeat loop.

UNIT IV:		

Data Types of R

Vectors: class of a vector, Elements of a vector, acceding vector elements, functions for vectors, obtaining the Length of a Vector. **Common vector operations:** Arithmetic & logical operations, Vector Indexing, using all () and any () functions, Vectorized operations, NA and NULL values.

Matrices: creating a matrix, accessing matrix elements, functions for matrices, matrix indexing, filtering on matrices. **Arrays:** creating an array, accessing elements of an array, functions for array.

UNIT V:		

Lists: creating a list, accessing list elements, functions for list, General list operations, list indexing, adding and deleting list elements.

Import and Export of data: Import and export of data in excel file:reading from excel format, write to excel format.

Data Visualization techniques: Introduction, pie chart, bar chart, scatter and box plots.

Outcomes:		

1. Data-Visualization tools and techniques offer executives and other knowledge workers new approaches

2. Data visualization is a general term that describes any effort to help people understand the significance of data by placing it in a visual context.

3. Patterns, trends and correlations that might go undetected in text-based data can be exposed and recognized easier with data visualization software.

4. It isn't just the attraction of the huge range of statistical analyses afforded by R that attracts data people to R. The language has also developed a rich ecosystem of charts, plots and visualizations over the years.

Text Books:		
2. Data Analytics with R, WILEY Publishing, Dr.Bharti Motwani.		
3. The Art of R Programming by Norman Matlof, No starch press, SAN FRANSISCO,2011.		
4. Data Analytics using R, McGrawHill Publications, Seema Acharya		

References:

2. Rumset D. J. (2010): Statistical Essentials for Dummies. Hoboken: Wiley Publishing

3. R for Data Science: Import, Tidy, Transform, Visualize, and Model Databy adley ickham , O'Reilly

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A-Semester IV
INTRODUCTION TO DATA SCIENCE WITH R-PROGRAMMING
LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		

1. Exposure to theory as well as practical knowledge through R used in data analytics.
2. Fundamental basics of statistics used in analyzing the data
3. How to find the pattern in the given dataset
4. How to interpret the data graphically
5. How to apply different types of algorithms for the given dataset

	SYLLABUS	

1. Write a program in R. To compute the product of two values
2. Write a program in R. to check whether the given number is even or odd.
3. Write a program in R. Sum of natural numbers.
4. Write a program in R. Find the factorial.
5. Exporting data to Excel, Text File
6. Mean, Median, Standard Deviation, Variance, Correlation in R
7. Correlation in R:Pearson & Spearman with Matrix Example
8. T Test in R
9. Chi-Square Test in R
10. Prediction using linear regression and visualizing the regression graphically
11. Prediction using logistic regression and visualizing the regression graphically
12. Bar chart in R

Outcomes:		

1. Learn R programing language with simple example.
2. Ability to write different programs in R.
3. Familiar to apply statistical methods in R.
4. Analyze various tests in R .

B.C.A. DATA SCIENCE -Semester IV

OBJECT ORIENTED SOFTWARE ENGINEERING

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. Illustrate basic taxonomy and terminology of the software engineering. 2. Plan and monitor the control aspects of project.		
	SYLLABUS	
UNIT I:		
The Scope of Object Oriented Software Engineering: Historical Aspects, Economic Aspects, Maintenance Aspects, Requirements, analysis and design aspects, the object oriented Paradigm, Terminology, Ethical Issues. **Software Life Cycle Models:** Software Development In Theory, Risks and other aspects of Iteration and Incrementation, Managing Iteration and Incrementation, other Life Cycle Models: Code and Fix, Waterfall, Rapid Prototyping, Open Source, Agile Processes, Synchronize and Stabilize, Spiral Models, Comparison of Life Cycle Models.		
UNIT II:		
The Software Process : The Unified Process, Iteration and Incrementation, The Requirements Workflow, The Analysis workflow, The Design Workflow ,The Implementation workflow, the test workflow, Post Delivery Maintenance, Retirement, the phases of the unified process, one-versus two-dimensional life cycle models, improving the software process, capability maturity models, costs and benefits of software process improvement.		
UNIT III:		
Models t o O b j e c t s : What is a module? Cohesion, Coupling, Data Encapsulation, Abstract Data Types, Information Hiding, Objects, Inheritance, Polymorphism and Dynamic Binding, The Object-Oriented Paradigm. **Reusability and Portability:** Objects and Reuse, Reuse during design and implementation reuse and post-delivery maintenance, portability, techniques for achieving portability. **Planning and Estimating:** planning and the software process, Estimating duration and cost.		
UNIT IV:		
The Requirements workflow: Determining what client needs , overview of the requirements, understanding the domain, the business model, initial requirements, rapid prototyping , human factors, reusing the rapid prototype, metrics for the requirement workflow. **The Analysis Workflow**: the analysis workflow, extracting the entity classes. **The Design Workflow**: Object –Oriented Design, the design workflow, formal techniques for detailed design, real time design techniques.		
UNIT V:		
The implementation workflow: choice of programming languages, good programming practice, coding standards, code reuse, integration, the implementation workflow. **Testing:** Quality Issues, Non – Execution based testing, execution based testing, what should be tested?, testing versus correctness proofs. Test case selection, Black Box Unit Testing techniques, Glass-Box Unit Testing Techniques.		
Outcomes:		

1. Explore the basic concepts of software engineering.
2. Choose appropriate life cycle model for a project.
3. Implement the phases of the traditional software development process.
4. Design various test cases for a software product.
5. Analyze different architectural views.

Text Books:

Stephen R.Schach -Object Oriented Software Engineering McGraw   Hill Higher Education

References:

Timothy C.Lethbridge, Robert Language Object Oriented Software Engineering

B.C.A. DATA SCIENCE -Semester IV
OBJECT ORIENTED SOFTWARE ENGINEERING LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		
1. Illustrate basic taxonomy and terminology of the software engineering. 2. Plan and monitor the control aspects of project.		
	SYLLABUS	
1	Online Examination System.	
2	Online Railway Reservation.	
3	Library Maintenance System.	
4	Any E-Commerce Portal.	
5	Biometric Attendance System.	
Outcomes:		
1. Understand the basic concepts of software engineering. 2. Applied appropriate life cycle model for a project. 3. Implement the phases of the traditional software development process. 4. Design various test cases for a software product. 5. Analyze different architectural views.		

BACHELOR OF COMPUTER APPLICATIONS

DATA SCIENCE

Syllabi

With effect from 2021-22 admitted batch

III YEAR I SEMESTER

Paper Code	Course	Teaching Hours	Sem End Exam	Mid Sem Exam*	Total Marks	Credits
BCA3.1.1	Big Data Analytics	4	75	25	100	4
BCA3.1.2	Big Data Analytics Lab	2	50	0	50	1
BCA3.1.3	Python Programming	4	75	25	100	4
BCA3.1.4	Python Programming Lab	2	50	0	50	1
BCA3.1.5	Statistical Package for Social Science	4	75	25	100	4
BCA3.1.6	Statistical Package for Social Science Lab	2	50	0	50	1
BCA3.1.7	Elective_ I[Theory] Deep Learning Data Science Applications	4	75	25	100	4
BCA3.1.8	Elective_ I[Lab] Deep Learning Lab Data Science Applications Lab	2	50	0	50	1
BCA3.1.9	Elective_ II[Theory] Information Storage Management Social Network Analytics	4	75	25	100	4
BCA3.1.10	Elective_ II[Lab] Information Storage Management Lab Social Network Analytics Lab	2	50	0	50	1
BCA3.1.11	Elective_ III[Theory] Cloud Computing Mobile Computing	4	75	25	100	4
BCA3.1.12	Elective_ III[Lab] Cloud Computing Lab Mobile Computing Lab	2	50	0	50	1
Total		**36**	**750**	**150**	**900**	**30**

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A Data Science- V Semester

Subject: BIG DATA ANALYTICS

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. Understand big data and Apache Hadoop Eco-system.		
2. Understand distributed, parallel, cloud computing and SQL concepts.		
3. Apply Hadoop concepts.		
4. Understand concepts of map and reduce and functional programming.		
	SYLLABUS	
Unit I:		
Introduction to Big data: Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting – Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling -Statistical Inference - Prediction Error.		
Unit II:		
Data Analysis: Regression Modeling - Multivariate Analysis – Bayesian Methods – Bayesian Paradigm -Bayesian Modeling - Inference and Bayesian Networks - SupportVector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees		
Unit III:		
Introduction to Hadoop: Hadoop- definition-Understanding distributed systems and Hadoop-Comparing SQL databases and Hadoop- Understanding MapReduce- Countingwords with Hadoop-running your first program-History of Hadoop-Starting Hadoop - The building blocks of Hadoop- NameNode- DataNode-Secondary NameNode-JobTracker and Task Tracker.		
Unit-IV:		
HDFS: Components of Hadoop -Working with files in HDFS-Anatomy of a MapReduce program-Reading and writing the Hadoop Distributed File system -The Design of HDFS-HDFS Concepts-The Command-Line Interface-Hadoop File system-The Java Interface-Data Flow-Parallel Copying with distcp- Hadoop Archives.		
Unit V:		
Tools and Frameworks: Apache Hive, MapR – Sharding – NoSQL Databases - S3 – Cloudera-MongoDB-Talend-Hadoop Distributed File Systems – Case Study.		
Outcomes:		
1. Gain conceptual understanding of analytics concepts, algorithms and statistical tests.		
2. Gains knowledge on how to analyze data by using various classification and clustering techniques.		
3. Understands how Hadoop can store and process the data and its architecture.		
4. Ablility to learn how to read and write data in Hadoop distributed file system.		
5. Familiarizes with modern data analytic tools of Big Data.		
Text Book:		
1.Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH,2012.		
2.Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly		
3.Data Mining Concepts and Techniques, Jiawei Han and Kamber, Morgan Kaufman Publications.		

References:		

1. Hadoop in Action by Chuck Lam, MANNING Publ.
2. Hadoop in Practice by Alex Holmes, MANNING Publishers
3. Mining of massive datasets, AnandRajaraman, Jeffrey D Ullman, Wiley Publications.

Department of Computer Applications
B.C.A. DATA SCIENCE -Semester V
BIG DATA ANALYTICS LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		

3. Covers Hadoop environment.
4. Covers File Management in Hadoop
5. Covers HIVE environment

	SYLLABUS	

1. Installation of VMWare to setup the Hadoop environment and its ecosystems.
2. Perform setting up and Installing Hadoop in its three operating modes.
   i.   Standalone. ii. Pseudo distributed. iii. Fully distributed.
3. Implementing the basic commands of LINUX Operating System – File/Directory creation, deletion, update operations.
4. Implement the following file management tasks in Hadoop: i. Adding files and directories ii. Retrieving files iii. Deleting files
   Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities
5. Run a basic word count Map Reduce program to understand Map Reduce Paradigm.
6. Write a Map Reduce program that mines weather data. Hint: Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.
7. Implement matrix multiplication with Hadoop Map Reduce
8. Installation of HIVE.
9. Use Hive to create, alter, and drop databases,
10. Use Hive to create tables, views, functions, and indexes.

Outcomes:		

6. Understanding Hadoop environment.
7. Implementation of File Management in Hadoop
8. Understanding HIVE environment
9. Design various database operations with HIVE .

B.C.A Data Science-Semester V
PYTHON

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:
1. To discuss about python language basics, operators and data structures like lists, tuples, sets and dictionaries.   2. To develop programs for file operations and module creations.   3. To explain the concepts of exception handling.   4. To implement programs using GUI and CGI technology.   5. To discuss the data base operations using MySQL API with python programming.

	SYLLABUS	
UNIT I:		**9 Classes**

Python basics, Objects- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types **Numbers -** Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules - **Sequences -** Strings, Lists, and Tuples, Mapping and Set Types.

UNIT II:		**9 Classes**

Files: File Objects, File Built-in Function [open()], File Built-in Methods, File Built-in Attributes, Standard Files, File System, File Execution, Persistent Storage Modules, Related Modules **Modules:** Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules.

UNIT III:		**11 Classes**

Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, Creating Exceptions, Why Exceptions (Now)? Why Exceptions at All?, Exceptions and the sys Module, Related Modules.

UNIT IV:		**10 Classes**

GUI Programming: Introduction, Tkinter and Python Programming, Brief Tour of Other GUIs, Related Modules and Other GUIs **Web Programming:** Introduction, Web Surfing with Python, Creating Simple Web Clients, CGI-Helping Servers Process Client Data, Building CGI Application.

UNIT V:		**11 Classes**

Database Programming: Introduction, Python Database Application Programmer's Interface (DBAPI), Object Relational Managers (ORMs), Related Modules.

Outcomes:		

1. Acquires knowledge on implementation of basics programs, operators and data structures
like lists, tuples, sets and dictionaries.

2. Develop knowledge on files and its operations.

3. Ability to implement various GUI programming and CGI programs.

4. Acquires knowledge on database and its applications.

5. Familiarizes with various ORM and related techniques.

Text Books:		
Python Programming for the Absolute Beginner,Third Edition by Michael Dawson		

References

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.
2. Think Python, Allen Downey, Green Tea Press.
3. Introduction to Python, Kenneth A. Lambert, Cengage.
4. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
5. Learning Python, Mark Lutz, O'.
6. Web sources suggested by the teacher concerned and the college librarian including reading material.

B.C.A Data Science-Semester V
PYTHON LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:

1. To develop programs on basic programs.
2. To develop programs for data structures like lists, tuples, sets and dictionaries.
3. To explain the concepts of exception handling.
4. To implement programs using GUI with tkinter module.
5. To implement the data base operations using MySQL API with python programming.

	SYLLABUS	

1. Write a python program to calculate a student's total marks, percentage, and grades. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria :

       Grade A: Percentage >=80
       Grade B: Percentage>=70 and <80
       Grade C: Percentage>=60 and <70
       Grade D: Percentage>=40 and <60
       Grade E: Percentage<40

2. Write a python program to display the first n terms of the Fibonacci series.
3. Write a python program to calculate the sum and product of two compatible matrices.
4. Write a function that takes a character and returns True if it is a vowel and False otherwise.
5. Write a menu-driven program to create mathematical 3D objects
          I. curve   II. sphere   III. cone   IV. arrow   V. ring   VI. Cylinder.

6. Write a python program to read n integers and display them as a histogram.
7. Write a python program to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula m=60/ (t+2), where t is the time in hours. Sketch a graph for t vs. m, where t>=0.
8. Write a program that takes two lists and returns True if they have at least one common member.
9. Write a Python program to print a specified list after removing the 0th, 2nd, 4th and 5th elements.
10. Try to configure the widget with various options like bg=" green", family=" times", and size=20.
11. Write a Python program to read the last 5 lines of a file.
12. Design a simple database application that stores the records and retrieves the same.

Outcomes:		

1. Acquires knowledge on implementation of basics programs, operators and data structures like lists, tuples, sets and dictionaries.
2. Develop knowledge on files and its operations.
3. Ability to implement various GUI programming and CGI programs.
4. Acquires knowledge on database and its applications.

B.C.A Data Science-Semester V
Statistical Package for Social Science

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

1. Understand the main features of SPSS
2. Use the SPSS GUI effectively
3. Perform descriptive analyses with SPSS
4. Perform common parametric and non-parametric tests
5. Perform simple regressions and multivariate analyses (factor and cluster)
6. Know where to find help

	SYLLABUS	
UNIT I:		

SPSS Environment: data editor, output viewer, syntax editor – Data view window – SPSS Syntax – Data creation – Importing data – Variable types in SPSS and Defining variables – Creating a Codebook in SPSS.

UNIT II:		

Computing Variables - Recoding (Transforming) Variables: Recoding Categorical String Variables using Automatic Recode - Rank Cases - Sorting Data - Grouping or Splitting Data.

UNIT III:		

Descriptive Statistics for Continuous Variables - The Explore procedure - Frequencies Procedure – Descriptives - Compare Means - Frequencies for Categorical Data.

UNIT IV:		

Statistical tests - Inferential Statistics for Association: Pearson Correlation, Chi-square Test of Independence – Inferential Statistics for Comparing Means: One Sample t Test, PairedSamples T Test, Independent Samples T Test, One-Way ANOVA.

UNIT V:		

Correlation and regression - Linear correlation and regression - Multiple regression (linear)

Multivariate analysis - Factor analysis - Cluster analysis

Outcomes:		

1. Students' familiarity with the tool box of statistical software. Capacitating students in analyzing complex information with the help of statistical software.
2. Statistical Package for Social Sciences (SPSS). A strong theoretical and empirical foundation in statistical analysis.

Text Books:		

SPSS Programming and Data Management: A Guide for SPSS and SAS Users, 3rd Edition

by Inc. Spss and Levesque Raynald

References
1. IBM 2016, IBM Knowledge Center: SPSS Statistics, IBM, viewed 18 May 2016, https://www.ibm.com/support/knowledgecenter/SSLVMB/ welcome/
2. HOW TO USE SPSS A Step-By-Step Guide to Analysis and Interpretation, Brian C. Cronk, Tenth edition published in 2018 by Routledge.

3. SPSS for Intermediate Statistics: Use and Interpretation, Nancy L. Leech et. al., Second edition published in 2005 by Lawrence Erlbaum Associates, Inc.
4. Using IBM SPSS statistics for research methods and social science statistics, William E. Wagner, Fifth edition published in 2015 by SAGE Publications, Inc.

B.C.A Data Science-Semester V
Statistical Package for Social Science LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:

1. Understand the main features of SPSS
2. Use the SPSS GUI effectively
3. Perform descriptive analyses with SPSS
4. Perform common parametric and non-parametric tests
5. Perform simple regressions and multivariate analyses (factor and cluster)

Know where to find help

	SYLLABUS	

Lab 1 and 2

- ➢ A   Getting familiar with SPSS
- ➢ B1   Entering data by hand
- ➢ B2   Using "Variable View"
- ➢ B3   Creating a frequency table
- ➢ C   Creating a histogram
- ➢ D   Creating a boxplot
- ➢ E   Calculating mean, modus and median
- ➢ F   Calculating measures of spread

Lab 3 and 4

- ➢ Computing new variables using "Compute"

- ➢ Changing the coding of a variable using "Recode"

- ➢ Importing (reading) data from a text file without columns

- ➢ Locating outliers using a boxplot

- ➢ Selecting and deleting cases

- ➢ Computing confidence interval for population means

- ➢ Testing a population mean using t-test

Lab 5 and 6

- ➢ Reading (importing) data from a text file with columns.

- ➢ Assessing Normality of data (Q-Q Plot, Normal quantile plot).

- ➢ Selecting a group case.

➢ Testing the difference between two independent groups using *t*-test.

➢ Visualizing difference between two groups with a double boxplot.

➢ Testing difference between related samples using *t*-test.

➢ Testing difference in increase between two different groups.

Lab 7 and 8

➢ Entering data for a two-way table

➢ Weighting cases with frequencies

➢ Setting the meaning of a value/code

➢ Creating a two-way table with all the occurrences

➢ Choosing the most adequate two-way table form

➢ Visualizing the counts from a two-way table

➢ Significance tests and confidence intervals for proportions

➢ Testing the association of two categorical variables using chi-square test

Lab 9 and 10

➢ ANOVA

➢ Non-parametric test: Wilcoxon Rank Sum Test

Outcomes:		
1. Students' familiarity with the tool box of statistical software. Capacitating students in analyzing complex information with the help of statistical software.		
2. Statistical Package for Social Sciences (SPSS). A strong theoretical and empirical foundation in statistical analysis.		

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A Data Science- V Semester

Subject: Deep Learning

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. Covers Neural Networks and its methodologies. 2. Includes Deep Learning environment setup. 3. Covers Tensorflow program on AWS cloud platform and its basics 4. Covers Neural Network for MNIST dataset 5. Covers CNN and RNN Models		
	SYLLABUS	
UNIT I:		
Introduction to Neural Network: what is neural network..? How neural networks works? Gradient descent,Stochastic Gradient descent,Perceptron,Multilayer Perceptron, BackPropagation **Building Deep learning Environment:** Overview of deep learning, DL environment setup locally, Installing Tensorflow, Installing Keras, Setting up a DL environment in the cloud, AWS, GCP, Run Tensorflow program on AWS cloud platform		
UNIT II:		
Tenserfow Basics: Placeholders in Tensorflow, Defining placeholders, Feeding placeholders with data, Variables, Constant, Computation graph, Visualize graph with Tensor Board **Activation Functions:** What are activation functions? Sigmoid function, Hyperbolic Tangent function, ReLu -Rectified Linear units, Softmax function		
UNIT III:		
Training Neural Network for MNIST dataset: Exploring the MNIST dataset, Defining the hyperparameters, Model definition, Building the training loop, Overfitting and Underfitting, Building Inference **Word Representation Using word2vec:** Learning word vectors, Loading all dependencies, Preparing the text corpus, defining our word2vec model, Training the model, Analyzing the model, Visualizing the embedding space by plotting the model on tensorboard		
UNIT IV:		
Clasifying Images with Convolutional Neural Networks(CNN): Introduction to CNN, Train a simple convolutional neural net, Pooling layer in CNN, Building ,training and evaluating our first CNN, Model performance optimization **Popular CNN Model Architectures:** Introduction to Imagenet, LeNet architecture, AlexNet architecture, VGGNet architecture, ResNet architecture		
UNIT V:		
Introduction to Recurrent Neural Networks(RNN): What are Recurrent Neural Networks (RNNs)?, Understanding a Recurrent Neuron in Detail,Long Short-Term Memory(LSTM), Back propagation Through Time(BPTT),Implementation of RNN in Keras		

Outcomes:		
1. Install and configure Tensorflow. 2. Understand the concept of Tensorflow program on AWS cloud platform and its basics 3. Understand the concept Neural Network for MNIST dataset 4. Understand the concept CNN and RNN Models		
Text Books:		
5. Neural Networks and Deep Learning by Charu C. Aggarwal Publisher: Springer International Publishing.		

References

1. Deep Learning (Adaptive computation and machine learning), Authors: Ian Goodfellow (Author), Yoshua Bengio (Author), Aaron Courville (Author),Publisher: The MIT Press; Illustrated Edition (November 18, 2016)
2. Deep Learning with Python (1st Edition),Authors: François Chollet (Author),Publisher: Manning Publications; 1st Edition (December 22, 2017)

3. 3. Fundamentals of Deep Learning: Designing next-generation machine intelligence algorithms, Authors: Nikhil Buduma (Author), Nicholas Locascio, Publisher: O'Reilly Media; 1st Edition (July 4, 2017)

B.C.A. DATA SCIENCE -Semester V

DEEP LEARNING LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:

6. Implementation of Deep Learning Techniqes.
7. Covers Tensorflow program on AWS cloud platform and its basics
8. Covers Neural Network for MNIST dataset
9. Covers CNN and RNN Models

	SYLLABUS	

11. Gender Detection
12. Predict Car Prices
13. Image Recognition
14. Image Classification
15. Predict Fuel Efficiency
16. Text Classification
17. Real-Time Face Mask Detection
18. Pneumonia Detection
19. Face Mask Detection
20. Number Plate Detection
21. *Chatbot with Deep Learning*

Outcomes:

10. Understand the basic concepts of neural networks
11. Applied the tensorflow library.
12. Implement the real time applications using Tensor Flow, CNN,RNN techniques.
13. Design various applications.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A Data Science- V Semester

Subject: Data Science Applications

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. Provide you with the knowledge and expertise to become a proficient data scientist. 2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science. 3. Produce Python code to statistically analyze a dataset. 4. Critically evaluate data visualizations based on their design and use for communicating stories from data.		
	SYLLABUS	
UNIT I:		
GUI Programming: Graphical User Interface - Python gui development options, Adding Widgets, GUI Coding Techniques, Customizing Widgets; Internet Programming - Network Scripting, Client-Side scripting, Pymailgui client, serverside scripting, Pymailcgi server; Tools and Techniques -databases and persistence, data structures, text and language, python/c integration		
UNIT II:		
Pandas and NumPy: Numpy Basics - Fast Element wise array functions, Multidimensional Array, Data Processing using arrays, file i/o with arrays; Pandas - Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics, Handling Missing Data, Hierarchical Indexing		
UNIT III:		
Data Preprocessing: Data Loading, Storage, and FileFormats - Reading and Writing data in text format, binary data formats, interacting with html and web apis, interacting with databases;		
UNIT IV:		
Data Wrangling: Clean, Transform, Merge, Reshape - Combining and Merging Data Sets, Reshaping and Pivoting, Data Transformation, String Manipulation; Data Aggregation and Group Operations – Group by Mechanics, Data Aggregation, Groupby Operations and and Transformations, Pivot Tables and Cross-Tabulation		
UNIT V:		
Data Visualization: A Brief matplotlib API Primer, Plotting Functions in pandas, Time Series, Financial and Economic Data Applications		
Outcomes:		
After the completion of the course, student will be able to 1. Explain how data is collected, managed and stored for data science. 2. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists. 3. Implement data collection and management scripts using Python Pandas.		
Text Books:		
1. Learning Python , OReilly, Mark Lutz 2. Programming Python, OReilly, Mark Lutz 3. Python For Data Analysis (O Reilly, Wes Mckinney)		

References

1. Python: The Complete Reference, Martin C. Brown, McGraw Hill Education

2. Head First Python, Paul Barry, O'Reilly

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester V
Data Science Applications LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		

1. Understanding Python programming concepts in data science, including their real-world applications.
2. Covers data collection and management scripts using Python Pandas.

	SYLLABUS	

1. Write a python program to sort list of dictionaries by values in Python – Using lambda function.
2. Write a Python Program for following sorting: i. Quick Sort ii. Heap Sort
3. Write a Python Program to Reverse a String Using Recursion
4. Write a Python Program to Count the Number of Words in a Text File
5. Write a Python Program to Read the Contents of a File in Reverse Order
6. Write a program to Merge and Join DataFrames with Pandas in Python
7. Write a program to implement Merge and Join DataFrames with Python Pandas
8. Write a Python Program to Append the Contents of One File to Another File
9. How to install and Load CSV files to Python Pandas
10. Write a program to implement Data analysis and Visualization with Python using pandas.
11. Write a program to Implement Plotting Functions in python pandas.

Outcomes:		

1. Apply Python programming concepts in data science, including their realworld applications.
2. Implement data collection and management scripts using Python Pandas.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A Data Science- V Semester

Subject: Information Storage Management

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:

1. To understand the basic components of Storage System Environment.
2. To understand the Storage Area Network Characteristics and Components.
3. To examine emerging technologies including IP-SAN.
4. To describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities.
5. To understand the local and remote replication technologies.

	SYLLABUS	
UNIT I:		

Introduction to Information Storage and Management: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle.

Storage System Environment: Components of the Host. RAID: Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares. Intelligent Storage System: Components, Intelligent Storage Array.

UNIT II:		

Direct-Attached Storage and Introduction to SCSI: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, SCSI Command Model.

Storage Area Networks: Fiber Channel, SAN Evolution, SAN Components, Fiber Channel Connectivity, Fiber Channel Ports, Fiber Channel Architecture, Zoning, Fiber Channel Login Types, Fiber Channel Topologies.

Network Attached Storage: Benefits of NAS, NAS File I/Components of NAS, NAS Implementations, NAS-Implementations, NAS File Sharing Protocols, NAS I/O Operations.

UNIT III:		

IP SAN: iSCSI, FCIP. Content-Addressed Storage: Fixed Content and Archives, Types of Archives, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples.
Storage Virtualization: Forms of Virtualization, NIA Storage Virtualization Taxonomy, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization.

UNIT IV:		

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Recovery: Backup Purpose, Considerations, Granularity, Recovery Considerations, Backup Methods and Process, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies

UNIT V:		
Replication: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface. Remote Replication: Modes of Remote Replication and its Technologies, Network Infrastructure.		
Outcomes:		
After the completion of the course, student will be able to 1. Understanding how data is collected in the basic components of Storage System Environment. 2. Understand the key concepts Storage Area Networks. 3. Understand the concepts of CAN and Virtualization.		
Text Books:		
1. EMC Corporation, Information Storage and Management, Wiley, India		
References 1. Robert Spalding, —Storage Networks: The Complete Reference —, Tata McGraw Hill, Osborne, 2003. 2. Marc Farley, —Building Storage Networks‖, Tata McGraw Hill, Osborne, 2001. 3. Meeta Gupta, Storage Area Networks Fundamentals, Pearson Education Limited, 2002.		

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications
B.C.A. DATA SCIENCE -Semester V
Information Storage Management LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		

1. Covers Data Storage techniques.
2. Covers Data Virtualization and Data Visualization Techniques.

	SYLLABUS	

1. Use data to solve a problem
2. Capture data in a spreadsheet
3. Processing data using Mathematical functions
4. Create a report for Employee and generate data visualization
5. Store data in a Database server and retrieve using excel
6. Export the data from excel to any database
7. Import the data from database server to excel sheet
8. Create a storage Virtualization
9. Analyze student data by different Charts
10. Backup entire database into a file
11. Restore entire database from a file

Outcomes:		

1. Understanding Data Storage techniques.
2. Understanding Data Virtualization and Data Visualization Techniques.
3. Understanding Backup and restoring of data from databases.

B.C.A Data Science- V Semester

Subject: Social Network Analytics

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. To understand the concept of semantic web and related applications. 2. To learn knowledge representation using ontology. 3. To understand human behavior in social web and related communities. 4. To learn visualization of social networks.		
	SYLLABUS	
UNIT I:		
Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.		
UNIT II:		
MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.		
UNIT III:		
EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS: Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.		
UNIT IV:		
PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.		
UNIT V:		
VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS: Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.		

Outcomes:		

After the completion of the course, student will be able to

1. Develop semantic web related applications.
2. Represent knowledge using ontology.
3. Predict human behaviour in social web and related communities.
4. Visualize social networks.

Text Books:		

1. Peter Mika, ―Social Networks and the Semantic Web‖, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications‖, 1st Edition, Springer, 2010.

References

1. Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web‖, Springer, 2009.

B.C.A. DATA SCIENCE -Semester V

Social Network Analytics LAB

Credits: 1	Theory: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		

1. Covers Social media analysis and predictions.
2. Covers Data Virtualization and Data Visualization Techniques.

	SYLLABUS	

1. Instagram Algorithm
2. Facebook Posts Sentiment Analysis
3. WhatsApp Chats Sentiment Analysis
4. Youtube Trending Videos Analysis
5. *Predict Tinder Matches*
6. Visual Recognition
7. Filtering Spam Content
8. Fake News Identification
9. Sentiment Analysis
10. Chatbot System

Outcomes:		

1. Understanding Data Virtualization and Data Visualization Techniques.
2. Understanding Backup and restoring of data from databases.

Gayatri Vidya Parishad College for Degree and PG Courses (AUTONOMOUS)
Department of Computer Applications

B.C.A Data Science-Semester V

Cloud Computing

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:		
1. The student will learn about the cloud environment, building software systems and components that scale to millions of users in modern internet. 2. The student will understand the cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas, and developing cloud based software applications on top of cloud platforms.		
	SYLLABUS	
UNIT I:		**(8 Hours)**
Introduction to Cloud Computing: Evolution and History of Cloud Computing, Introduction to Cloud Computing, Why Cloud Computing is Becoming Highly Important, Features of Cloud Computing, Cloud Computing for various users, Advantages of Cloud Computing, Limitations of Cloud Computing.		
UNIT II:		**(12 Hours)**
Cloud Models and Types: The NIST Model, Cloud Cube Model, Deployment Models, Service Models. Layers and Types of Cloud, Components of Cloud Computing, Cloud Computing Service Providers. **Software as a Service (SaaS)**: Software as a Service , Evolution of SaaS ,Brief Introductory part of Software as a Service , SaaS Unification Technologies , SaaS Integration Products and Technologies, SaaS Product Selection Criteria, SaaS Integration Services, Advantages of SaaS		
UNIT III:		**(10 Hours)**
Platform as a Service (PaaS): Introduction to PaaS, Evolution of PaaS, PaaS Service Providers- Acquia Cloud, Amazon AWS, Amazon Elastic Beanstalk, Google App Engine, Force.com, PaaS Application Framework, PaaS Operator Verbs, PaaS Developer Verbs, Advantages and Challenges of PaaS		
UNIT IV:		**(12 Hours)**
Infrastructure as a Service (IaaS): Evolution, IaaS Architecture- Advantages and Disadvantages of Infrastructure as a Service, SAN model, IaaS Providers, IaaS Architecture, Advantages and Disadvantages of Infrastructure as a Service **Data in Cloud :** Evolution of Network Storage in Cloud, Data as a Service, Database as a Service, Cloud Based Data Storage, Advantages and Limitations of Cloud Based Storage Solution, Cloud Based Data Storage Service Providers		
UNIT V:		**(8 Hours)**
Virtualization: Introduction to Virtualization and its Technical Evolution, History of Virtualization, Types of Virtual Machines, Advantages of Virtualization, Components of Virtualization, Types of Virtualization.		
Outcomes:		
1. Compare the strengths and limitations of cloud computing. 2. Identify the architecture, infrastructure and delivery models of cloud computing. 3. Apply suitable virtualization concept. 4. Choose the appropriate cloud player, Programming Models and approach. 5. Address the core issues of cloud computing such as security, privacy and interoperability. 6. Design Cloud Services and Set a private cloud.		

Text Books:		
1. Text books: Handbook of Cloud Computing By Dr.Anand Nayyar (Editor), First Edition 2019, BPB Publication, India.		

References

1. 1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter
2. TATA McGraw- Hill , New Delhi – 2010
3. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
4. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
5. Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press

Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christenvecctiola, S Tammaraiselvi, TMH

B.C.A Data Science-Semester V

Cloud Computing LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:

The course is designed to develop skills to design and analyze the cloud platform It strengthens the ability to the students to design his/her own website in the cloud. It enables them to
gain knowledge in practical applications of cloud platforms.

	SYLLABUS	

1. Create a word document of your class time table and store locally and on cloud with doc and pdf format.

2. Prepare a PowerPoint on cloud on topic of your choice.

3. Create your resume in a neat format using Google cloud

4. Install OpenStack and use it as Infrastructure as a Service and use technology ownCloud.

5. Installing and using identity management feature of OpenStack.

6. Write a program for web feed using PHP, HTML.

7. Installing and using security feature of own Cloud.

8. Installing and using Administrative features of own Cloud.

9. Create a website using Google Sites.

10. Case study on Amazon EC2.

Outcomes:		

After completion of course, student will be able to:
1. Create a documents in Cloud platform.
2. Manage organize and manipulate the files in Cloud.
3. Knows how to use Open Stack and creates his/her own cloud.
4. Knows how to create his own websites in the cloud

B.C.A Data Science-Semester V

Mobile Computing

Credits: 4	Theory: 4 Hours	Tutorials: -
Max Marks: 100	External: 75 Marks	Internal: 25 Marks

Course Objectives:
1. To study the emerging technologies in the context of wireless networks 2. The student will understand the mobile computing environment 3. The student will understand the mobile computing platform Android Studio.

	SYLLABUS	
UNIT I:		**(10 Hours)**

Mobile Communications: An Overview- Mobile Communication-guided transmission, unguided transmission-signal propagation frequencies, antennae, modulation, modulation methods and standards for voice-oriented data communication standards, modulation methods and standards for data and voice communication, mobile computing- novel applications and limitations, mobile computing architecture, mobile system networks.

Mobile devices and systems: Cellular networks and frequency reuse, Mobile smart phones, Smart mobiles and systems, handheld pocket computers, Handheld devices, Smart systems, Limitations of mobile devices.

UNIT II:		**(10 Hours)**

GSM and other 2G Architectures: GSM-services and system architecture, Radio interfaces of GSM, Protocols of GSM, Localization, Call handling, GPRS system architecture. Wireless medium access control, CDMA,
3G, 4G and 5G Communication: Modulation, Multiplexing, Controlling the medium access, Spread spectrum, Coding methods, IMT-20003G wireless communication standards, WCDMA 3G communication standards, CDMA 3G communication standards, Broadband wireless access, 4G networks, 5G Networks.

UNIT III:		**(12 Hours)**

Mobile IP Network layer: IP and Mobile IP network layers: OSI layer functions, TCP/IP and Internet protocol, Mobile internet protocol; Packet delivery and Handover Management; Location Management: Agent Discovery; Mobile TCP

Introduction to Mobile Adhoc network: fixed infrastructure architecture, MANET infrastructure architecture; MANET: properties, spectrum, applications; Security in Ad-hoc network; Wireless sensor networks; sensor network applications.

UNIT IV:		**(8 Hours)**

Synchronization: Synchronization in mobile computing systems, Usage models for Synchronization in mobile application, Domain-dependant specific rules for data synchronization, Personal information manager, synchronization and conflict resolution strategies, synchronizer; Mobile agent: mobile agent design, aglets; Application Server.

UNIT V:		**(10 Hours)**

Mobile Wireless Short Range Networks and Mobile Internet: Wireless networking and wireless LAN, Wireless LAN (WLAN) architecture, IEEE 802.11protocol layers, Wireless application protocol (WAP)-WAP1.1 architecture, wireless datagram protocol (WDP), Wireless Transport Layer Security (WTLS), wireless transaction and session layers, wireless application environment.

Outcomes:		
1. Interpret Wireless local area networks (WLAN): MAC design principles, 802.11 WIFI 2. Discuss fundamental challenges in mobile communications and potential Techniques in GSM 3. Demonstrate Mobile IP in Network layer. 4. Elaborate TCP/IP Protocols and database issues. 5. Illustrate different data delivery methods and synchronization protocols. 6. Develop applications that are mobile-device specific and demonstrate current Practice in mobile computing contexts		
Text Books:		
1) Mobile Computing, 2nd edition, Raj kamal, Oxford,2011 2) Mobile Computing, Technology Applications and Service Creation, 2nd Edition, Asoke K Talukder, Hasanahmed, Roopa R Yavagal, McGraw Hill,2017		
References 1) "Principles of Mobile Computing," 2nd Edition, UWE Hansmann, Lother Merk, Martin S. Nocklous, Thomas Stober, Springer.2003		

B.C.A Data Science-Semester V

Mobile Computing LAB

Credits: 1	Lab: 2 Hours	Tutorials: -
Max Marks: 50	External: 50 Marks	Internal:

Course Objectives:		

1. To understand the basic concepts of mobile computing. 2. To learn the basics of mobile telecommunication system. 3. To be familiar with the network layer protocols and Ad-Hoc networks. 4. To know the basis of transport and application layer protocols. 5. To gain knowledge about different mobile platforms and application development.		
	SYLLABUS	
1. Create "hello world" application to display "hello world" in the middle of the screen in the emulator as well as android phone. 2. Create an android app with first activity having edittext and send button. On click of send button, use explicit intent to send the text within edittext to a second activity and displayed within textview. 3. Create a calculator app that performs addition, subtraction, division and multilpication operation on numbers. 4. Create an app that uses radiobutton group which calculates discount on shopping bill amount. Use ediitext to enter bill amount and select one of three radio buttons to determine a discount for 10, 15, or 20 percent.the discount is calculated upon selection of one of the buttons and displayed in a textview control.. 5. Create an app that uses radiobutton group of all courses in your college. On selecting one of the buttons, the TIC of that course should be displayed in a textview control at the bottom of the screen.. 6. Create an app for displaying Current location in Google Map. 7. Create an app for generating Student Marks List. 8. Create an app for Login. 9. Create an application generating Electricity Bill. 10. Create an app to display 3 button controls vertically aligned. On selecting a button, the color of the screen will change.		

Outcomes:		

After completion of course, student will be able to:
1. Install and configure Android application development tools.
2. Design and develop user Interfaces for the Android platform.
3. Save state information across important operating system events.
4. Apply Java programming concepts to Android application development.

Time: 3 Hours   **Max. Marks : 75**

SECTION-A

Answer any FIVE of the following Questions: **(5 x 10= 50 Marks)**

1. ⎫
2. ⎬ UNIT-1

3. ⎫
4. ⎬ UNIT-2

5. ⎫
6. ⎬ UNIT-3

7. ⎫
8. ⎬ UNIT-4

9. ⎫
10. ⎬ UNIT-5

SECTION - B

Answer any FIVE of the following Questions   **(5 × 3 = 15 Marks)**

11. ⎫
12. ⎬ UNIT-1

13. ⎫
14. ⎬ UNIT-2

15. ⎫
16. ⎬ UNIT-3

17. ⎫
18. ⎬ UNIT-4

19. ⎫
20. ⎬ UNIT-5

SECTION - C

Answer the following Questions   **(5 × 2 = 10 Marks)**

1. UNIT-1

2. UNIT-2

3. UNIT-3

4. UNIT-4

5. UNIT-5