VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in

Computer Science

SYLLABUS

Master of Science
in
Computer Science
(I-II Semester)

With effect from the Academic Year
2024-25

Department of Studies in Computer Science

Programme: Master of Science (M.Sc.) in Computer Science
Duration: 2 Years (4 semesters)

Programme Overview:
Master of Science (M.Sc.) in Computer Science programme is designed to prepare students for a career in Industry, Government, Society and the scientific community by introducing them to a wide range of new technologies in Computer Science disciplines. The programme aims to address research, solve real-world problems, participate in interdisciplinary research and its applications.

Programme Educational Objectives (PEOs):
After 3-4 years of completion of the programme the graduates will be able to:

1. Ability to apply the basic knowledge of database systems, computing, operating system, digital circuits, microcontroller, computer organization and architecture in the design of computer based systems.
2. Ability to specify, design and develop projects, application softwares and system softwares by using the knowledge of data structures, analysis and design of algorithm, programming languages, software engineering practices and open source tools.
3. Ability to debug, verify and validate the systems using various testing methods and tools.

Program Outcomes:

1. Computer knowledge: Apply the knowledge of mathematics, science and engineering fundamentals to the solution of complex problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex problems reaching substantiated conclusions using principles of mathematics, natural sciences.
3. Design/development of solutions: Design solutions for complex 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.
4. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern IT tools to complex problems with an understanding of the limitations.
5. Environment and sustainability: Understand the impact of the professional solution in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
6. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
7. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
8. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
9. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Distribution of Courses/Papers in Postgraduate Programme as per Choice Based Credit System (CBCS) in

Computer Science

M.Sc., I - SEMESTER

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams(Hrs)
				IA	Sem. Exam	Total	L	T	P		
FIRST	DSC1	24CSC1C1L	Data Structures	30	70	100	4	-	-	4	3
	DSC2	24CSC1C2L	Object Oriented Programming using Java	30	70	100	4	-	-	4	3
	DSC3	24CSC1C3L	Computer Networks	30	70	100	4	-	-	4	3
	DSC4	24CSC1C4L	Discrete Mathematical Structures	30	70	100	4	-	-	4	3
	SEC1	24CSC1S1LP	Web Stack Technologies	20	30	50	-	1	2	2	1
	DSC1P	24CSC1C1P	Data Structures Lab	20	30	50	-	-	4	2	4
	DSC2P	24CSC1C2P	Object Oriented Programming using Java Lab	20	30	50	-	-	4	2	4
	DSC3P	24CSC1C3P	Computer Networks Lab	20	30	50	-	-	4	2	4
Total Marks for I Semester						**600**				**24**	

M.Sc. II-SEMESTER

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
SECOND	DSC5	24CSC2C5L	Relational Database Management Systems	30	70	100	4	-	-	4	3
	DSC6	24CSC2C6L	Python Programming	30	70	100	4	-	-	4	3
	DSC7	24CSC2C7L	Data Analytics	30	70	100	4	-	-	4	3
	DSC8	24CSC2C8L	Software Engineering	30	70	100	4	-	-	4	3
	SEC2	24CSC2S2LP	PHP Programming	20	30	50	-	1	2	2	2
	DSC5P	24CSC2C5P	Relational Database Management Systems Lab	20	30	50	-	-	4	2	4
	DSC6P	24CSC2C6P	Python Programming Lab	20	30	50	-	-	4	2	4
	DSC7P	24CSC2C7P	Data Analytics Lab	20	30	50	-		4	2	4
Total Marks for II Semester						**600**				**24**	

I Semester

M.Sc. Computer Science First Semester

Course: Data Structures	**Course Code:** 24CSC1C1L
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. To impart the basic concepts of data structures and algorithms
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs

Unit-I	**Teaching hours**
Introduction To Data Structure: Data Management concepts, Data types – primitive and non- primitive, Types of Data Structures- Linear & Non Linear Data Structures. Linear Data Structure Array: Representation of arrays, Applications of arrays, sparse matrix and its representation.	13
Unit-II	
Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi, Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	13
Unit-III	
Nonlinear Data Structure : Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, Postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees- Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph-Matrix Representation Of Graphs, Elementary Graph operations (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree).	13
Unit-IV	
SORTING and SEARCHING Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Sorting on Several Keys, List and Table Sort, Linear Search, Binary Search. Hashing And File Structures : Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques	13

Reference Books:

1. An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. SorensonPublisher-Tata McGraw Hill 2nd Edition 2017.
2. Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International 2nd Edition 2018.
3. S. Lipschutz, “Data Structures”, Tata McGraw Hill Education, 1st Edition, 2008.
4. D. Samanta, “Classic Data Structures”, PHI Learning, 2nd Edition,2004.
5. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub. 2001 2nd edition.

6. Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher-Thomson Learning2014 2nd edition.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Implements basic data structures such as stacks, queues and trees.
2	Apply algorithms and data structures in various real-life software problems.
3	Develop skills in implementations and applications of data structures.
4	Discuss the computational efficiency of the principal algorithms for sorting, searching.

Course: Object Oriented Programming using Java	**Course Code:** 24CSC1C2L
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. To impart the basic concepts of Java
2. To understand concepts about classes, Objects and methods
3. To understand basic concepts about Polymorphism, Abstract classes and interfaces

Unit-I	**Teaching hours**
Introduction to Java programming, The Java Virtual Machine, Variables and data types, Bit manipulation Conditional and looping constructs, Arrays, 2D Array, Object-oriented programming with Java Classes and Objects Fields and Methods, Constructors, Overloading methods, Garbage collection, Nested classes.	13
Unit-II	
Inheritance, Overriding methods, Polymorphism. Making methods and classes final, Abstract classes and methods, Interfaces. Exception handling with try-throw-catch-finally constructs	13
Unit-III	
The Exception class Packages, Package access, Documentation comments. The Object class, Cloning objects, The JDK Linked List class, Strings, String builders, String conversions Working with types: Wrapper classes, Enumeration interface.	13
Unit-IV	
Applets, Configuring applets, Applet capabilities and restrictions, Basics of AWT and Swing, Layout Managers, Event Handling, The Action Listener interface, Panels, Classes for various controls, such as label, choice, list, , Checkbox, etc., Dialogs and frames, Using menus, Using the adapter classes, Graphics.	13

References:

1. Herbet Schildt and Dale Skrien, Java Fundamentals - A comprehensive Introduction, 2017, McGrawHill Education.
2. P.J. Deitel and H.M. Deitel, Java for Programmers, 9th edition, Pearsoneducation
3. P.J. Deitel and H.M. Deitel, Java: How to Program, 2nd edition, PHI.

Course Outcomes (CO): After completion of this course student will be able to

CO	Statement
1	Understand Java based software code of medium to high complexity
2	Identify classes, objects, members of a class and the relationships among them neededfor a specific problem.
3	Explain and write input – output programming in java and applications using Applets.
4	Apply the Java programming concepts and develop the applications with graphical user interface.

Course: Computer Networks	**Course Code:** 24CSC1C3L
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Build an understanding of the fundamental concepts of data communication and computer networking.
2. Understand how errors detected and corrected that occur in transmission
3. Know about routing mechanisms and different routing protocols
4. Understand transport layer functions

UNIT 1	**Teaching Hours**
Introduction to Computer Networks: Basics of Computer Networks - Problems associated with computer networks: Communication problems, Identification problems, and Connection problems – Network protocol basics – Service identification – MAC Address - IPv4 Addressing System, Subnetting and Super netting, IPv6 Addressing System - Network requirements: Network interface card (NIC), Media, and Networking devices – Hub, Switch, and Routers.	**13 Hours**
UNIT 2	
Network Topologies and Network Architectures: Network Topologies – Bus, Star, Ring, Mesh – Network Architectures – Client/Server Architecture, Peer-To-Peer Architecture - Open System Interconnect (OSI) Reference Model - TCP/IP Model - TCP Operation - UDP Operation – Flow Control – Congestion Control.	**13 Hours**
UNIT 3	
Local Area Networks: LAN components – Packet Switching and Forwarding – LAN Technologies - Ethernet, Token Bus, Token Ring, Wireless LAN – Multiple Access Protocols – Error-Detection and Correction Techniques. Wide Area Networks: WAN Components – WAN Technologies - WAN Encapsulation	**13 Hours**
UNIT 4	
Routing: Static Routing and Dynamic Routing - Routed Protocols (IP and IPX) - Routing Protocols. Protocols: Address Resolution Protocol (ARP) Protocol - Dynamic Host Configuration Protocol (DHCP)- Domain Name System (DNS) – Internet Protocol (IP) – Internet Control Message Protocol (ICMP) - Hypertext Transfer Protocol (HTTP) - File Transfer Protocol (FTP) - Simple Mail Transfer Protocol (SMTP), Remote Administration Protocols: Telnet and Secure Shell (SSH).	**13 Hours**

References:

1. Behrouz A. Forouzan Data Communications and Networking, , McGrawHill, 5th Edition,2017
2. James F Kurose and Keith W Ross Computer Networking, A Top-Down Approach, PearsonEducation, 6th Edition, 2017.
3. Larry L Peterson and Brusce S Davie, Computer Networks, ELSEVIER, 6th Edition, 2020.
4. Andrew S Tanenbaum, Computer Networks, Pearson Education, 5th Edition

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Apply the knowledge of Packet switching concepts in computer networking
2	Identify different categories of IP addresses and design subnets.
3	Analyze different Unicast and multicast routing mechanisms.
4	Analyze the transport-layer concepts and services -unreliable vs. reliable data transfer

Course: Discrete Mathematical Structures	**Course Code:** 21CSC1C4L
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Understand sets, propositions and conditional.
2. Apply Principles of Mathematical induction.
3. Solve Different Graph Problems.

UNIT 1	**Teaching Hours**
Sets and Logic: Sets, propositions, conditional propositions and logical equivalence, arguments and rules of inference, quantifiers, nested quantifiers. Proofs: Principles of Mathematical induction, Functions, Relations: relations, operations on relations.	**13 Hours**
UNIT 2	
Properties of relations, equivalence relations, matrices of relations, Partially ordered sets, lattices, finite Boolean algebra, functions on Boolean algebra. Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits	**13 Hours**
UNIT 3	
Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs. Trees: Terminology and characterizations of trees, spanning trees, minimal spanning trees, shortest-path algorithm	**13 Hours**
UNIT 4	
Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.	**13 Hours**

References:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 8th edition, 2021 Tata McGraw Hill.
2. Deo N., Graph theory with application to Engineering and Computer Science, Prentice Hall of India.
3. Kolman, Busby, Ross, Discrete Mathematical Structures, Pearson Education, 6th edition, 2015.
4. J.P. Tremblay and R. Manohar, Discrete Mathematical structures with applications toComputer Science, Tata McGraw Hill, 1st edition, 2017.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand sets, relations, functions and discrete structures.
2	Apply propositional logic and first order logic to solve problems.
3	Understand discrete mathematical structures.
4	Formulate and solve graph problems.

Course: Web Stack Technologies	**Course Code:** 24CSC1S1LP
Teaching Hours/Week (L-T-P): 0 - 1 - 2	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. Understand the concepts of web design.
2. Understand the concepts of list and tables.
3. Using HTML, CSS in developing the website applications.

UNIT 1	**Teaching Hours**
Introduction to Web Concepts: Internet – Client/Server Model, Web browsers, web servers, MIME, URL, HTTP Introduction to HTML & XHTML5 tags, Basic syntax and structure, text markups, images, lists, tables, progress, Media tags-audio and video ,forms, frames.	**08 Hours**
UNIT 2	
Scripting Language: Introduction to scripting Language, Memory concepts, Arithmetic Decision making. Java Script Control Structures, Java Script Functions, Program units in Java Script, Functions, Scope Rules, Recursion Java Script global functions, Java Script Arrays, Date object, DOM	**09 Hours**
UNIT 3	
Introduction to CSS: Inline Styles, Creating Style Sheets with the style element, conflicting Styles, Linking External Style Sheets, Positioning Elements, Backgrounds, Element Dimensions, and the CSS Box Model, User Style Sheets.	**09 Hours**

References:

1. DT Editorial Services HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2nd Edition 2016 Dreamtech Press.
2. Frank Zammetti Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker 1st Edition 2020 APRES
3. Chris Bates Web Programming 3rd Edition 2007 Wiley Publications
4. Kogent Learning Solutions Inc HTML5 Black Book 2nd Edition Dreamtech
5. Chris Northwood The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer 1st edition 2018 Apress Publications
6. Laura Lemay, Rafe Colburn & Jennifer Kyrnin Mastering HTML, CSS & Javascript Web Publishing 1st Edition 2016 BPB Publications

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Create Small Web Page using different tags of HTML & also using XHTML.
2	Create Dynamic Web Pages using Java Script and CSS.
3	Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in common web implementations.

Course: Web Technologies Lab	**Course Code: 24CSC1S1LP**
Teaching Hours/Week (L-T-P): 0 - 1 - 2	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. Students will be able to Make own Web page and how to host own web site on internet.
2. Students will also learn about the protocols involved in internet technology.

Practical List:

1. Design a static web portal using HTML5 semantic elements, style using CSS
2. Design a web page to demonstrate, customization of Bootstrap classes using CSS
3. Develop an event countdown timer using HTML5, CSS/Bootstrap and JavaScript
4. Design a JS program to show the stack implementation using Arrays
5. Write a JS program to demonstrate any 4 methods of a. String object b. Date object c. Number Object
6. Write a JS program to illustrate the following concepts considering appropriate scenario a. Different ways of creating objects and nested objects b. Different kinds of DOM events

Course: Data Structure Lab	**Course Code:** 24CSC1C1P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives: At the end of this lab session,

1. The student will be able to design and analyze the time and space efficiency of the data structure ·
2. Be capable to identity the appropriate data structure for given problem ·
3. Have practical knowledge on the applications of data structures

Practical List:

1. Program to find factorial of a given number using recursion function.
2. Design, develop and implement a menu driver program in c for the following array operations.
   a) creating array of N integers elements, b) display of array element with suitable headings, c) inserting an element at a given valid position, d) deleting a element at a givenvalid position, e) exit
3. Program to demonstrate use of sequential search.
4. Program to demonstrate use of binary search.
5. Program to search for a student information using rollno as a key.
6. Program to implement singly linked list perform Search, Insert and Delete operation using dynamic memory allocation.
7. Program to implement doubly linked list perform Search, Insert and Delete operation using dynamic memory allocation.
8. Program to implement stack using array implementation.
9. Program to implement stack using linked list, using dynamic memory allocation.
10. Reverse a string using dynamic memory allocation.
11. Program to convert infix to postfix expression using stack, using dynamic memory allocation.
12. Program to evaluation of postfix expression using stack dynamic memory allocation.
13. Program to implement queue to perform enqueue and dequeue operations using dynamic memory allocation.
14. Program to implement queue to perform enqueue and dequeue expression using array operation.
15. Program to implement Double Ended Queue.
16. Program to implement priority queue.
17. Program to implement Tower of Hanoi using recursion.
18. Program to implement Fibonacci series using recursion.
19. Program to implement binary tree traversal.
20. Program to implement Hash Table with open addressing.

Course: Java Programming Lab	**Course Code:** 24CSC1C2P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. To impart hands on experience with java programming
2. To write programs for solving real world problems using java
3. To write multithreaded programs
4. To write programs on applets and servlets.

Practical List:

1. Classes and Objects:

a. Write a program in java with class Rectangle with the data fields width, length, area and color. The length, width, area are of double type and color is string type. The methods are set_length(), set_width(), set_color and find_area(). Create two objects of Rectangle and compare their area and color. If area and color both are same for the objects then display "Matching rectangles" otherwise display "Non matching rectangles".

b. Write a java program to overload constructor and method.

2. Inheritance and Polymorphism:

a. Write a program in java to create player class. Inherit the classes Cricket_player, Football_Player and Hockey_player from Player class.

b. Consider the trunk calls of a telephone exchange. A trunk call can be ordinary, urgent or lightning. The charges depend on the duration and type of the call. Write a program using the concept of polymorphism to calculate the charges.

3. String Operations:

a. Write a Java program to perform String operations.

b. Write a Java program to check whether the given string is Anagram or not.

4. Package and Interface:

a. Write a program to make a package Balance in which has account class with display_balance method in it. Import balance package in another program to access Display_balance method of account class.

b. Create the dynamic stack by implementing the interfaces that defines Push() and Pop() methods.

5. Exception Handling:

a. On a single track two vehicles are running. As vehicles are going on same direction there is no problem. If the vehicles are running in different direction there is a chance of collision. To avoid collision write a java program using Exception handling.

6. Multithreading:

a. Write a program in java to create five java threads with different priorities. Send two

threads of higher priority to sleep state. Check the aliveness of the threads and mark which thread is long lasting.

b. Write a Multi_threaded java program to implement producer-consumer problem.

7. Applets and Event handling:

a. Write a Java Program to create an applet to handle all mouse events.

b. Design an applet which uses Card Layout with 3 Buttons. When the user clicks on any button, the background color must be change.

8. Servlets:

a. Write a Servlet program to accept username, address and display them in a web page by passing parameters.

b. Write a Program to request server information viz Request Method, URL, Protocol and remote address.

Course: Computer Networking Lab	**Course Code:** 24CSC1C3P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. To get practical knowledge of working principles of various communication protocols
2. Analyze structure and formats of TCP/IP layer protocols using network tools

Practical List:

1. Write a program to display IP Address and the name of the computer that you are currently working on.
2. Write a program to print the IP Address of "www.vskub.ac.in" in all IP Address of it.
3. Write a program to print all network interfaces of "local host".
4. Write a program to check if IP Address is IPV4 or IPV6 Address.
5. Write a program to implement the Simple Version of "nslookup" utility.
6. Write a program to display all parts of URL.
7. Write a Program to list all ports hosting a TCP Server in a Specified host..
8. Write a Program to Display Server's data and time details at the client end server.
9. Implement an FTP server using socket programming.
10. Implement a chat server using socket programming.
11. Write a Java program to check whether the given DNS is found in the internet or not.

II Semester

II Semester

Distribution of Courses/Papers in Postgraduate Programme II Semester as per Choice Based Credit System (CBCS) Proposed for PG Programs

With Practical

Semester No.	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
SECOND	DSC5	24CSC2C5L	Relational Database Management Systems	30	70	100	4	-	-	4	3
	DSC6	24CSC2C6L	Python Programming	30	70	100	4	-	-	4	3
	DSC7	24CSC2C7L	Data Analytics	30	70	100	4	-	-	4	3
	DSC8	24CSC2C8L	Software Engineering	30	70	100	4	-	-	4	3
	SEC2	24CSC2S2LP	PHP Programming	20	30	50	-	1	2	2	1
	DSC5P	24CSC2C5P	Relational Database Management Systems Lab	20	30	50	-	-	4	2	4
	DSC6P	24CSC2C6P	Python Programming Lab	20	30	50	-	-	4	2	4
	DSC7P	24CSC2C7P	Data Analytics Lab	20	30	50	-		4	2	4
Total Marks for II Semester						**600**				**24**	

Dept Name: Dept. of Studies in Computer Science
Semester-II
DSC5: Relational Database Management Systems

Course Title: Relational Database Management Systems	Course code: 24CSC2C5L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 hrs.
Summative Assessment Marks: 70	

Course Outcomes (CO's):

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

CO	Statement
1	Understand the significance of databases, types of databases, merits and limitations of different DBMS.
2	Explain and apply the concept of normalization for database design
3	Understand and apply concurrency control and transaction processing mechanisms.
4	Learn the characteristics implementation of object oriented and distributed database management systems and their architecture.
5	Understand the design techniques used in RDBMS, extension techniques in RDBMS, standards for OODBMS, products and applications.

Unit	Description	Hours
1	Introduction and data models: Problem with File-based systems. Introduction to Database and Database Management systems, objectives of database management, Overview of DBMS, Database administrator, Database Designers, End users. The three-level architecture, components of DBMS, advantages and disadvantages of DBMS. Data associations, data model classification, Entity-Relationship model. Different types of keys (Primary key, Secondary key, Candidate key, Foreign key and Alternate key).	13
2	The Relational Model: Relational database, relational algebra, relational calculus SQL- Data definition, relational database manipulation using SQL, DDL, DML, DCL, TCL, DQL, views, embedded data manipulation. Relational Database Design: Anomalies in a database, functional dependency.	13
3	Normalization – 1NF, 2NF, 3NF, BCNF and 4NF. Limitations of 4NF and BCNF. Files, indexing and transaction management: File organization and storage, secondary storage devices, RAID technology, operations in file, heap files and sorted files, hashing techniques, B-trees and B+ trees.	13
4	Recovery management and concurrency control: Schedules and recoverability, serializability of schedules concurrency control, locking techniques, time stamp ordering multi version concurrency control, granularity of data items. Database recovery techniques, ARIES recovery algorithm.	13

References:

1. Elmasri and Navathe, Fundamentals of Database Systems, AddisonWesley, 5th edition, 2018.
2. Bipin C Desai, An Introduction to Database Systems, Galgotia Publications, 2012.
3. Silberschatz A, Korth H.F and Sudarshan S, Database System Concepts, Tata McGraw Hill
4. S K Singh, Database Systems-Concepts, Design and Applications, Pearson Education.
5. Date, C. J., An Introduction to Database Systems, Addison-Wesley.

DSC6: Python Programming

Course Title: Python Programming	Course code: 24CSC2C6L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 hrs.
Summative Assessment Marks: 70	

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

1. Explain basic principles of Python programming language
2. Implement object oriented concepts
3. Implement database and GUI applications.
4. Explain basic principles of Python programming language

Unit	Description	Hours
1	INTRODUCTION TO PYTHON PROGRAMMING: Python interpreter and interactive mode; values and types variables, expressions, statements, tuple assignment, Order of operations, comments, debugging; modules and functions: function Calls, adding new functions, Definitions and Uses, flow of execution, parameters and arguments, Fruitful functions. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, range, break, continue, pass; recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.	13
2	LISTS, TUPLES, DICTIONARIES: Lists: Traversing a List, list operations, list slices, list methods, Map, Filter and Reduce, list loop, mutability, aliasing, cloning lists, list parameters; Dictionaries: operations and methods; advanced list processing - list comprehension; Tuples: tuple assignment, tuple as return value.	13
3	FILES, MODULES, PACKAGES: Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages: PANDAS, NUMPY, SCIKIT-LEARN	13
4	CLASSES AND OBJECTS: Introduction, Defining Classes, Creating Objects, Data Abstraction and Hiding through Classes, Class method and self argument, Class Constructor (init() Method), Data Members, Calling a Class Method from another Class Method, Class Methods and Static Methods, Inheritance, Types of Inheritance, Abstract Classes and Interfaces, Operator Overloading, Overriding Methods.	13

References:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, Introduction to Computation and Programming Using Python,

Revised and expanded Edition, MIT Press , 2013.

4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter- disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

DSC7: Data Analytics

Course Title: Data Analytics	Course code: 24CSC2C7L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (CO's):

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

1. A brief methodological description and some descriptive statistics of data.
2. Concerning data quality issues.
3. Converting data to different scales or scale types and reducing data dimensionality.
4. Understand the concept of Clustering and Classification techniques.

Unit	Description	Hours
1	**Introductory:** Introduction to Data, Big Data and Data Science, Big Data Architectures, Small Data, What is Data? A Short Taxonomy of Data Analytics, Examples of Data Use, A Project on Data Analytics, KDD Process, CRISP-DM Methodology. Descriptive Statistics: Scale Types, Descriptive Univariate Analysis, Descriptive Bivariate Analysis.	**13 Hours**
2	**Multivariate Analysis:** Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics, Infographics and Word Clouds. **Data Quality and Preprocessing:** Data Quality, Missing Values, Redundant Data, Inconsistent Data, Noisy Data, Outliers, Converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction., Principal Component Analysis.	**13 Hours**
3	**Clustering:** Distance Measures, Clustering Validation, Clustering Techniques, K-means, Centroid and Distance Measures, DBSCAN, Agglomerative Hierarchical Clustering. **Frequent Pattern Mining:** Frequent Itemsets, Apriori, Association Rules, Behind Support and Confidence, Other Types of Pattern.	**13 Hours**
4	**Regression:** Predictive Performance Estimation, Finding the Parameters of the Model, Technique and Model Selection. **Classification:** Binary Classification, Predictive Performance Measures for Classification, Distance-based Learning Algorithms (K-nearesr Neighbor Algorithm), Probabilistic Classification Algorithms (Naïve Bayes Algorithm).	**13 Hours**

References:

1. A General Introduction to Data Analytics, Joao Mendes Moreira, Andre C P L F de Carvallo, Tomas Horvath, Wiley, 2019.
2. Anil Maheshwari, "Data Analytics", 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180.
3. Data Analytics: Principles, Tools, and Practices by Dr. Gaurav Aroraa, Chitra Lele, Dr. Munish Jindal.

DSC8: Software Engineering

Course Title: Software Engineering	Course code: 24CSC2C8L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 hrs.
Summative Assessment Marks: 70	

Course Outcomes (CO's):

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

1. Analyze the process model chosen for the development of software and its merits and demerits
2. Identify the clear, correct and consistent requirements for the project
3. Design suitable data, architecture and user interface that copes with the requirements
4. Estimate the cyclomatic complexity and design the corresponding test cases.
5. Conduct various integration testing approaches and note down pit falls in requirements, design

Unit	Description	Hours
1	THE NATURE OF SOFTWARE: The Nature of Software, The Changing Nature of Software SOFTWARE ENGINEERING: Defining the Discipline, The Software Process, Software Engineering Practice, Software Development Myths. THE SOFTWARE PROCESS STRUCTURE: A Generic Process Model, Defining a Framework Activity, Identifying a Task set, Process Patterns	13
2	AGILE DEVELOPMENT: What is Agility, Agility and the Cost of Change, What is an Agile Process, Extreme Programming, Scrum. UNDERSTANDING REQUIREMENTS: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Analysis Model, Negotiating Requirements and Validating Requirements.	13
3	REQUIREMENTS MODELING: SCENARIOS and CLASS BASED METHODs: Requirements Analysis, Scenario-Based Modeling, Identifying Analysis Classes, Specifying Attributes, Defining Operations, Class Responsibility-Collaborator Modeling, Association and Dependencies. DESIGN CONCEPTS: Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model. USER INTERFACE DESIGN: The Golden Rules, User interface Analysis and Design.	13
4	SOFTWARE TESTING STRATEGIES: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object Oriented Software, Validation Testing, System Testing and The Art of Debugging. TESTING CONVENTIONAL APPLICATIONS: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing and Black-Box Testing.	13

References:

1. Roger S Pressman Software Engineering - A Practitioner's Approach, 8th Edition, TMH publication, 2014.
2. Ian Sommerville Software Engineering, Pearson Education limited, 8th Edition 2007.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publications, 3rd Edition 2005.
4. Rajib Mall Fundamentals of Software Engineering, PHI India Publications. 5th Edition, 2018.

SEC 2: PHP Programming

Course Title: PHP Programming	Course code: 24CSC2S2LP
Total Contact Hours: 0 - 1 - 2	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 01 hr.
Summative Assessment Marks: 30	

Course Outcomes (COs):

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

1. Define and understand the basic concepts of PHP.
2. Apply PHP to improve accessibility of a web document.
3. Implement responsive web Sites using PHP by connecting to the My-SQL database

Unit	Description	Hours
1	Introduction to PHP: PHP Intro, PHP Install, PHP Syntax, PHP Variables, PHP Echo / Print, PHP Data Types, PHP Strings, PHP Constants, PHP Operators	08
2	Html Form with PHP: PHP Form Handling, PHP Form Validation, PHP Form Required, PHP Form URL/E-mail, PHP Form Complete. Decisions and Loop: Making Decisions, Doing Repetitive task with looping Mixing Decisions and looping with Html	08
3	PHP If, Else and Elseif, PHP Switch, PHP While Loops, PHP For Loops Database connectivity: Database Operations with PHP, Connecting to My-SQL (or any other database), Selecting a db, Building & Sending Query, Retrieving, Updating	10

References (indicative)

1. The Joy of PHP Programming, Fifth Edition, Alan Forbes, Plum Island
2. Programming the World Wide Web – Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
3. Internet & World Wide Web How to Program – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
4. Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley India, 2006
5. The Web Warrior Guide to Web Programming – Xue Bai et al, Thomson, 2003
6. https://www.tutorialspoint.com/restful/index.html (REST Web Services topics are referred to this link)
7. https://www.w3schools.com/php/php_forms.asp

DSC5P: Relational Database Management Systems Lab

Course Title: Relational Database Management Systems Lab	Course code: 24CSC2C5P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 04 hrs.
Summative Assessment Marks: 30	

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

1. Design database schema for a given application and apply normalization
2. Acquire skills in using SQL commands for data definition and data manipulation.
3. Develop solutions for database applications using procedures and triggers.

DBMS Laboratory

A. Consider the following schema for a Library Database:

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

Write SQL queries to
1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch,etc.

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

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

4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.

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

B. Consider the following schema for Order Database:

SALESMAN (Salesman_id, Name, City, Commission)
CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)

Write SQL queries to
1. Count the customers with grades above Bangalore's average.

2. Find the name and numbers of all salesmen who had more than one customer.

3. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)

4. Create a view that finds the salesman who has the customer with the highest order of a day.

5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

C. Consider the schema for Movie Database:

ACTOR (Act_id, Act_Name, Act_Gender)
DIRECTOR (Dir_id, Dir_Name, Dir_Phone)
MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST (Act_id, Mov_id, Role)
RATING (Mov_id, Rev_Stars)

Write SQL queries to
1. List the titles of all movies directed by 'Hitchcock'.

2. Find the movie names where one or more actors acted in two or mor emovies.

3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).

4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.

5. Update rating of all movies directed by 'Steven Spielberg' to 5.

D. Consider the schema for College Database:

STUDENT (USN, SName, Address, Phone, Gender)
SEMSEC (SSID, Sem, Sec)
CLASS (USN, SSID)
SUBJECT (Subcode, Title, Sem, Credits)
IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to
1. List all the student details studying in fourth semester 'C' section.

2. Compute the total number of male and female students in each semester and in each section.

3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects.

4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.

5. Categorize students based on the following criterion: If

Final IA = 17 to 20 then CAT ='Outstanding'

If Final IA = 12 to 16 then CAT = ‘Average’ If

Final IA< 12 then CAT = ‘Weak’

Give these details only for 8th semester A, B, and C section students.

E. Consider the schema for Company Database:

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

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

2. Show the resulting salaries if every employee working on the ‘IoT’ project is given a 10 percent raise.

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

4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).

5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

DSC6P: Python Programming Lab

Course Title: Python Programming Lab	Course code: 24CSC2C6P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 04 hrs.
Summative Assessment Marks: 30	

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

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries

Python Laboratory

1. Compute the GCD of two numbers.
2. Find the square root of a number.
3. Exponentiation (power of a number).
4. Find the maximum of a list of numbers.
5. Linear search and Binary search.
6. Selection sort, Insertion sort.
7. Program to create, slice, change, delete and index elements using Tuple.
8. Find first n prime numbers.
9. Program to create, slice, change, add, delete and index elements using list.
10. Program that take command line arguments (word count).
11. Write a program to reverse the string.
12. Program to change, delete, add and remove elements in Dictionary.
13. Find the most frequent words in a text read from a file.
14. Simulate elliptical orbits in Pygame.
15. Simulate bouncing ball using Pygame.

DSC7P: Data Analytics Lab

Course Title: Data Analytics Lab	Course code: 24CSC2C7P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 04 hrs.
Summative Assessment Marks: 30	

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

1. Demonstrate proficiency in creating and manipulating data structures using pandas, including DataFrames created from dictionaries and lists.
2. Ability to visualize data effectively using libraries such as Matplotlib and Seaborn
3. Create various types of plots, including histograms, pie charts, scatter plots, and count plots, to interpret and present data insights clearly.
4. Understand importing, cleaning, and preprocessing real-world datasets (e.g., CSV files)
5. Students will learn to compute and interpret key statistical metrics.

1.	Do the following analysis by creating dataframe using pandas. a. Create a dataframe using the dictionary data Structure. b. Calculate the statistics of the dataset created. c. Create another dataframe using the list method. d. Calculate the max, min, average of the price column.
2.	Do the following analysis by creating a dataframe using pandas. a. Create a dataset with columns 'Contact','Max temp (∘C)','Weight (kg)','Height (cm)','Gender','Company' with 10 rows b. Calculate absolute frequency for the given dataset c. Calculate relative frequency for the column in given dataset d. Draw histogram for the gender column e. Draw pie chart for the gender column
3.	Do The Following Analysis on The DataSet(“Lab1.csv”) a. Import The DataSet b. Display The Properties Of The DataSet c. Find The Max,Min,Medium Values For Particular Column d. Draw a Histogram For The Particular Column
4.	Do the following analysis on (“lab2.csv”) a. Import dataset " lab2.csv " into Jupyter notebook b. Print the data with the null values c. Replace null values with NaN d. Find the max, min, median values for particular Column. f. Draw the scatter plot for total_sqft and price
5.	Do the following analysis on (“lab3.csv”) a. Import the dataset b. Describe the strategy of the dataset c. Display the information about dataset d. Draw a Scatter graph between petal length and petal width e. Draw histogram for sepal length
6.	Do The Following Analysis on The DataSet (Lab4.CSV) a. Load the dataset b. Display the information of datasets

	c. Drop the columns id, description d. Sort the dataset according to imdb_score e. Delete the NAN values from dataset f. Draw a scatter plot for the movies and its release year
7.	Do the following Analysis on the DataSet("Lab5.csv") a. Import the dataset b. Display the column names of the dataset c. Sort the dataset according to gender d. Display the statistics of the dataset e. Draw the histogram for male or female having anxiety
8.	Do the following Analysis on the DataSet("Lab6.csv") a. Import the dataset b. Change the names of the Dataset Columns c. Describe the data in dataset d. Calculate the max, min, average BMI from the given dataset e. Draw a distribution plot for cfunction
9.	Do the following Analysis on the DataSet("Lab7.csv") a .Import the dataset into the jupyter notebook b. Drop the column named '0' from the dataset c. Replace the values from results column (0 as 'fail' and 1 as 'pass') d. Count the total students which are passed e. Draw a Distribution graph for the Total Column
10.	Do the following analysis on the ("lab10.csv") a. Import the dataset b. Create a histogram using seaborn for total_bill column c. Create a countplot for the sex column d. Draw a catplot for the day and the total_bill columns e. Draw a scatter plot for the tip vs total_bill

SEC2: PHP Programming

Course Title: PHP Programming	Course code: 24CSC2S2LP
Teaching Hours/Week (L-T-P): 0 - 0 - 2	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 01 hrs.
Summative Assessment Marks: 30	

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

1. Design and develop dynamic web pages with good aesthetic sense of designing.
2. Understand the concepts of Web Application Terminologies, Internet Tools other Web services.
3. Design and develop pages using the JavaScript, XML, CSS, PHP.

PHP Programming Laboratory

1. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
2. Write a PHP program to display a digital clock which displays the current time of the server.
3. Write the PHP programs to do the following:
   a) Implement simple calculator operations.
   b) Find the transpose of a matrix.
   c) Multiplication of two matrices.
   d) Addition of two matrices.
4. Write a PHP program to sort the student records which are stored in the database using selection sort.

CBCS Question Paper Pattern for PG Semester End Examination with Effect from the AY 2024-25

Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

Paper Code: **Paper Title:**
Time: 3 Hours **Max. Marks: 70**

Part A:
Answer any ten questions. Each question carries 2 marks. **2x10=20**

1. a)
b)
c)
d)
e)
f)
g)
h)
i)
j)
k)
l)

Part B:
Answer any five of the following questions. **10x5=50**

2.
3.
4.
5.
6.
7.
8.

Note: Question No. 2 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…

Q6. 10Marks
Note: Question No.6, *shall be from Unit I and II,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q7. 10 Marks
Note: Question No.7*, shall be from Unit III and IV*, the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q8. 10 Marks
Note: Question No-8 shall be from *any of the unit*, the Question may be a whole or it may consists of sub questions such as a,b, c etc…

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Skill Enhancement Courses (SECs)

Paper Code: **Paper Title:**

Time: 1 Hours **Max. Marks: 30**

There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

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Scheme for Practical Examination (PG)

1.	**Writing Program**	**: 05 Marks**
2.	**Program Execution**	**: 20 Marks**
3.	**Viva Voce**	**: 05 Marks**
		Total : 30 Marks

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AGARA SRI KRISHNADEVARA

JNANASAGARA CAMPUS, BA

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its Structure under Choice

[CBCS]

Syllabus of III & IV

Master of Sci

in

Department of Studies in Computer Science

Programme: Master of Science (M.Sc.) in Computer Science
Duration: 2 Years (4 semesters)

Programme Overview:
Master of Science (M.Sc.) in Computer Science programme is designed to prepare students for a career in Industry, Government, Society and the scientific community by introducing them to a wide range of new technologies in Computer Science disciplines. The programme aims to address research, solve real-world problems, participate in interdisciplinary research and its applications.

Programme Educational Objectives (PEOs):
After 3-4 years of completion of the programme the graduates will be able to:

1. Ability to apply the basic knowledge of database systems, computing, operating system, digital circuits, microcontroller, computer organization and architecture in the design of computer based systems.
2. Ability to specify, design and develop projects, application softwares and system softwares by using the knowledge of data structures, analysis and design of algorithm, programming languages, software engineering practices and open source tools.
3. Ability to debug, verify and validate the systems using various testing methods and tools.

Program Outcomes:

1. Computer knowledge: Apply the knowledge of mathematics, science and engineering fundamentals to the solution of complex problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex problems reaching substantiated conclusions using principles of mathematics, natural sciences.
3. Design/development of solutions: Design solutions for complex 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.
4. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern IT tools to complex problems with an understanding of the limitations.
5. Environment and sustainability: Understand the impact of the professional solution in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
6. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
7. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
8. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
9. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Department of Studies in Computer Science

JnanaSagara, Ballari - 583105

Distribution of Courses/Papers in Postgraduate Programme MSC III as per Choice Based Credit System (CBCS)

Semester No.	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
Third	DSC9	24CSC3C9L	R-Programming	30	70	100	4	-	-	4	3
	DSC10	24CSC3C10L	Data Mining	30	70	100	4	-	-	4	3
	DSE1	24CSC3E1AL	Digital Image Processing	30	70	100	4	-	-	4	3
		24CSC3E1BL	Cryptographic and Network Security	30	70	100	4	-	-	4	3
		24CSC3E1CL	AI Driven Cyber Security	30	70	100	4	-	-	4	3
	DSE2	24CSC3E2AL	A. Cloud Computing	30	70	100	4	-	-	4	3
		24CSC3E2BL	B. Social Network Analysis	30	70	100	4	-	-	4	3
		24CSC3E2CL	C. Software Testing	30	70	100	4	-	-	4	3
	GEC1	24CSC3G1AL	Computer Networks and Internet Technologies	20	30	50	1	1	-	2	1
		24CSC3G1BL	Web Designing								
		24CSC3G1CL	Introduction To C Programming								
	SEC3	24CSC3S3LP	Research Methodology	20	30	50	1	-	2	2	1
	DSC9P	24CSC3C9P	R- Programming Lab	20	30	50	-	-	4	2	4
	DSC10P	24CSC3C10P	Data Mining Lab	20	30	50	-	-	4	2	4
						600				**24**	

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Department of Studies in Computer Science

JnanaSagara, Ballari - 583105

Distribution of Courses/Papers in Postgraduate Programme MSC IV as per Choice Based Credit System (CBCS)

Semester No.	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
Fourth	DSC12	24CSC4C12L	Data Science with python	30	70	100	4	-	-	4	3
	DSC13	24CSC4C13L	Distributed Storage Management	30	70	100	4	-	-	4	3
	DSE3	24CSC4E3AL	Social Network Analysis	30	70	100	4	-	-	4	3
		24CSC4E3BL	Soft Computing	30	70	100	4	-	-	4	3
		24CSC4E3CL	Pattern Recognition	30	70	100	4	-	-	4	3
	DSE4	24CSC4E4AL	A. Digital Image Processing	30	70	100	4	-	-	4	3
		24CSC4E4BL	B. Natural Language Processing	30	70	100	4	-	-	4	3
		24CSC4E4CL	C. Deep Learning	30	70	100	4	-	-	4	3
	GEC1	24CSC4G2AL	Multimedia and Animation	20	30	50	2	-	-	2	1
		24CSC4G2BL	Cyber Security								
		24CSC4G2CL	R-Programming								
	DSC12P	24CSC4C12P	Data Science Lab	20	30	50	-	-	4	2	4
	DSC13P	24CSC4C1R	Major Project	30	70	100	-	-	8	4	4
						600				**24**	

III Semester

M.Sc. Computer Science Third Semester

Course: R-Programming	**Course Code:** 24CSC3C9L
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Learn Fundamentals of R.
2. Covers how to use different functions in R, how to read data into R, accessing R packages, writing R functions, debugging, and organizing data using R functions.
3. The whole syllabus will give an idea to collect, compile and visualize data using statistical functions.

Unit-I	**Teaching hours**
Introduction to R:What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), packageDescription(), help(), find.package(), library() - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and –inf.	13
Unit-II	
R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame – R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables - R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if – else if statement, switch statement – R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.	13
Unit-III	
R-Function : function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values - R-Strings – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower().R Vectors – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting.	13
Unit-IV	
Descriptive Statistics: Data Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median – Mode. R –Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – Bar Charts: Bar Chart Labels, Title and Colors.	13

Reference Books:

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN : 978-93-5260-455-5.
2. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.
3. Tutorials Point (I) simply easy learning, Online Tutorial Library (2018), R Programming,

Retrieved from https://www.tutorialspoint.com/r/r_tutorial.pdf.
4. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015, ISBN: 978-1-119-05580-8

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand the basics of Fundamentals of R.
2	Understands the loading, retrieval techniques of data
3	Understand how data is analysed and visualized using statistic functions.

course: Data Mining	**Course Code:** 24CSC3C10L
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Perform the preprocessing of data and apply mining techniques on it.
2. Use data analysis tools for scientific applications.
3. Implement various supervised machine learning algorithms.

UNIT 1	**Teaching Hours**
Introduction to data mining (DM): Motivation for Data Mining - Data MiningDefinition and Functionalities — Classification of DM Systems - DM task primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM — KDD Process.	**13 Hours**
UNIT 2	
Data Pre-processing: Data summarization, data cleaning, data integration and transformation, data reduction, data discretization and concept hierarchy generation, feature extraction, feature transformation, feature selection, introduction to Dimensionality Reduction, CUR decomposition.	**13 Hours**
UNIT 3	
Concept Description, Mining Frequent Patterns, Associations and Correlations: What is concept description? - Data Generalization and summarization-based characterization - Attribute relevance - class comparisons, Basic concept, efficient and scalable frequent item-set mining methods, mining various kind of association rules, from association mining to correlation analysis, Advanced Association Rule Techniques, Measuring the Quality of Rules.	**13 Hours**
UNIT 4	
Classification and Prediction: Classification vs. prediction, Issues regarding classification and prediction, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree- Based Algorithms. Cluster Analysis: Clustering: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering -K-Means Algorithm, K- Means Additional issues, PAM Algorithm;	**13 Hours**

References:

1. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann
2. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley & Sons 3. Inc.
3. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand how to apply classification, clustering, and association rule mining.
2	Understand how to cleaning, transformation, and reduction.
3	Understand how to discover patterns and correlations for decision-making.

Course: Digital Image Processing	**Course Code:** 24CSC3E1AL
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Explain fundamentals of image processing.
2. Compare transformation algorithms.
3. Contrast enhancement, segmentation and compression techniques.

UNIT 1	**Teaching Hours**
Introduction: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.	**13 Hours**
UNIT 2	
Image Enhancement In The Spatial Domain : Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	**13 Hours**
UNIT 3	
Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.	**13 Hours**
UNIT 4	
Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.	**13 Hours**

References:

1. Milan Sonka, "Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India
3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Learn fundamental concepts, pixel relationships, and applications.
2	Apply spatial and frequency domain techniques for image improvement.
3	Implement edge detection, region-based segmentation, and thresholding methods.

Course: Cryptographic and Network Security	**Course Code:** 24CSC3E1BL
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Apply the knowledge of mathematics to perceive the foundations of Cryptography and network security and explain the security principles.
2. Design solutions for problems on classical encryption techniques and illustrate symmetric and asymmetric cryptographic algorithms.
3. Develop solutions for problems on public key cryptosystems.
4. Analyze different authentication protocols, integrity protocols and key agreement protocols.

UNIT 1	**Teaching Hours**
Computer and Network Security Concepts: Computer Security concepts, The OSI Security Architecture, Security Attacks, Services and Mechanisms, A Model of Network Security. Introduction to Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality.	**13 Hours**
UNIT 2	
Symmetric Ciphers: Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor machine, Steganography Block Cipher and The Data Encryption Standard: Traditional Block Cipher Structures, The Data Encryption Standard, DES Example, Strength of DES, Block Cipher Design principles.	**13 Hours**
UNIT 3	
Advanced Encryption Standards: Finite field Arithmetic, AES Structure, AES Transformation Functions, AES key Expansion, An AES Example, AES Implementation. BLOCK CIPHER OPERATION: Multiple Encryption and triple DES, Electronic Code Book, Cipher Block.	**13 Hours**
UNIT 4	
Asymmetric Ciphers: Public Key Cryptography and RSA: Principles of PublicKey Cryptosystems, The RSA Algorithm, Other Public Key Cryptosystems : Diffie - Hellman Key Exchange. Digital Signatures: Digital Signatures, NIST Digital Signature Algorithm.	**13 Hours**

References:

1. William Stallings, Cryptography and Network Security, Seventh Edition, Prentice Hall of India, 2017.
2. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in a Public World, Second Edition, Pearson Education Asia, 2002.
3. Atul Kahate, Cryptography and Network Security, Tata McGraw Hill, 2003.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand Security Concepts
2	Implement symmetric and asymmetric encryption methods.
3	Use AES, RSA, and digital signatures for secure communication.

Course: AI Driven Cyber Security	**Course Code:** 24CSC3E1CL
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Illustrate the understanding of Cyber Security Fundamentals.
2. Analyses the attacker motivation and the techniques used by them to break the security of the application.
3. Study the vulnerabilities in applications and networks. Analyses the possible attacks that can be built by the hackers.

UNIT 1	**Teaching Hours**
Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, classification of Cyber Crime, Social Engineering, Categories of Cyber Crime, Property Cyber Crime. CybercrimeIndian perspective/the Indian ITA 2000, Cyber Offenses: How criminals plan then.	**13 Hours**
UNIT 2	
Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses, Cybercrime: Mobile and wireless Devices	**13 Hours**
UNIT 3	
AI for Cybersecurity, The Use Cases Intend to Solve Various Cybersecurity Challenges through A Unified DL Pipeline, AI Conducts Two Reverse Engineering Tasks, Related Work, Model Architecture, Model Training Issues, Model Performance, Deployed Model, Source Code and Dataset, Remaining Issues.	**13 Hours**
UNIT 4	
AI Detects DNS Cache Poisoning Attack, The Security Problem, Raw Data Generation and Collection, Labeling DNS Sessions, Feature Extraction and Data Sample Representation, Data Set Construction, Model Architecture, Parameter Tuning, Evaluation results, Model Deployment, Remaining Issues, Code and Data Resources	**13 Hours**

References:

1. Incident Response and Computer Forensics, Kevin Mandia, Chris Prosise, Matt Pepe Tata McGraw - Hill, New Delhi, 2006
2. Software Forensics, Tata, Robert M Slade McGraw -Hill,. New Delhi ,2005
3. “Understanding Forensics in IT ” , Bernadette H Schell, Clemens Martin Cybercrime, ABC – CLIO Inc, California, 2004. NIIT Ltd,2005

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand the basic concepts of crime, crime behavior, forensic science and its linkage to crime scenario.
2	Analyze the techniques used by hackers to create frauds.
3	Determine and analyse software vulnerabilities and security solutions to reduce the risk of exploitation.
4	Apply the AI principles to solve cybersecurity challenges.

Course Title: Cloud Computing	Course code: 24CSC3E2AL
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 Hours
Summative Assessment Marks: 70	

Course Outcomes (COs):

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

1. Apply the key dimensions of Cloud Computing and characteristics.
2. Analyze and infer the benefits and drawbacks of Cloud computing.
3. Analyze and apply the various types of virtualization and capacity planning metrics to Clouds.
4. Identify the uses of different Cloud Service.

Cloud Computing

Unit	Description	Hours
1	**Defining Cloud Computing**: Cloud Types, The NIST model, The Cloud Cube Model, Deployment models, Service models, Examining the Characteristics of Cloud Computing, Paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing; Assessing the value proposition: Early adopters and new applications, the laws of cloudonomics, cloud computing obstacles, behavioral factors relating to cloud adoption, measuring cloud computing costs, specifying SLAs	**12 Hours**
2	**Understanding Cloud Architecture:** Exploring the Cloud Computing Stack, Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols; Understanding Services and Applications by Type: Defining IaaS, Defining PaaS, Defining SaaS, Defining IDaaS.	**10 Hours**
3	**Understanding Abstraction and Virtualization:** Using Virtualization Technologies, Load balancing and Virtualization, Understanding Hypervisors; Capacity Planning: Defining Baseline and Metrics, Baseline measurements, System metrics, Load testing, Resource ceilings, Server and instance types, Network Capacity, Scaling.	**10 Hours**
4	**Understanding Service Oriented Architecture:** Introducing Service Oriented Architecture, Event-driven SOA or SOA 2 0, The Enterprise Service Bus, Service catalogs, Defining SOA Communications, Business Process Execution Language, Business process modeling, Managing and Monitoring SOA, SOA management tools, SOA security, The Open Cloud Consortium, Relating SOA and Cloud Computing	**10 Hours**
5	**Understanding Cloud Security:** Securing the Cloud, the security boundary, Security service boundary, Security mapping, Securing Data, Brokered cloud storage access, Storage location and tenancy, Encryption, Auditing and compliance, Establishing Identity and Presence, Identity protocol standards, Windows Azure identity standards	**10 Hours**

References:

1. David S Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide (free e-book available)
2. Kai Hwang Geoffrey, C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufman Publishers,

Course: Social Network Analysis	**Course Code:** 24CSC3E2BL
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. To understand the components of the social network.
2. To model and visualize the social network.
3. To mine the users in the social network.
4. To understand the evolution of the social network.

UNIT 1	**Teaching Hours**
Introduction: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.	**13 Hours**
UNIT 2	
Modelling and Visualization: Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - CentralityClustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- NodeLink Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.	**13 Hours**
UNIT 3	
Mining Communities: Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks. Evolution: Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis.	**13 Hours**
UNIT 4	
A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.	**13 Hours**

References:

1. Advances in Social Network Mining and Analysis Giles Mark Smith John Yen Springer 2010.
2. Web Mining and Social Networking – Techniques and applications Guandong Xu Yanchun Zhang Lin Li Springer 1 st Edition2012.
3. Social Networks and the Semantic Web Peter Mik Springer 1 st Edition2007.
4. Applications of Social Media and Social Network Analysis Przemyslaw Kazienko, Nitesh Chawla

Springer 2015.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Work on the internal components of the social network.
2	Model and visualize the social network.
3	Analyse the behaviour of the users in the social network.
4	Predict the possible next outcome of the social network.

Course: Software Testing	**Course Code:** 24CSC3E2CL
Teaching Hours/Week (L-T-P): 4 - 0 - 0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Understand importance of testing techniques in software quality management and assurance.
2. Identify various types of software risks and its impact on different software application.
3. Create test case scenarios for different application software using various testing techniques.

UNIT 1	**Teaching Hours**
Introduction: Software Testing, Importance of testing, Roles and Responsibilities, Testing Principles, Attributes of Good Test, V-Model, Test Case Generation , SDLC Vs STLC, Software Testing Life Cycle-in detail. Types of Testing: Testing Strategies: Unit Testing, Integration Testing, System Testing, Smoke, Regression Testing, Acceptance Testing.	**13 Hours**
UNIT 2	
Non Functional Testing: Performance Test, Memory Test , Scalability Test, Compatibility Test, Security Test, Cookies Test, Session Test, Recovery Test, Installation Test, Ad-hoc Test, Risk Based Test, Compliance Test. McCall's Quality Factors, FURPS.	**13 Hours**
UNIT 3	
Software Testing Methodologies: Validation & Verification, White/Glass Box Testing, Black Box Testing, Grey Box Testing, Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Boundary Value Analysis, Equivalence Class Partition, State Based Testing, Cause Effective Graph, Decision Table, Use Case Testing, Exploratory testing and Testing Metrics, Testing GUI.	**13 Hours**
UNIT 4	
Test Cases Design: Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Execution: Execute test cases, Error/Defect Detecting and Reporting, DRE(Defect Removal Efficiency), Object ,Types of Bugs , Art of Debugging,. Debugging Approaches, Reporting the Bugs.	**13 Hours**

References:

1. Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw-Hill International Editions.
2. Ian Sommerville, Software engineering, Pearson education Asia.
3. Software Testing Techniques, 2nd edition, Boris Beizer, 1990.
4. Software Testing: Principles and Practices by Srinivasan Desikan.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Learn testing principles, types, and lifecycle processes.
2	Perform functional and non-functional testing using various methodologies.
3	Develop, execute, and debug test cases for effective defect detection.

Course: Computer Networks and Internet Technologies	**Course Code:** 24CSC3G1AL
Teaching Hours/Week (L-T-P): 1 - 1 - 0	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination: 30** Marks

Course Objectives:

1. Understand networks, internet growth, and transmission media.
2. Understand asynchronous communication and modulation.
3. Understand Network Technologies.

UNIT 1	**Teaching Hours**
Introduction: Growth of computer networking, Complexity in network system, Motivation and Tools: Resource sharing, Growth of the internet, probing the internet, interpreting the ping response, tracing a route. Transmission Media: Copper wires, glass fibers.	**10 Hours**
UNIT 2	
Communications: Introduction, the need for asynchronous communications, Half and Full duplex asynchronous communication, Long distance Communication: Sending signals across long distances, Modem hardware used for Modulations and Demodulation, spread spectrum.	**6 Hours**
UNIT 3	
Computer Networks: Definition, network types, network topology, network devices, OSI model, TCP/IP model, Local Area Network (LAN), Wide Area Network (WAN), Search Engines: Popular search engines, how to register a web site on internet, Blogs, Overview of HTML.	**10 Hours**

References:

1. Douglas E Comer, Internetworking with TCP/IP, Vol. I-Principles, Protocols, & Architecture, 3/e, PHI.
2. V. Rajaraman, Introduction to Information Technology, PHI.
3. Kolman, Busby, Ross, Discrete Mathematical Structures, Pearson Education, 6th edition, 2015
   P. K. Singh, Introduction to Computer Networks, V. K. Publications, New Delhi.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Learn network growth, transmission media, and resource sharing.
2	Study asynchronous communication, modulation, and long-distance transmission.
3	Analyze network types, topologies, OSI/TCP-IP models, and web technologies.

Course: Web Designing	**Course Code:** 24CSC3G1BL
Teaching Hours/Week (L-T-P): 1 - 1 - 0	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination: 30** Marks

Course Objectives:

1. Understand the concepts of web design.
2. Understand the concepts of list and tables.
3. Using HTML, CSS in developing the website applications.

UNIT 1	**Teaching Hours**
Introduction to WWW: Protocols and programs, secure connections, application and development tools, the web browser, What is server, choices, Logging users, dynamic IP Web Design: Web site design principles, planning the site and navigation.	**10 Hours**
UNIT 2	
Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure. Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, list, tables, borders and boxes, margins, padding lists, positioning using CSS, CSS2.	**10 Hours**
UNIT 3	
Javascript: Client side scripting, What is Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition.	**6 Hours**

References:

1. Web Technologies, Black Book, Dreamtech Press, 2018.
2. Steven Holzner, “HTML Black Book”, Dremtech press, 2000.
3. Steven Holzner, “HTML Black Book”, Dremtech press, 2000.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand Web Fundamentals.
2	Create structured websites using HTML and CSS for styling and layout.
3	Use JavaScript for dynamic web interactions and user engagement.

Course: Introduction To C Programming	**Course Code:** 24CSC3G1CL
Teaching Hours/Week (L-T-P): 1 - 1 - 0	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination: 30** Marks

Course Objectives:

1. Develop a C program.
2. Control the sequence of the program and give logical outputs.
3. Implement strings in your C program.

UNIT 1	**Teaching Hours**
Introduction to Programming Concepts: Software, Classification of Software, Algorithms and Flowcharts, Overview of C Language: History of C, Character set, C tokens, Identifiers, Keywords, structure of C program, executing a C program. Constants, variables, data types, declaration of variables	**10 Hours**
UNIT 2	
Managing Input and Output Operations: The scanf() & printf() functions for input and output operations, reading a character, writing a character, (the getchar() & putchar() functions). Control Statements: Decision making with if statement, simple if statement, the if..else statement.	**10 Hours**
UNIT 3	
Arrays: Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays, Multi Dimensional Arrays. Strings: Declaring and Initializing strings, Operations on strings. Structures, Unions, Pointers.	**6 Hours**

References:

1. Balaguruswamy, "Programming In ANSI C", 4th Edition, TMH Publications, 2007.
2. Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education, 2006.
3. Mahapatra, " Thinking In C ", PHI Publications, 1998.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Learn software concepts, algorithms, flowcharts, and C language fundamentals.
2	Use input/output functions and control statements for decision-making.
3	Apply arrays, strings, structures, unions, and pointers in C programming.

Course: Research Methodology	**Course Code:** 24CSC3S3LP
Teaching Hours/Week (L-T-P): 1 - 0 - 2	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. Understand the concepts of web design.
2. Understand the concepts of list and tables.
3. Using HTML, CSS in developing the website applications.

UNIT 1	**Teaching Hours**
Introduction to Research: Nature and importance of research- Aims, Objectives and Principles: Fundamental research vs. applied research with examples: Qualitative vs Quantitative research: Theoretical research vs. experimental research with examples: Selection of a research problem and Sources of literature – Journals, Conferences, Books. Types of sources: Literature Survey engines- Scopus, web of Science, Google Scholar, PubMed, NCBI, Scihub, etc. Science citation index: Citations, h-index, i10 index, impact factor	**08 Hours**
UNIT 2	
Methods of Data Collection: Data Collection Methods- Framing a hypothesis, designing controlled experiments, choosing the sample-size, sampling bias, importance of independent replicates, conducting an experiment, maintaining a lab-notebook to record observations: Identifying experimental errors. Case-studies on welldesigned experiments vs. poorly designed experiments. Correlations vs. Causation .Good laboratory Practices	**09 Hours**
UNIT 3	
Analysis using software tools: Descriptive Statistics: Mean, standard deviation, variance, plotting data and understanding error-bars. Curve Fitting: Correlation and Regression. Distributions: Normal Distribution, Gaussian distribution, skewed distributions. Inferential Statistics: Hypothesis testing and understanding p-value. Parametric tests: Student's t-test, ANOVA. Tests to analyse categorical data: Chi-square test.	**09 Hours**

References:

1. C.R. Kothari, Research Methodology: Methods and Techniques, II Ed. New Age International Publishers, (2009).
2. Shanthibhushan Mishra, Shashi Alok, Handbook of Research Methodology, I Ed, 2017, Educreation Publishers.
3. Introduction to Statistical methods with MATLAB (MATLAB and Simulink Training (mathworks.com).

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Learn research types, problem selection, and literature sources.
2	Understand frame hypotheses, design experiments.
3	Perform statistical analysis, hypothesis testing, and data visualization.

Course: R- Programming Lab	**Course Code:** 24CSC3C9P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. To learn statistical programming, computation, graphics, and modeling.
2. To learn Writing functions and use R in an efficient way.
3. To learn about basic types ofstatistical models.

Practical List:

1)	Write a R program to take input from the user (name and age) and display the values. Also print the version of R installation.
2)	Write a R program to get the details of the objects in memory.
3)	Write a R program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91.
4)	Write a R program to create a simple bar plot of five subjects marks.
5)	Write a R program to get the unique elements of a given string and unique numbers of vector.
6)	Write a R program to create three vectors a,b,c with 3 integers. Combine the three vectors to become a 3×3 matrix where each column represents a vector. Print the content of the matrix.
7)	Write a R program to create a 5 x 4 matrix , 3 x 3 matrix with labels and fill the matrix by rows and 2 × 2 matrix with labels and fill the matrix by columns.
8)	Write a R program to combine three arrays so that the first row of the first array is followed by
	the first row of the second array and then first row of the third array.
9)	Write a R program to create an array using four given columns, three given rows, and two given tables and display the content of the array.
10)	Write a R program to create an empty data frame.
11)	Write a R program to create a data frame from four given vectors.
12)	Write a R program to create a data frame using two given vectors and display the duplicated elements and unique rows of the said data frame.
13)	Write a R program to save the information of a data frame in a file and display the information of the file.
14)	Write a R program to create a matrix from a list of given vectors.

Course: Data Mining Lab	**Course Code:** 24CSC3C10P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Practical List:

SL No.	
1.	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data Samples. Read the training data from a .CSV file.
2.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
4.	Analyse discretization by considering data as ages and find the bin values.
5.	Write a machine learning program to print a confusion matrix.
6.	Write a program to implement Bayes classifier by considering input as fruit and calculate the entropy and gini.
7.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print correct predictions. Java/Python ML library classes can be used for this problem.
8.	Implement the non-parametric Locally Weighted Regression algorithm to fit data points.
9.	Write a program to implement Multiple Regression algorithm to print correct predictions. Python ML library classes can be used for this problem.
10.	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.

IV Semester

Course: Data Science with Python	**Course Code:**24MCA3C12L
Teaching Hours/Week(L-T-P):4-0-0	**No.ofCredits:**04
Internal Assessment:30Marks	**Semester End Examination:**70Marks

Unit-I	**Teaching hours**
INTRODUCTION TO PYTHON: Structure of Python Program-Underlying mechanism of Module Execution Branching and Looping-Problem Solving Using Branches and Loops-Functions - Lists and Mutability- Problem Solving Using Lists and Functions	13
Unit-II	
SEQUENCE DATATYPES AND OBJECT-ORIENTED PROGRAMMING : Sequences, Mapping and Sets- Dictionaries- -Classes: Classes and Instances Inheritance- Exceptional Handling- Introduction to Regular Expressions using "re"module. USING NUMPY Basics of NumPy- Computation on NumPy-Aggregations-Computation on Arrays- Comparisons, Masks and Boolean Arrays-Fancy Indexing-Sorting Arrays-Structured Data: NumPy's Structured Array . Introduction to Seaborn, creating statistical plots with seaborn, Customizing plots with seaborn, advanced seaborn features, and regression.	13
Unit-III	
Introduction to Data Visualization: Introduction to data visualization, Importance of data visualization, types of data visualization, tools for data visualization. Area plots, Histograms, Bar charts, Pie chart, Box plots, Scatter plots, bubble plots.	13
Unit-IV	
DATA MANIPULATION WITH PANDAS - Introduction to Pandas Objects-Data indexing and Selection-Operating on Data in Pandas- Handling Missing Data-Hierarchical Indexing - Combining Data Sets. Aggregation and Grouping-Pivot Tables- Vectorized String Operations - Working with Time Series-High Performance Pandas- and query().	13

Reference Books:

1. Jake VanderPlas, Python Data Science Handbook - Essential Tools for Working with Data, O'Reily Media, Inc, 2016
2. Zhang. Y, An Introduction to Python and Computer Programming, Springer Publications,2016
3. JoelGrus, Data Science from Scratch First Principles with Python, O'Reilly, Media,2016
4. T.R. Padmanabhan, Programming with Python, Springer Publications,
5. Hasnain Raz, Data Visualization with Matplotlib and Seaborn 1 st Edition Packt Publishing,

Course Outcomes (CO):After completion of this course student will be able to

CO	Statement
1	Demonstrate the use of built-in objects of Python
2	Demonstrate significant experience with python program development environment
3	Demonstrate significant experience with python program development environment
4	Demonstrate usage of Pivot table, Scatter Plot , 3D plotting.

Course: Distributed Data Storage Management	**Course Code:** 24CSC4C13L
Teaching Hours/Week(L-T-P):4-0-0	**No. of Credits:**04
Internal Assessment:30Marks	**Semester End Examination:**70Marks

Unit-I	**Teaching hours**
Introduction to Distributed Computing Concepts: Basic concepts of distributed systems, distributed computing models, issues in designing distributed systems Inter Process Communication Fundamental concepts related to inter process communication including message passing mechanism, Concepts of group communication Remote Communication Remote Procedural Call (RPC), Remote Method Invocation (RMI)	13
Unit-II	
Clock synchronization: Introduction of clock synchronization, Global state, Mutual Exclusion Algorithms, Election algorithms. **Distributed Shared Memory**: Fundamental concepts of DSM, types of DSM, various hardware DSM systems, Consistency models, issues in designing and implementing DSM systems.	13
Unit-III	
Distributed System Management: Resource Management Scheduling Algorithms, Task Assignment, Load balancing approach, Load sharing approach **Process Management** Process Migration Mechanism, Thread models **Distributed File System** Concepts of a Distributed File System (DFS), file models	13
Unit-IV	
Introduction to Cloud Computing: Cloud Computing history and evolution, benefits of cloud computing. **Cloud Computing Architecture** Cloud Architecture model, Types of Clouds: Public Private & Hybrid Clouds, Cloud based services: Platform as a service (PaaS), Software as a service (SaaS), Infrastructure as a service (IaaS)	13

References:

1. Distributed Systems: Principles and Paradigms by Andrew S. Tanenbaum and Maarten Van Steen: 3rd edition. Year: 2017.
2. Storage Systems by Alexander Thomasian Publisher: Morgan Kaufman Year: 2021
3. Designing Data-Intensive Applications by Martin Kleppmann Publisher: O'Reilly Media Year: 2017

Course Outcomes(CO):After completion of this course student will be able to

CO	Statement
1	Understand the need for distributed systems in handling large-scale data and ensuring reliability.
2	Analyze the performance and reliability of distributed storage systems.
3	Apply appropriate data replication and consistency techniques
4	Address security and fault tolerance concerns in distributed storage environments.

Course: Internet of Things	**CourseCode:**24CSC4E3AL
Teaching Hours/Week (L-T-P):4-0-0	**No. of Credits:** 04
Internal Assessment: 30Marks	**Semester End Examination:** 70 Marks

UNIT 1	**Hours**
Introduction & Concepts: Introduction to Internet of Things, Definitions and Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems	**13 Hours**
UNIT 2	
IoT levels and Development Templates, IoT Level-1, IoT Level-2, IoT Level-3, IoT Level- 4, IoT Level-5, IoT Level-6. IoT Platform Design Methodology: Introduction, IoT Design Methodology:	**13 Hours**
UNIT 3	
Python Programming: Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date Time applications, Classes, Python Packages of Interest for IoT.	**13 Hours**
UNIT 4	
Raspberry Pi: Basic Building Blocks - The Board, Linux on Raspberry Pi, Raspberry pi interfaces, programming Raspberry Pi with python Case Studies (any 2 to be covered): Home Automation, Environment, Weather, Agriculture, Productivity Applications.	**13 Hours**

References:

1. Arshdeep Bahga, Vijay Madisetti Internet Of Things-A Hands on Approach, University of Penn, http://www.internet-of-things-book.com
2. Adrian McEwen & Hakim Cassimally Designing the Internet of Things, ISBN 978-81-265-5686-1 Wiley Publication.
3. Ovidiu Vermesan, Peter Friess Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems. River Publishers Series in Communication.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Realize the evolution of IOT in Mobile Devices, Cloud & Sensor Networks.
2	Study the building blocks of IOT, its characteristics and application areas of IOT.
3	Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi.
4	Explore the architecture, its components and working of IOT components.

Course: Soft Computing	**CourseCode:**24CSC4E3BL
Teaching Hours/Week (L-T-P):4-0-0	**No. of Credits:** 04
Internal Assessment: 30Marks	**Semester End Examination:** 70 Marks

UNIT 1	**Teaching Hours**
Introduction to Soft Computing: Introduction-Artificial IntelligenceArtificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network-Adaline Network-Madaline Network	**13 Hours**
UNIT 2	
Artificial Neural Networks: Back propagation Neural Networks - Kohonen Neural Network - Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.	**13 Hours**
UNIT 3	
Fuzzy Systems: Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions - Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.	**13 Hours**
UNIT 4	
Genetic Algorithms: Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm. Hybrid Systems: Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic	**13 Hours**

References:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2002.
2. Kwang H.Lee, First course on Fuzzy Theory and Applications‖, Springer, 2005.
3. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications‖, Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2003.

Course Outcomes(CO): After completion of this course student able to

CO	Statement
1	To learn the basic concepts of Soft Computing.
2	To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
3	To apply soft computing techniques to solve problems.

Course: Pattern Recognition	**CourseCode:**24CSC4E3CL
Teaching Hours/Week (L-T-P):4-0-0	**No. of Credits:** 04
Internal Assessment: 30Marks	**Semester End Examination:** 70 Marks

UNIT 1	**Teaching Hours**
Introduction: Application of Pattern Recognition, statistical Decision Theory, Image Processing and Analysis. **Probability:** Introduction, Probability of Events, Random Variables, Joint Distribution and Densities	**13 Hours**
UNIT 2	
Moments of Random variables, Estimation of Parameters from samples, Minimum Risk Estimations. **Statistical Decision Making:** Introduction, Baye's Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries,- Estimation of Error rates, Characteristic centers, Estimating the Composition of Populations.	**13 Hours**
UNIT 3	
Non Parametric Decision Making: Introduction, Histograms, Kernel and Windows Estimators, Nearest Neighbor Classification Techniques, Adaptive Decision Boundaries, Adaptive Discriminate Functions, Minimum Squared.	**13 Hours**
UNIT 4	
Artificial Neural Networks: Introduction, Nets without Hidden layers, Nets with Hidden layers, The Back – Propagation Algorithm, Hopfied Nets – An Application: Classifying Sex from facial images.	**13 Hours**

References:

1. Earl Gose, Richard Johnsonbaugh and Steve Jost, Pattern Recognition and Image Analysis, PHI, 1997.
2. Fu.K.S., Syntactic Methods in Pattern Recognition, Academic Press, 1974.
3. Tray Y Young and Thomas W Calvert, Classification, Estimation and Pattern Recognition, American Elsevier Publication Company Inc., 1994.
4. Duda R.O. and Hart P.E., Pattern Classification and Scene Analysis, John Wiley.

Course Outcomes(CO): After completion of this course student able to

CO	Statement
1	Summarize the various techniques involved in pattern recognition.
2	Categorize the various pattern recognition techniques into supervised and unsupervised
3	Illustrate the artificial neural network based pattern recognition.
4	Discuss the applications of pattern recognition in various applications.

Course: Artificial Intelligence	**CourseCode:**24CSC4E4AL
Teaching Hours/Week (L-T-P):4-0-0	**No. of Credits:** 04
Internal Assessment: 30Marks	**Semester End Examination:** 70 Marks

Artificial Intelligence

UNIT 1	**Hours**
WHAT IS ARTIFICIAL INTELLIGENCE: The AI problems, The underlying assumption, What is an AI technique, The level of the model, Criteria for success. Problem Spaces And Search: Defining the problem as a State space search, Production Systems, Problem Characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems.	**13 Hours**
UNIT 2	
HEURISTIC SEARCH TECHNIQUES: Generate-And-Test, Hill climbing, Best-First search, Problem Reduction, Constraint Satisfaction, Means-Ends analysis, Knowledge Representation Issues: Representations and Mappings, Approaches to Knowledge representation, Issues in knowledge representation.	**13Hours**
UNIT 3	
USING PREDICATE LOGIC: Representing simple facts in logic, Representing instance and ISA relationship, Compatible functions and Predicates, Resolution, Representing Knowledge using Rules: Procedural versus Declarative knowledge, Logic programming, Forward versus Backward reasoning, Matching, Control Knowledge.	**13Hours**
UN IT 4	
SYMBOLIC REASONING UNDER UNCERTAINITY: Introduction to Monotonic reasoning, Logics for Nonmonotonic reasoning, Augumenting a Problem solver, Implementation- DFS, BFS, Weak Slot-and-Filler Structures: Semantic Nets, Frames, Strong Slot-and-Filler Structures: Conceptual Dependency, Slots, CYC.	**13 Hours**

References:

1. Elaine Rich, Kevin Knight & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009
2. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand AI Problems, Understand AI Problems and their implications on Problem solving.
2	Apply heuristic search methods, grasp knowledge representation approaches, and address issues in knowledge representation.

3	Proficiently use predicate logic, represent knowledge using rules, and differentiate between procedural and declarative knowledge.
4	Apply monotonic reasoning, non monotonic logics, and augment problem solvers, and implement search algorithms while understanding slot-and-filler structures.
5	Analyze natural language syntactically and semantically, handle discourse and pragmatics, explore statistical NLP.

Course: Natural Language Processing	**CourseCode:**24CSC4E4BL
Teaching Hours/Week (L-T-P):4-0-0	**No. of Credits:** 04
Internal Assessment: 30Marks	**Semester End Examination:** 70 Marks

UNIT 1	**Teaching Hours**
Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model. **Word level and syntactic analysis:** Word Level Analysis	**13 Hours**
UNIT 2	
Regular Expressions-Finite State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Extracting Relations from Text: From Word Sequences to Dependency Paths:** Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation	**13 Hours**
UNIT 3	
Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, **Evaluating Self-Explanations in iSTART:** Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems	**13 Hours**
UNIT 4	
iSTART: Evaluation of Feedback Systems, **Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures:** Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Information Retrieval and Lexical Resources	**13 Hours**

References:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessing and Text Mining", Springer-Verlag London Limited 2007.
3. Mayank Dave Computer Networks, Cengage Learning, 5th Edition.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Analyze the natural language text.
2	Define the importance of natural language.
3	Understand the concepts Text mining.
4	Illustrate information retrieval techniques.

Course : Block chain Technology	Course code: 24CSC4E4CL
Teaching Hours/Week(L-T-P):4-0-0	No. of Credits: 04
Internal Assessment Marks: 30Marks	Semester End Examination:70Marks

Unit	Description	Hours
1	Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.	14
2	Cyberspace and the Law & Cyjber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need forComputer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, DigitalForensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.	13
3	Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, SecurityChallenges Posed by Mobile Devices, Registry Settings for Mobile Devices,Authentication serviceSecurity,Attacks on Mobile/CellPhones,Mobile Devices:Security Implications for Organizations,Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.	12
4	Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.	13

References:

1. "Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher - A beginner-friendly textbook that covers the basics of blockchain technology.
2. "Blockchain for Dummies" by Tiana Laurence - A comprehensive textbook that covers the fundamentals of blockchain technology and its applications.
3. "Mastering Blockchain" by Imran Bashir - A technical textbook that covers the basics of blockchain technology, including architecture, consensus algorithms, and smart contracts.

Course Outcomes (COs):
At the end of the course, students will be able to:
1. State the basic concepts of block chain.
2. Paraphrase the list of consensus and Demonstrate and Interpret working of hyper ledger Fabric.
3. Implement SDK composer tool and explain the Digital identity for government.

Course: Multimedia and Animation	**Course Code:** 24CSC3G2AL
Teaching Hours/Week(L-T-P):2-0-0	**No.ofCredits:**02
Internal Assessment:20Marks	**Semester End Examination:**30Marks

UNIT1	**Teaching Hours**
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles, Text, images, audio and video	**08**
UNIT2	
Text and image compression, compression principles, text compression- Run length, Huffman, LZW, Document Image compressionusingT2andT3 coding, image compression-GIF, TIFF and JPEG	**09**
UNIT3	
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and ReversibleVLCs,MPEG7standardization process of multimedia content description, MPEG 21 multimedia framework	**09**

References:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
2. John Billamil, Louis Molina,"Multimedia:AnIntroduction",PHI,2002.
3. FredHalsall,"MultimediaCommunications",Pearsoneducation,2001.
4. Raif Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002.

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	To Understand the multimedia application
2	To Understand the Animation elements
3	Discussing the Video compression
4	Text and image compression

Course: Cyber Security	**Course Code: 24CSC4G2BL**
Teaching Hours/Week (L-T-P):2-0-0	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

UNIT 1	**Teaching Hours**
INTRODUCTION TO CYBERCRIME CYBERCRIME Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws, Global Perspectives.	**08**
UNIT 2	
CYBER OFFENSES HOW CRIMINALS PLAN THEM Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercafe & cybercrimes. BOTNETS The fuel for cybercrime, Attack Vector	**09**
UNIT 3	
TOOLS AND METHODS USED IN CYBERCRIME Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks	**09**

References:

1. Sunit Belapure andNina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)
2. Cyber security: Managing Systems, Conducting Testing, and Investigating Intrusions, Thomas J. Mowbray, John Wiley & Sons, 2013
3. Cyber Security Essentials James Graham, Ryan Olson, Rick Howard CRC Press 2010

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Elucidate the cybercrime terminologies.
2	Describe Cyber offenses and Botnets
3	Illustrate Tools and Methods used on Cybercrime.
4	Elucidate Phishing and Identity Theft.
5	Justify the need of Computer Forensics.

Course : R-Programming	Course code: 24CSC4G2CL
Teaching Hours/Week(L-T-P):2-0-0	No. of Credits: 02
Internal Assessment Marks: 20Marks	Semester End Examination:30 Marks

Unit	Description	Hours
1	Introduction to R:What is R? Why R? Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed.packages(), packageDescription(), help(), find.package(), library() - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits – Special Values functions : NA, Inf and –inf.	8
2	R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame – R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables - R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if – else if statement, switch statement – R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.	9
3	R-Function : function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values - R-Strings – Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower().R Vectors – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting.	9

Reference Books:

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN : 978-93-5260-455-5.
2. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.
3. Tutorials Point (I) simply easy learning, Online Tutorial Library (2018), R Programming, Retrieved from https://www.tutorialspoint.com/r/r_tutorial.pdf.
4. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015, ISBN: 978-1-119-05580-8

Course Outcomes (CO): After completion of this course student able to

CO	Statement
1	Understand the basics of Fundamentals of R.
2	Understands the loading, retrieval techniques of data
3	Understand how data is analysed and visualized using statistic functions.

Course: Data Science Lab	**Course Code:** 24CSC4C12P
Teaching Hours/Week(L-T-P): 0-0-4	**No. of Credits:** 02
Internal Assessment: 20Marks	**Semester End Examination:** 30 Marks

Practical List:

1.	Python program to demonstrate working with Dictionaries in Python
2.	Python program to demonstrate the basic Numpy array creation
3.	Python program to perform array operation using Numpy package.
4.	Python program to demonstrate the concepts of expanding and squeezing NumPy arrays and sorting elements within a NumPy array.
5.	Python program to compute summary statistics such as mean , median, mode , standard deviation and variance of the given different types of data.
6.	Basic Visualization using matplotlib in Python 1. Line plots 2. Area plots Histograms
7.	Basic Visualization using matplotlib in Python 1. Bar charts 2. Pie charts 3. Box plots 3. Scatter plots
8	Python Program to perform file operation Excel Data set
9.	Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris dataset.
10.	Python Program to perform data manipulation operation using pandas package
11.	Python Program to understand and demonstrate how to handle Nan values , sort data based on column values and group data using the groupby() function in Pandas
12.	Python Program to work with Panda Data Frames.
13.	Python Program to implement Frequency Distribution
14.	Python Program to implement Normal Curves

CO	Statement
1.	Students will learn to write Python programs for basic operations
2.	Students will gain hands-on experience in performing array operations with NumPy and working with data frames using Pandas.
3.	Students will learn to create various visualizations like line graphs and bar charts using Matplotlib.
4.	Students will implement statistical operations such as frequency distributions, averages, and correlation analysis in Python.

CBCS Question Paper Pattern for PG Semester End Examination with Effect from the AY 2024-25

Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

Paper Code: **Paper Title:**
Time: 3 Hours **Max. Marks: 70**

Part A:
Answer any ten questions. Each question carries 2 marks. **2x10=20**

1. a)
b)
c)
d)
e)
f)
g)
h)
i)
j)
k)
l)

Part B:
Answer any five of the following questions. **10x5=50**

2.
3.
4.
5.
6.
7.
8.

Note: Question No. 2 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…

Q6. 10Marks
Note: Question No.6, *shall be from Unit I and II,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q7. 10 Marks
Note: Question No.7*, shall be from Unit III and IV*, the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q8. 10 Marks
Note: Question No-8 shall be from *any of the unit*, the Question may be a whole or it may consists of sub questions such as a,b, c etc…

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Skill Enhancement Courses (SECs)

Paper Code: **Paper Title:**

Time: 1 Hours **Max. Marks: 30**

There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

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Scheme for Practical Examination (PG)

1. **Writing Program : 05 Marks**
2. **Program Execution : 20 Marks**
3. **Viva Voce : 05 Marks**

Total : 30 Marks

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Scheme for Major Project Evaluation (PG)

1. **Project Write Up : 15 Marks**
   (project's scope, objectives, methodology, use-case diagrams, results etc.)
2. **Project Demo : 40 Marks**
3. **Viva Voce : 15 Marks**

Total : 70 Marks

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