



**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY**  
**JNANASAGARA CAMPUS, BALLARI-583105**

**Department of Studies  
in Computer Science**

**SYLLABUS**

**Master of Computer Applications**  
(I-II Semester)

**With effect from the Academic Year**  
**2024-25**

**Department of Studies in Computer Science**

**Programme:** Master of Computer Applications (MCA)

**Duration:** 2 Years (4 semesters)

### **Programme Overview:**

Master of Computer Applications (MCA) 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.

**I-SEMESTER**

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		
<b>FIRST</b>	DSC1	24MCA1C1L	Data Structures	30	70	100	4	-	-	4	3
	DSC2	24MCA1C2L	Object Oriented Programming using JAVA	30	70	100	4	-	-	4	3
	DSC3	24MCA1C3L	Computer Networks	30	70	100	4	-	-	4	3
	DSC4	24MCA1C4L	Mathematics for Computer Applications	30	70	100	4	-	-	4	3
	SEC1	24MCA1S1LP	Web Stack Technologies	20	30	50	1	-	2	2	1
	DSC1P	24MCA1C1P	Data Structure with Algorithms Lab	20	30	50	-	-	4	2	4
	DSC2P	24MCA1C2P	Object Oriented Programming using JAVA Lab	20	30	50	-	-	4	2	4
	DSC3P	24MCA1C3P	Computer Networks lab	20	30	50	-	-	4	2	4
<b>Total Marks for I Semester</b>						<b>600</b>				<b>24</b>	

**II- SEMESTER**

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		
<b>SECOND</b>	DSC5	24MCA2C5L	Relational Database Management Systems	30	70	100	4	-	-	4	3
	DSC6	24MCA2C6L	Data Mining	30	70	100	4	-	-	4	3
	DSC7	24MCA2C7L	C# & ASP.Net	30	70	100	4	-	-	4	3
	DSC8	24MCA2C8L	Software Engineering	30	70	100	4	-	-	4	3
	SEC2	24MCA2S2LP	PHP Programming	20	30	50	1	-	2	2	1
	DSC5P	24MCA2C5P	Relational Database Management Systems Lab	20	30	50	-	-	4	2	4
	DSC6P	24MCA2C6P	Data Mining Lab	20	30	50	-	-	4	2	4
	DSC7P	24MCA2C7P	C# & ASP.Net Lab	20	30	50	-		4	2	4
<b>Total Marks for II Semester</b>						<b>600</b>				<b>24</b>	

# **I Semester**

<b>Course:</b> Data Structures	<b>Course Code:</b> 24MCA1C1L
<b>Teaching Hours/Week (L-T-P):</b> 4 - 0 - 0	<b>No. of Credits:</b> 04
<b>Internal Assessment:</b> 30 Marks	<b>Semester End Examination:</b> 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

<b>Unit-I</b>	<b>Teaching hours</b>
<b>Introduction To Data Structure:</b> 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
<b>Unit-II</b>	
<b>Stack:</b> 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
<b>Unit-III</b>	
<b>Nonlinear Data Structure :</b> 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
<b>Unit-IV</b>	
<b>SORTING and SEARCHING</b> 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. Sorenson Publisher-Tata McGraw Hill 2<sup>nd</sup> Edition 2017.
2. Data Structures using C & C++ -By Ten Baum Publisher – Prentice-Hall International 2<sup>nd</sup> 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 2<sup>nd</sup>edition.
6. Data Structures: A Pseudo-code approach with C -By Gilberg & Forouzan Publisher-Thomson Learning 2014 2<sup>nd</sup> 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.

<b>Course:</b> Object Oriented Programming using Java	<b>Course Code:</b> 24MCA1C2L
<b>Teaching Hours/Week (L-T-P):</b> 4 - 0 - 0	<b>No. of Credits:</b> 04
<b>Internal Assessment:</b> 30 Marks	<b>Semester End Examination:</b> 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, Conditional and looping constructs, Arrays. 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 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, McGraw Hill Education.
2. P.J. Deitel and H.M. Deitel, Java for Programmers, 9<sup>th</sup> edition, Pearson education
3. P.J. Deitel and H.M. Deitel, Java: How to Program, 2<sup>nd</sup> 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 needed for 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.

<b>Course:</b> Computer Networks	<b>Course Code:</b> 24MCA2C3L
<b>Teaching Hours/Week (L-T-P):</b> 4 - 0 - 0	<b>No. of Credits:</b> 04
<b>Internal Assessment:</b> 30 Marks	<b>Semester End Examination:</b> 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

<b>UNIT 1</b>	<b>Teaching Hours</b>
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.	<b>13 Hours</b>
<b>UNIT 2</b>	
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.	<b>13 Hours</b>
<b>UNIT 3</b>	
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	<b>13 Hours</b>
<b>UNIT 4</b>	
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).	<b>13 Hours</b>

### References:

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

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

<b>CO</b>	<b>Statement</b>
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

<b>Course:</b> Mathematics for Computer Applications	<b>Course Code:</b> 24MCA1C4L
<b>Teaching Hours/Week (L-T-P):</b> 4 - 0 - 0	<b>No. of Credits:</b> 04
<b>Internal Assessment:</b> 30 Marks	<b>Semester End Examination:</b> 70 Marks

**Course Objectives:**

1. Understand sets, propositions and conditional.
2. Apply Principles of Mathematical induction.
3. Understand the concepts of Probability Distribution
4. Solve Different Graph Problems

<b>UNIT 1</b>	<b>Teaching Hours</b>
<b>Set Theory and Matrices:</b> Sets, Operations on sets, Cardinality of sets, inclusion-exclusion principle, pigeonhole principle, matrices, finding Eigen values and Eigen vectors, Cayley Hamilton theorem(Statement), Problems on Cayley Hamilton theorem. <b>Mathematical Logic:</b> Propositional Logic, Applications of Propositional Logic	<b>13 Hours</b>
<b>UNIT 2</b>	
Propositional Equivalences Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs. <b>Recurrence Relations:</b> Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions	<b>13 Hours</b>
<b>UNIT 3</b>	
<b>Random variable and probability distribution:</b> Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and co-variance and co-variance of random variables. Binomial and normal distribution, Exponential and normal distribution with mean and variables and problems	<b>13 Hours</b>
<b>UNIT 4</b>	
<b>Graph Theory :</b> Graphs and Graphs models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring	<b>13 Hours</b>

**Reference Books:**

1. Richard A Johnson and C.B Gupta “Probability and statistics for engineers” Pearson Education.
2. J.K Sharma “Discrete Mathematics”, Mac Millian Publishers India, 3rd edition,2011.2015.

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

<b>CO</b>	<b>Statement</b>
1	Understand the concepts of Set Theory and Matrices.
2	Apply propositional logic to solve problems.
3	Understand Recurrence Relations and Solving problems.
4	Understand the concepts of Random variable and Probability distributions.
5	Formulate and solve graph problems.

<b>Course:</b> Web Stack Technologies	<b>Course Code:</b> 24MCA1S1LP
<b>Teaching Hours/Week (L-T-P):</b> 0 - 1 - 2	<b>No. of Credits:</b> 02
<b>Internal Assessment:</b> 20 Marks	<b>Semester End Examination:</b> 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.

<b>UNIT 1</b>	<b>Teaching Hours</b>
<b>Introduction to Web Concepts:</b> 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.	<b>08 Hours</b>
<b>UNIT 2</b>	
<b>Scripting Language:</b> 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	<b>09 Hours</b>
<b>UNIT 3</b>	
<b>Introduction to CSS:</b> 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.	<b>09 Hours</b>

**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**

<b>CO</b>	<b>Statement</b>
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.

<b>Course:</b> Web Stack Technologies Lab	<b>Course Code:</b> 24MCA1S1LP
<b>Teaching Hours/Week (L-T-P):</b> 0 - 1 - 2	<b>No. of Credits:</b> 02
<b>Internal Assessment:</b> 20 Marks	<b>Semester End Examination:</b> 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

<b>Course:</b> Data Structures Lab	<b>Course Code:</b> 24MCA1C1P
<b>Teaching Hours/Week (L-T-P):</b> 0 - 0 - 4	<b>No. of Credits:</b> 02
<b>Internal Assessment:</b> 20 Marks	<b>Semester End Examination:</b> 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 datastructure .
2. Be capable to identify 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 usingdynamic memory allocation.
7. Program to implement doubly linked list perform Search, Insert and Delete operation usingdynamic 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 dynamicmemory 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.

<b>Course:</b> Object Oriented Programming using JAVA Lab	<b>Course Code:</b> 24MCA1C2P
<b>Teaching Hours/Week (L-T-P):</b> 0 - 0 - 4	<b>No. of Credits:</b> 02
<b>Internal Assessment:</b> 20 Marks	<b>Semester End Examination:</b> 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 bypassing parameters.
- b. Write a Program to request server information viz Request Method, URL, Protocol and remote address.

<b>Course:</b> Computer Networking Lab	<b>Course Code:</b> 24MCA1C3P
<b>Teaching Hours/Week (L-T-P):</b> 0 - 0 - 4	<b>No. of Credits:</b> 02
<b>Internal Assessment:</b> 20 Marks	<b>Semester End Examination:</b> 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

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		
<b>SECOND</b>	DSC5	24MCA2C5L	Relational Database Management Systems	30	70	100	4	-	-	4	3
	DSC6	24MCA2C6L	Data Mining	30	70	100	4	-	-	4	3
	DSC7	24MCA2C7L	C# & ASP.Net	30	70	100	4	-	-	4	3
	DSC8	24MCA2C8L	Software Engineering	30	70	100	4	-	-	4	3
	SEC2	24MCA2S2LP	PHP Programming	20	30	50	1	-	2	2	1
	DSC5P	24MCA2C5P	Relational Database Management Systems Lab	20	30	50	-	-	4	2	4
	DSC6P	24MCA2C6P	Data Mining Lab	20	30	50	-	-	4	2	4
	DSC7P	24MCA2C7P	C# & ASP.Net Lab	20	30	50	-	-	4	2	4
<b>Total Marks for II Semester</b>						<b>600</b>				<b>24</b>	

<b>Course Title:</b> Relational Database Management Systems	<b>Course Code:</b> 24MCA2C5L
<b>Total Contact Hours:</b> 52	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 03 hrs.
<b>Summative Assessment Marks:</b> 70	

Course Outcomes (CO's):

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

<b>CO</b>	<b>Statement</b>
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.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
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 based, 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

<b>Course Title:</b> Data Mining	<b>Course Code:</b> 24MCA2C5L
<b>Total Contact Hours:</b> 52	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 03 hrs.
<b>Summative Assessment Marks:</b> 70	

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

<b>CO</b>	<b>Statement</b>
1	Understand what Is Data Mining, what kinds of data can be mined, what kinds of patterns can be mined, and what kinds of applications are targeted.
2	Apply Data preprocessing techniques.
3	How to mine Data Patterns using Classification techniques.
4	Understand Cluster Analysis.
5	Implementing OLAP in Data Warehousing.

<b>UNIT 1</b>	<b>Teaching Hours</b>
Data mining – Motivation – Importance - DM Vs KDD - DM Architecture - Data Types – DM Tasks –DM System Classification - Primitives of DM - Data Mining Query Language - DM Metrics - DM Applications - DM Issues – Social Implications of DM, Data Preprocessing: Summarization - Data cleaning	<b>13 Hours</b>
<b>UNIT 2</b>	
Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation, Mining Frequent Patterns – Frequent Item set Mining Methods. Classification: Classification by Decision Tree Induction – Bayesian Classification	<b>13 Hours</b>
<b>UNIT 3</b>	
Rule based Classification - Prediction– Accuracy and Error Measures, Cluster Analysis – Types of Data in Cluster Analysis – Categorization of clustering Methods – Partition Methods - Outlier Analysis – Mining Data Streams – Social Network Analysis – Mining the World Wide Web	<b>13 Hours</b>
<b>UNIT 4</b>	
Data Warehousing: OLTP Vs OLAP - Multidimensional Data Model -DW Architecture Efficient Processing of OLAP queries - Metadata repository – DWH Implementation – OLAM	<b>13 Hours</b>

**Reference Books:**

1. JiaweiHan, Micheline amber, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier India Private Limited, 2012.
2. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2012.
3. K.P.Soman, ShyamDiwakar, V.Ajay, "Insight into Data Mining Theory & Practice, Prentice Hall India, 2012
4. G.H.Gupta, "Introduction to Data Mining with Case Studies", 2nd Edition, PHI.
5. Ralph Kimball, Margy Ross "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", 3rd Edition , Wiley, Jul 2013.

<b>Course Title:</b> C# & ASP.Net	<b>Course Code:</b> 24MCA2C7L
<b>Total Contact Hours:</b> 52	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 03 hrs.
<b>Summative Assessment Marks:</b> 70	

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

<b>CO</b>	<b>Statement</b>
1	Able to explain how C# fits into the .NET platform.
2	Describe the utilization of variables and constants of C#
3	Use the implementation of object-oriented aspects in applications.
4	Analyze and Set up Environment of .NET Core.
5	Evaluate and create a simple project application.

<b>UNIT 1</b>	<b>Teaching Hours</b>
Introduction to C#: Understanding C#, .NET, overview of C#, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, implicit and explicit casting. Constants, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.	<b>13 Hours</b>
<b>UNIT 2</b>	
Object Oriented Concepts-I: Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism.	<b>13 Hours</b>
<b>UNIT 3</b>	
Object Oriented Concepts-II: Sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.	<b>13 Hours</b>
<b>UNIT 4</b>	
Introduction to .NET FRAMEWORK: Assemblies, Versioning, Attributes, reflection, viewing meta data, remoting, security in .NET, Environment Setup of .NET Core and create a small project. Teaching-Learning Process Active learning	<b>13 Hours</b>

**References:**

1. Faraz Rasheed, "Programmer Heaven C# School".
2. Stephen Walthert, "ASP .NET 3.5 unleashed", SAMS.
3. Shibi Panikkar and Kumar Sanjeev, "C# with .Net Framework", Firewall Media.
4. Jeffery Richter, "Applied Microsoft .Net Framework Programming".
5. Balaguruswamy, "Programming with C#", TMH.

Course Title: Software Engineering	Course code: 24MCA2C7L
<b>Total Contact Hours: 52</b>	<b>Course Credits: 04</b>
<b>Formative Assessment Marks: 30</b>	<b>Duration of ESA/Exam: 03 hrs.</b>
<b>Summative Assessment Marks: 70</b>	

### 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:**

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

<b>Course Title:</b> PHP Programming	<b>Course Code:</b> 24MCA2S2LP
<b>Total Contact Hours:</b> 0 - 1 - 2	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 20	<b>Duration of ESA/Exam:</b> 01 hr.
<b>Summative Assessment Marks:</b> 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](https://www.w3schools.com/php/php_forms.asp)

<b>Course Title:</b> PHP Programming	<b>Course Code:</b> 24MCA2S2LP
<b>Teaching Hours/Week (L-T-P):</b> 0 - 0 - 2	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 20	<b>Duration of ESA/Exam:</b> 01 hrs.
<b>Summative Assessment Marks:</b> 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.

Course Title: Relational Database Management Systems Lab	Course code: 24MCA2C5P
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 more movies.
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.

<b>Course Title:</b> Data Mining Lab	<b>Course Code:</b> 24MCA2C6P
<b>Teaching Hours/Week (L-T-P):</b> 0 - 0 - 4	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 20	<b>Duration of ESA/Exam:</b> 04 hrs.
<b>Summative Assessment Marks:</b> 30	

Course Outcomes (COs):

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

1. Implement various machine learning algorithms, including FIND-S, Candidate-Elimination, k-Means, and EM.
  2. Demonstrate the ability to preprocess and analyze datasets, including reading from CSV files and discretization techniques.
  3. Evaluate machine learning models using performance metrics such as confusion matrices, entropy, and Gini index.
  4. Understand different clustering algorithms, enhancing their understanding of data structures.
  5. Apply Bayesian networks for medical diagnosis, applying theoretical concepts to real-world healthcare data.
- 
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. Analyze 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 Neighbor 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.

<b>Course Title:</b> C# & ASP.Net Lab	<b>Course Code:</b> 24MCA2C7P
<b>Teaching Hours/Week (L-T-P):</b> 0 - 0 - 4	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 20	<b>Duration of ESA/Exam:</b> 04 hrs.
<b>Summative Assessment Marks:</b> 30	

Course Outcomes (COs):

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

- Demonstrate the knowledge of .NET Framework and the fundamentals of developing modular application by using C# programming.
  - Design and Develop Solutions for real time problems using object oriented principles.
  - Analyse and evaluate user requirements for software functionality and create new applications.
  - Demonstrate Component Services and develop Windows based application.
  - Implement interactive executable web applications using Network Programming and Remoting.
  - Create database driven applications using ADO.NET.
  - Design and Develop client /server side model and mobile application using ASP.NET 8. Apply .NET programming in industry based application.
1. Develop a C# program to simulate simple arithmetic calculator for Addition, Subtraction, Multiplication, Division and Mod operations. Read the operator and operands through console.
  2. Develop a C# program to print Armstrong Number between 1 to 1000.
  3. Develop a C# program to list all substrings in a given string. [ Hint: use of Substring() method]
  4. Develop a C# program to demonstrate Division by Zero and Index Out of Range exceptions.
  5. Develop a C# program to generate and print Pascal Triangle using Two Dimensional arrays.
  6. Develop a C# program to generate and print Floyds Triangle using Jagged arrays.
  7. Develop a C# program to read a text file and copy the file contents to another text file.
  8. Develop a C# C# Program to Implement Stack with Push and Pop Operations [Hint: Use class, get/set properties, methods for push and pop and main method
  9. Design a class “Complex” with data members, constructor and method for overloading a binary operator ‘+’.

10. Develop a C# program to read Two complex number and Print the results of addition.
11. Develop a C# program to create a class named shape. Create three sub classes namely: circle, triangle and square, each class has two member functions named draw () and erase ().
12. Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.
13. Develop a C# program to create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
14. Develop a C# program to create an interface Resizable with methods resizeWidth(int width) and resizeHeight(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods

**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:  
Time: 3 Hours

Paper Title:

Max. Marks: 70

**Part A:**

Answer all 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        |
| <b>Total</b> |                   | <b>: 30 Marks</b> |

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

**Department of Studies in Computer Science**

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

*Syllabus of III & IV Semester*

*Master of Computer Applications*



**With effect from 2024-25 Onwards**

Approved in the BOS dated 25.03.2025

*[Handwritten signatures in blue ink]*

## Department of Studies in Computer Science

**Programme:** Master of Computer Application (MCA) in Computer Science

**Duration:** 2 Years (4 semesters)

### Programme Overview:

Master of Computer Application (MCA) 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 MCA 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	24MCA3C9L	R-Programming	30	70	100	4	-	-	4	3
	DSC10	24MCA3C10L	Internet of Things	30	70	100	4	-	-	4	3
	DSE1	24MCA3E1AL	Operation Research	30	70	100	4	-	-	4	3
		24MCA3E1BL	Machine Learning	30	70	100	4	-	-	4	3
		24MCA3E1CL	Block chain Technology	30	70	100	4	-	-	4	3
	DSE2	24MCA3E2AL	Cloud Computing	30	70	100	4	-	-	4	3
		24MCA3E2BL	Software Testing	30	70	100	4	-	-	4	3
		24MCA3E2CL	AI driven Cyber Security	30	70	100	4	-	-	4	3
	GEC1	24MCA3G1AL	Computer Networks and Internet Technologies	20	30	50	2	-	-	2	1
		24MCA3G1BL	Introduction to C Programming								
		24MCA3G1CL	Web Designing								
	SEC3	24MCA3S3LP	Research Methodology	20	30	50	1	-	2	2	1
	DSC10P	24MCA3C9P	R- Programming Lab	20	30	50	-	-	4	2	4
DSC11P	24MCA3C10P	Mini Project/Internship*	20	30	50	-	-	4	2	4	
						<b>600</b>				<b>24</b>	

**\*Internship: Students are required to complete a 4-Week internship during the break between their 2nd and 3rd semesters and submit a copy of the report during the 3rd semester.**



# VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY



## Department of Studies in Computer Science

JnanaSagara, Ballari - 583105

### Distribution of Courses/Papers in Postgraduate Programme MCA 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	24MCA4C12L	Data Science with Python	30	70	100	4	-	-	4	3
	DSC13	24MCA4C13L	Dev. Ops & Agile Programming	30	70	100	4	-	-	4	3
	DSE3	24MCA4E3AL	Social Network Analysis	30	70	100	4	-	-	4	3
		24MCA4E3BL	Real Time Big Data Analytics	30	70	100	4	-	-	4	3
		24MCA4E3CL	Software Project Management	30	70	100	4	-	-	4	3
	DSE4	24MCA4E4AL	Digital Image Processing	30	70	100	4	-	-	4	3
		24MCA4E4BL	Business Intelligence and Analysis	30	70	100	4	-	-	4	3
		24MCA4E4CL	Deep Learning	30	70	100	4	-	-	4	3
	GEC2	24MCA4G2AL	Multimedia and Animation	20	30	50	2	-	-	2	1
		24MCA4G2BL	Cyber Security								
		24MCA4G2CL	R-Programming								
DSC12P	24MCA4C12P	Data Science Lab	20	30	50	-	-	4	2	4	
DSC13P	24MCA4C13P	Major Project	30	70	100	-	-	8	4	4	
						<b>600</b>				<b>24</b>	

### MCA SEMESTER III

#### **DSC9: R-Programming**

<b>Course : R-Programming</b>	<b>Course code: 24MCA3C9L</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>Semester End Examination:70Marks</b>

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
<b>1</b>	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.	<b>13</b>
<b>2</b>	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.	<b>15</b>
<b>3</b>	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.	<b>15</b>
<b>4</b>	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.	<b>13</b>

#### **References:**

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](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
5. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN : 978-93-5260-455-5.

#### **Course Outcomes (CO):**

**After completion of this course student able to**

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.

### DSC10: Internet of Things

<b>Course : Internet of Things</b>	<b>Course code: 24MCA3C10L</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>Semester End Examination:70Marks</b>

Unit	Description	Hours
<b>1</b>	<b>Introduction &amp; Concepts:</b> 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,	<b>15</b>
<b>2</b>	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.	<b>15</b>
<b>3</b>	<b>Python Programming:</b> 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.	<b>13</b>
<b>4</b>	<b>Raspberry Pi:</b> 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.	<b>13</b>

**References:**

1. Arshdeep Bahga, Vijay Madisetti Internet Of Things-A Hands on Approach, University of Penn, <http://www.internet-of-things-book.com> 4
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 (COs):**

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

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.

### DSE1: Operation Research

<b>Course : Operation Research</b>	<b>Course code: 24MCA3E1AL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>Semester End Examination:70Marks</b>

Unit	Description	Hours
<b>1</b>	Introduction: Evolution of OR, Definitions of OR, Scope of OR, Applications of OR, Phases in OR study. Characteristics and limitations of OR, models used in OR, Linear Programming problem (LPP), Generalized LPP- Formulation of problems as L.P.P. Solutions to LPP by graphical method (Two Variables).	<b>13</b>
<b>2</b>	LPP: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method, Degeneracy in LPP. Concept of Duality, writing Dual of given LPP. Solutions to L.P.P by Dual Simplex Method.	<b>13</b>
<b>3</b>	Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem.	<b>13</b>
<b>4</b>	Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determine the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks-Problems.	<b>13</b>

**References:**

1. Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt. Ltd. 2016.
2. Operations Research, Paneerselvan, PHI
3. Operations Research, A M Natarajan, P Balasubramani, Pearson Education, 2005
4. Introduction to Operations Research, Hillier and Lieberman, 8th Ed., McGraw Hill

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

1. Understand Core Concepts – Demonstrate a solid understanding of the fundamental principles and theories related to the subject.
2. Apply Knowledge Practically – Utilize learned concepts to solve real-world problems and case studies effectively.
3. Develop Critical Thinking – Analyze and evaluate information critically to make informed decisions and solve complex issues.

### DSE1: Machine Learning

<b>Course : Machine Learning</b>	<b>Course code: 24MCA3E1BL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>SemesterEnd Examination:70Marks</b>

Unit	Description	Hours
<b>1</b>	<b>The Art of Machine Learning for Predictive Data Analytics:</b> Different Perspectives on Prediction Models, Choosing a Machine Learning Approach, Matching Machine Learning Approaches to Projects Matching Machine Learning Approaches to Data and Your Next Steps. <b>Descriptive Statistics &amp; Data Visualization for Machine Learning:</b> Descriptive Statistics for Continuous Features, Central Tendency, Variation, Descriptive Statistics for Categorical Features, Populations & Samples.	<b>14</b>
<b>2</b>	<b>Machine Learning for Predictive Data Analytics:</b> What is Predictive Data Analytics?, What is Machine Learning?, How does Machine Learning Work?, What can go wrong with Machine Learning?, The Predictive Data Analytics Project Life Cycle: CRISP-DM and Predictive Data Analytics Tools.	<b>14</b>
<b>3</b>	<b>Probability-based Learning:</b> Bayes Theorem, Bayesian Prediction, Conditional Independence & Factorization, Standard Approach: The Naive Bayes Model, A Worked Example. <b>Error-based Learning:</b> Simple Linear Regression, Measuring Error, Error Surfaces, Standard Approach: Types of Regression.	<b>12</b>
<b>4</b>	<b>Information-based Learning:</b> Decision Trees, Shannon's Entropy Model, Information Gain, Standard Approach: The ID3 Algorithm, A Worked Example: Predicting Vegetation Distributions, Alternative Feature Selection & Impurity Metrics, Handling Continuous Descriptive Features, Tree Pruning and Model Ensembles.	<b>12</b>

**References:**

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.
2. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd, 2013.
3. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.

**Course Outcomes (COs):**

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

1. Explain the characteristics of datasets and compare the trivial data and big data for various Applications
2. Illustrate implement machine learning techniques and computing environment that are suitable for the applications under consideration
3. Describe various ways for implementation of selecting suitable model parameters for

### DSE1: Blockchain Technology

<b>Course : Blockchain Technology</b>	<b>Course code: 24MCA3E1CL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>Semester End Examination:70Marks</b>

Unit	Description	Hours
<b>1</b>	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.	<b>14</b>
<b>2</b>	Cyberspace and the Law & Cyber 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 for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.	<b>13</b>
<b>3</b>	Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.	<b>12</b>
<b>4</b>	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.	<b>13</b>

**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.

## DSE2: Cloud Computing

<b>Course : Cloud Computing</b>	<b>Course code: 24MCA3E2AL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>Semester End Examination:70Marks</b>

Unit	Description	Hours
<b>1</b>	<b>Defining Cloud Computing:</b> 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. The laws of cloudonomics.	<b>13</b>
<b>2</b>	<b>Understanding Cloud Architecture:</b> Exploring the Cloud Computing Stack, Composability, Infrastructure, Platforms, Communication Protocols; Understanding Services and Applications by Type: Defining IaaS, Defining PaaS, Defining SaaS, Defining IDaaS.	<b>14</b>
<b>3</b>	<b>Understanding Abstraction and Virtualization:</b> Using Virtualization Technologies, Load balancing and Virtualization, Understanding Hypervisors; Capacity Planning: Defining Baseline and Metrics, Baseline measurements, System metrics, Load testing, Server and instance types, Network Capacity.	<b>13</b>
<b>4</b>	<b>Understanding Service Oriented Architecture:</b> Introducing Service Oriented Architecture, Eventdriven 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.	<b>12</b>

**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, 10 2012.
3. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications (free e-book available)

<b>Course Outcomes (COs):</b>
<b>At the end of the course, students will be able to:</b>
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.

### DSE2: Software Testing

<b>Course : Software Testing</b>	<b>Course code: 24MCA3E2BL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>Semester End Examination:70Marks</b>

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	<b>Introduction:</b> 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. Clean Room Software Engineering. Functional/Non Functional Testing. Testing Tools, Categorization of testing methods: Manual Testing, Automation Testing and Automated Testing Vs. Manual Testing.	<b>14</b>
2	<b>Non Functional Testing:</b> 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.	<b>12</b>
3	<b>Software Testing Methodologies:</b> 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	<b>14</b>
4	<b>Test Cases Design:</b> Write Test cases, Review Test cases, Test Cases Template, Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Environment setup, Understand the SRS, Hardware and software requirements, Test Data.	<b>12</b>

**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.
5. Software Testing and Quality Assurance: Theory and Practice by Kshirasagar Naik and Priyadarshi Tripathy.

<b>Course Outcomes (COs): At the end of the course, students will be able to:</b>
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.
4. Apply different testing methodologies used in industries for software testing.

## DSE2: AI Driven Cyber Security

<b>Course : AI Driven Cyber Security</b>	<b>Course code: 24MCA3E2CL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment Marks: 20Marks</b>	<b>Semester End Examination:70Marks</b>

<b>Unit</b>	<b>Description</b>	<b>Hr</b>
<b>1</b>	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. Cyber crime Indian perspective/the Indian ITA 2000, Cyber Offenses: How criminals plan then	<b>13</b>
<b>2</b>	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	<b>13</b>
<b>3</b>	AI for Cyber security, The Use Cases Intend to Solve Various Cyber security 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.	<b>13</b>
<b>4</b>	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	<b>13</b>

**References:**

1. Machine Learning and Security by Clarence Chio, David Freeman ,Released February 2018  
Publisher(s): O'Reilly Media, Inc.
2. Hands-On Artificial Intelligence for Cybersecurity by Alessandro Parisi Released August 2019  
Publisher(s): Packt Publishing.

<b>Course Outcomes (COs):</b>
<b>After completion of this course, students would be able to:</b>
1. Identify cyber threats and limitations of machine learning in security.
2. Apply machine learning methods to detect anomalies.
3. Apply feature generation and the theory of network defense.
4. Apply supervised learning for abuse problems.

### GEC1-Computer Networks and Internet Technology

<b>Course : Computer Networks and Internet Technology</b>	<b>Course code: 24MCA3G1AL</b>
<b>Teaching Hours/Week(L-T-P):2-0-0</b>	<b>No. of Credits: 02</b>
<b>Internal Assessment Marks: 20Marks</b>	<b>Semester End Examination:30Marks</b>

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
<b>1</b>	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.	<b>9</b>
<b>2</b>	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.	<b>8</b>
<b>3</b>	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	<b>9</b>

**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. P. K. Singh, Introduction to Computer Networks, V. K. Publications, New Delhi.
4. Rachna Sharma, Computer Networks, University Science Press, Laxmi Publications.

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

1. Understand the Network and Internet Terminologies.
2. Understand the Network Communication Systems.
- 3 Understand the types of Computer Networks.

### GEC1: Introduction to C Programming

<b>Course :Introduction to C Programming</b>	<b>Course code: 24MCA3G1BL</b>
<b>Teaching Hours/Week(L-T-P):2-0-0</b>	<b>No. of Credits: 02</b>
<b>Internal Assessment Marks: 20Marks</b>	<b>Semester End Examination:30Marks</b>

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
<b>1</b>	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.	<b>9</b>
<b>2</b>	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.	<b>8</b>
<b>3</b>	Arrays: Declaring and Initializing, One Dimensional Arrays, Two Dimensional Arrays, Multi-dimensional Arrays. Strings : Declaring and Initializing strings, Operations on strings. Structures, Unions, Pointers.	<b>9</b>

#### **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.
4. Yashwant Kanetkar, "Let Us C", 13th Edition, PHP, 2013.

#### **Course Outcomes (COs):**

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

1. Describe the concept of C programming and its fundamental.
2. Illustrate various controls statements, arrays.
3. Implement strings in your C program.
4. Manage I/O operations in your C program.

### GEC1: Web Designing

<b>Course : Web Designing</b>	<b>Course code: 24MCA3G1CL</b>
<b>Teaching Hours/Week(L-T-P):2-0-0</b>	<b>No. of Credits: 02</b>
<b>Internal Assessment Marks: 20Marks</b>	<b>Semester End Examination:30Marks</b>

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
<b>1</b>	<b>Introduction to WWW:</b> 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.	<b>9</b>
<b>2</b>	<b>Introduction to HTML:</b> 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.	<b>9</b>
<b>3</b>	<b>Javascript:</b> Client side scripting, What is Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition.	<b>8</b>

**References:**

1. Web Technologies, Black Book, Dreamtech Press, 2018.
2. Steven Holzner, "HTML Black Book", Dreamtech press, 2000.
3. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson, 4th edition, 2012.

**Course Outcomes (COs):**

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

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

### SEC3: Research Methodology

<b>Course : Research Methodology</b>	<b>Course code: 24MCA3S3LP</b>
<b>Teaching Hours/Week(L-T-P):1-0-2</b>	<b>No. of Credits: 02</b>
<b>Internal Assessment Marks: 30Marks</b>	<b>Semester End Examination:70Marks</b>

Unit	Description	Hours
1	<p><b>Introduction to Research:</b> 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.</p>	8
2	<p><b>Methods of Data Collection</b> 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 well-designed experiments vs. poorly designed experiments. Correlations vs. Causation .Good laboratory Practices.</p>	9
3	<p><b>Data analysis (Practical)</b> 1. Search for academic articles and papers on a specific topic using Google Scholar or PubMed. 2. Calculate citation metrics such as h-index, i10 index, and impact factor of a given set of research papers. 3. Demonstrate the difference between correlation and causation using sample data. 4. Illustrate collections of data sets from different sources. 5. Clean a raw dataset to remove noise and outliers. 6. Demonstrate choosing the sample-size.</p>	9

**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.

<b>Course Outcomes (COs): At the end of the course, students will be able to:</b>
1.Understanding research Paradigm
2.Knowledge of research designs
3.Familiarity with data collection methods

### R programming Lab

<b>Course: R- Programming Lab</b>	<b>Course Code: 24MCA3C9P</b>
<b>Teaching Hours/Week (L-T-P): 0 - 1 - 2</b>	<b>No. of Credits: 02</b>
<b>Internal Assessment: 20 Marks</b>	<b>Semester End Examination: 30 Marks</b>

**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 a two-dimensional 5x3 array of sequence of even integers greater than 50.
10) 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.
11) Write a R program to create an empty data frame.
12) Write a R program to create a data frame from four given vectors.
13) 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.
14) Write a R program to save the information of a data frame in a file and display the information of the file.

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

- |   |
|---|
| 1. Students will learn to perform basic input/output operations and retrieve system information in R.     |
| 2. Students will master creating, manipulating, and analyzing vectors, matrices, arrays, and data frames. |
| 3. Students will gain skills to generate simple plots like bar plots for data representation.             |
| 4. Students will learn to manage data, create data frames, and save/load data to/from files.              |

## MCA IV SEM

### Data Science with Python

<b>Course: Data Science with Python</b>	<b>Course Code:24MCA4C12L</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No.ofCredits:04</b>
<b>Internal Assessment: 30Marks</b>	<b>Semester End Examination:70Marks</b>

<b>Unit-I</b>	<b>Teaching hours</b>
<b>INTRODUCTION TO PYTHON:</b> 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
<b>Unit-II</b>	
<b>SEQUENCE DATATYPES AND OBJECT-ORIENTED PROGRAMMING :</b> Sequences, Mapping and Sets- Dictionaries- -Classes: Classes and Instances Inheritance- Exceptional Handling- Introduction to Regular Expressions using “re”module. <b>USING NUMPY</b> 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
<b>Unit-III</b>	
<b>Introduction to Data Visualization</b> - 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
<b>Unit-IV</b>	
<b>DATA MANIPULATION WITH PANDAS</b> - 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 1st Edition Packt Publishing.

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

<b>CO</b>	<b>Statement</b>
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.

<b>Course: Dev. Ops &amp; Agile Programming</b>	<b>Course Code: 24MCA4C13L</b>
<b>Teaching Hours/Week(L-T-P): 4-0-0</b>	<b>No. of Credits: 04</b>
<b>Internal Assessment: 30Marks</b>	<b>Semester End Examination: 70Marks</b>

<b>Unit-I</b>	<b>Teaching hours</b>
<b>Introduction:</b> Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility	13
<b>Unit-II</b>	
<b>Project Planning:</b> Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations	13
<b>Unit-III</b>	
<b>Project Design:</b> Fundamentals, Design principles– <b>SOLID</b> <b>Design Methodologies:</b> Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development.	13
<b>Unit-IV</b>	
<b>Testing:</b> The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.	13

#### References:

1. Ken Schwaber, Mike Beedle, “Agile Software Development with Scrum”, International Edition, Pearson.
2. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, First International Edition, Prentice Hall.
3. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, International edition, Addison Wesley.

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

<b>CO</b>	<b>Statement</b>
1	Interpret the concept of agile software engineering and its advantages in software development.
2	Analyze the core practices behind several specific agile methodologies..
3	Identify the roles and responsibilities in agile projects and their difference from projects following traditional methodologies.
4	Determine the role of design principles in agile software design...

## Social Network Analysis

<b>Course: Social Network Analysis</b>	<b>Course Code: 24MCA4E3AL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits : 04</b>
<b>Internal Assessment:30Marks</b>	<b>Semester End Examination: 70Marks</b>

<b>UNIT1</b>	<b>Teaching Hours</b>
<b>INTRODUCTION:</b> Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.	<b>13</b>
<b>UNIT2</b>	
<b>MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION</b> Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modeling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.	<b>13</b>
<b>UNIT3</b>	
<b>EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS</b> Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.	<b>13</b>
<b>UNIT4</b>	
<b>PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES</b> Understanding and predicting human behavior for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and counter measures.	<b>13</b>

### References:

1. Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.
3. Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.

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

<b>CO</b>	<b>Statement</b>
1	Ability to design and develop semantic web related applications .
2	Ability to represent knowledge using ontology.
3	Ability to predict human behavior in social web and related communities
4	Ability to visualize social networks

## Real Time Big Data Analytics

<b>Course: Real Time Big Data Analytics</b>	<b>Course Code: 24MCA4E3BL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits:04</b>
<b>Internal Assessment:30Marks</b>	<b>Semester EndExamination:70Marks</b>

<b>UNIT-1</b>	<b>Teaching Hours</b>
<p><b>A new paradigm for Big Data:</b> Scaling with a traditional database - NoSQL is not a panacea - First principles - Desired properties of a Big Data system - The problems with fully incremental - Lambda Architecture - Recent trends in technology - Example application: SuperWebAnalytics.com. <b>Data model for Big Data:</b> The properties of data - The fact-based model for representing data - Graph - A complete data model for SuperWebAnalytics.com.</p>	<b>13</b>
<b>UNIT-2</b>	
<p><b>Data storage on the batch layer:</b> Storage requirements for the master dataset - Choosing a storage solution for the batch layer - How distributed file systems work - Storing a master dataset with a distributed file system - Vertical partitioning - Low-level nature of distributed file systems - Storing the SuperWebAnalytics.com master dataset on a distributed file system</p> <p><b>Batch layer:</b> Computing on the batch layer, Re-computation algorithms vs. incremental algorithms, Scalability in the batch layer, MapReduce: a paradigm for Big Data computing, Low-level nature of MapReduce, Pipe diagrams: a higher-level way of thinking about batch computation</p>	<b>13</b>
<b>UNIT-3</b>	
<p><b>Batch layer - Architecture and algorithms:</b> Design of the SuperWebAnalytics.com batch layer - Workflow overview - Ingesting new data - URL normalization - User-identifier normalization - Deduplicate pageviews - Computing batch views</p> <p><b>Batch layer: Implementation:</b> Starting point - Preparing the workflow - Ingesting new data - URL normalization - User-identifier normalization - Deduplicate pageviews - Computing batch views</p>	<b>13</b>
<b>UNIT-4</b>	
<p><b>Serving layer:</b> Performance metrics for the serving layer - The serving layer solution to the normalization/denormalization problem - Requirements for a serving layer database - Designing a serving layer for SuperWebAnalytics.com - Contrasting with a fully incremental solution.</p> <p><b>Realtime views :</b> Computing realtime views - Storing realtime views - Challenges of incremental computation - Asynchronous versus synchronous updates - Expiring realtime views..</p> <p><b>Queuing and stream processing:</b> Queuing, Stream processing, Higher-level, one-at-a-time stream processing, SuperWebAnalytics.com speed layer</p> <p><b>Queuing and stream processing: Illustration:</b> Defining topologies with Apache Storm, Apache Storm clusters and deployment, Guaranteeing message processing</p>	<b>13</b>

### Reference Books:

1. Big Data - Principles And Best Practices Of Scalable Real-Time Data Systems Nathan Marz With James Warren Manning Publications 2015 Edition
2. Spark in Action Petar Zečević Marko Bonaći Manning Publications Nov 2016
3. Edition George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.
4. Hadoop: The Definitive Guide Tom White O'reilly Media 4 th Edition,2015
5. Big Data and Analytics Seema Acharya,Subhash ini Chellappan Wiley India Publications, May 2015
6. Big Data Black book D T Editorial Services Dream tech press 2016 Edition

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

<b>CO</b>	<b>Statement</b>
1	Apply the basic knowledge related to Big data , its elements , its analytics , computing in Big data etc. to the solutions of complex real world engineering problems.
2	Select and apply appropriate modern tools of Hadoop ecosystem to the solution of various problems in storage, processing, accessing, managing and analysing the Big data.
3	Design and Develop Map Reduce programs to the solution of various real world application problems.
4	To understand the introduction of the fuzzy decision making
5	Identify the importance of Big data Stack architecture and Analyse the merits of u modern data warehouses against the limitations of Traditional Databases.

## Software Project Management

<b>Course: Software Project Management</b>	<b>Course Code:24MCA4E3CL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No.ofCredits:04</b>
<b>Internal Assessment: 30Marks</b>	<b>Semester End Examination:70Marks</b>

<b>UNIT-1</b>	<b>Teaching Hours</b>
<p><b>Introduction to Project Management</b>                      Importance of software project management: What is a project? Problems with Software Projects What are Project Management? Stages of Project. The Feasibility Study Planning. Project Execution. The Stakeholder of Project. All parties of project. The Role of Project Manager. Project Management Framework. Project Planning  <b>Integration Management.</b> what is Integration Management. Project Plan Development. Plan Execution. Scope Management. what is Scope Management?.</p>	<b>13</b>
<p><b>UNIT-2</b></p> <p>Methods for Selecting Projects. Project Charter. Scope Statement. Work Breakdown Structure. Stepwise Project Planning Overview. Main Steps in Project Planning.  <b>Project Scheduling Time Management.</b> Importance of Project Schedules. Schedules and Activities. Sequencing and Scheduling Activity. Project Network Diagrams. Network Planning Models. Duration Estimating and Schedule Development. Critical Path Analysis. Program Evaluation and Review Technique (PERT).</p>	<b>13</b>
<p><b>UNIT-3</b></p> <p><b>Project Cost Management</b>                      Importance and Principles of Project Cost Management. Resource Planning. Cost Estimating. Types of Cost Estimates. Expert Judgment. Estimating by Analogy. COCOMO Model. Cost Budgeting. Cost Control.  <b>Project Quality Management</b>                      Quality of Information Technology Projects. Stages of Software Quality Management Quality Planning. Quality Assurance. Quality Control. Quality Standards. Tools and Techniques For Quality Control.</p>	<b>13</b>
<p><b>UNIT-4</b></p> <p><b>Project Human Resources Management</b>                      What is Project Human Resources Management?. Keys to Managing People. Organizational Planning. Issues in Project Staff Acquisition and Team Development.  <b>Project Communication Management</b>                      Communications Planning. Information Distribution. Performance Reporting. Administrative Closure. Suggestions for Improving Project Communications.</p>	<b>13</b>

### References:

1. Kathy Schwalbe, "Information Technology Project Management", International Student Edition, THOMSON Course Technology, 2003
2. Bob Hughes and Mike Cotterell, "Software Project Management", Third Edition, Tata McGraw-Hill.
3. Basics of Software Project Management, NIIT, Prentice-Hall India, 2004.
4. Pankaj Jalote, Software Project Management in Practice, Pearson Ed., 2002.
5. S.A. Kelkar, Software Project Management, a Concise Study, Revised Edition, PrenticeHall India, 2003

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

<b>CO</b>	<b>Statement</b>
1	Understand the practices and methods for successful software project management
2	Identify techniques for requirements, policies and decision making for effective resource management
3	Apply the evaluation techniques for estimating cost, benefits, schedule and risk.

## Digital Image Processing

<b>Course: Digital Image Processing</b>	<b>Course Code: 24MCA4E4AL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits:04</b>
<b>Internal Assessment:30Marks</b>	<b>SemesterEndExamination:70Marks</b>

<b>UNIT-1</b>	<b>Teaching Hours</b>
<b>Introduction:</b> Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure),SomeBasicRelationshipsBetweenPixels-NeighborsandConnectivityof pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.	<b>13</b>
<b>UNIT-2</b>	
<b>Image Enhancement In The Spatial Domain :</b> 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	<b>13</b>
<b>UNIT-3</b>	
<b>Image Enhancement In Frequency Domain:</b> Introduction, Fourier Transform, Discrete Fourier Transform(DFT), properties of DFT, Discrete Cosine Transform(DCT), Image Filtering in frequency domain	<b>13</b>
<b>UNIT-4</b>	
<b>Image Segmentation:</b> 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.	<b>13</b>

### References:

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

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

<b>CO</b>	<b>Statement</b>
1	Explain fundamental so image processing.
2	Compare transformation algorithms.
3	Contrast enhancement, segmentation and compression techniques.

### Business Intelligence and Analysis

<b>Course: Business Intelligence And Analysis</b>	<b>Course Code: 24MCA4E4BL</b>
<b>Teaching Hours/Week(L-T-P):0-0-4</b>	<b>No. of Credits:02</b>
<b>Internal Assessment:30Marks</b>	<b>Semester End Examination:70Marks</b>

<b>UNIT-1</b>	<b>Teaching Hours</b>
<b>Decision Support and Business Intelligence:</b> Opening Vignette , Changing Business Environments and Computerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), A Framework for Business Intelligence (BI), A Work System View of Decision Support	<b>13</b>
<b>UNI-2</b>	
<b>Decision Making Systems, Modelling and Support:</b> Decision Making, Models, Phases of the Decision-Making Process, The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions Are Supported, personality types, The decision makers. <b>Decision support system development:</b> Introduction to DSS development, The traditional system development life cycle, Alternative development life cycle, Prototyping: The DSS development methodologies.	<b>13</b>
<b>UNIT-3</b>	
<b>Business intelligence: Data Warehousing, Data Acquisition, Business Analytics &amp; Visualization:</b> The Nature and Sources of Data, Data Collection, Problems and Quality, The Web/Internet and Commercial Database Services, Database Management System in Business Intelligence, Data Warehousing, Data Marts, Business Intelligence, Online Analytical Processing, Data Mining, Data Visualization, Multidimensionality and Real Time Analytics, Business Intelligence, and the Web	<b>13</b>
<b>UNIT-4</b>	
<b>Knowledge Management:</b> Introduction to Knowledge Management, Organizational learning and transformation, Knowledge management initiatives, Approaches to knowledge management, Information technology in knowledge management, Knowledge management system implementation, roles of people in knowledge management, ensuring success of knowledge management <b>Expert system:</b> Basics concepts of expert system, Applications of expert system, Structure of expert systems, How expert system works, Problems areas suitable for expert systems, Benefits and capabilities of expert systems, Problems and limitations of expert system, Expert system success factors, Types of expert systems,	<b>13</b>

#### References:

1. Business Intelligence, A Managerial Perspective on Analytics Sharda, R, Delen D, Turban E. Pearson. 2014 2
2. Decision support systems and intelligent systems Efraim Turban , Jay E. Ting-Peng Liang PHI 7 th edition,2010
3. Business Intelligence, Analytics, and Data Science, Ramesh Sharda, Dursun Delen Efraim Turban Pearson Education 2019
4. Data Science for Business Foster Provost & Tom Fawcett O'Reilly Media, Inc 2013

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

<b>CO</b>	<b>Statement</b>
1	Apply the basics of data and business to understand Decision Support systems and Business Intelligence framework.
2	Describe the significance of computerized Decision Support, apply the basics of mathematics to understand the mathematical modeling behind decision support.
3	Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.
4	Analyze the importance of knowledge management and explain its activities, approaches and its implementation.

## Deep Learning

<b>Course: Deep Learning</b>	<b>Course Code: 24MCA4E4CL</b>
<b>Teaching Hours/Week(L-T-P):4-0-0</b>	<b>No. of Credits:04</b>
<b>Internal Assessment: 30Marks</b>	<b>Semester End Examination: 70Marks</b>

<b>UNIT-1</b>	<b>Teaching Hours</b>
Introduction to AI, Machine Learning, and Deep Learning, Definitions and differences, Real-world applications, The Evolution of Machine Learning, From probabilistic models to neural networks, Key milestones in ML history, Understanding Deep Learning, Key concepts and terminology, Why "deep"? The role of multiple layers, Current Achievements and Future Directions, Notable successes, The hype vs. the reality, Future trends and predictions, Data Representations for Neural Networks, Scalars, vectors, matrices, and tensors, Real-world examples, Tensor Operations, Element-wise operations, Broadcasting, Tensor reshaping, Gradient-Based Optimization, Derivatives and gradients.	<b>13</b>
<b>UNIT-2</b>	
Overview of TensorFlow and Keras, History and development, Key features and components, Basic TensorFlow Operations, Constant tensors and variables, Basic mathematical operations, Practical Exercise: Linear Classifier in TensorFlow, Building and training a simple linear classifier, Building Blocks of Neural Networks, Layers, models, and the compile step, Choosing Loss Functions and Metrics, Different types of loss functions, Metrics for evaluation, Training and Evaluating Models, The fit() method, Monitoring loss and metrics, Inference and Model Usage, Making predictions.	<b>13</b>
<b>UNIT-3</b>	
Binary Classification, Regression Analysis, K-fold validation and model evaluation, multiclass classification, and regression, Generalization, Underfitting, and Overfitting, Strategies to avoid overfitting, Model Evaluation Techniques, Training, validation, and test sets, Beating a baseline, Improving Model Fit, Tuning gradient descent parameters, Architectural improvements, Improving Generalization, Data curation and feature engineering, Early stopping and regularization techniques.	<b>13</b>
<b>UNIT-4</b>	
Basics of Convolutional Neural Networks, Convolution and pooling operations, Training ConvNets from Scratch, Small dataset challenges and solutions, Data Augmentation Techniques, Enhancing training datasets, Image Segmentation, Techniques and applications, Modern ConvNet Architectures, Time Series Data and Tasks, Types and challenges, Use cases, Temperature Forecasting Example, Data preparation and model building, Recurrent Neural Networks (RNNs).	<b>13</b>

### References:

1. Deep Learning with Python, François Chollet, Manning Publications, 2<sup>nd</sup> Edition, Co, ISBN: 9781617296864
2. Deep Learning for Coders with fastai & PyTorch, Jeremy Howard & Sylvain Gugger, O'reilly, ISBN:978-1-492-04552-6
3. Neural Networks – A Comprehensive Foundation, Simon Haykins, PHI, 2005, ISBN10: 0139083855

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

<b>CO</b>	<b>Statement</b>
1	Describe basic concepts of neural network, its applications and various learning models
2	Acquire the knowledge on Recurrent, Recursive Nets
3	Analyze different Network Architectures, learning tasks, Convolutional networks
4	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
5	Analyze performance of deep learning techniques

## Multimedia and Animation

<b>Course: Multimedia and Animation</b>	<b>Course Code: 24MCA4G2AL</b>
<b>Teaching Hours/Week(L-T-P):2-0-0</b>	<b>No.ofCredits:02</b>
<b>Internal Assessment:20Marks</b>	<b>Semester End Examination:30Marks</b>

<b>UNIT1</b>	<b>Teaching Hours</b>
Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles, Text, images, audio and video	<b>08</b>
<b>UNIT2</b>	
Text and image compression, compression principles, text compression- Run length, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression-GIF, TIFF and JPEG	<b>09</b>
<b>UNIT3</b>	
Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework	<b>09</b>

### References:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.
2. John Billamil, Louis Molina, "Multimedia: An Introduction", PHI, 2002.
3. Fred Halsall, "Multimedia Communications", Pearson education, 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

<b>CO</b>	<b>Statement</b>
1	Understand the multimedia application
2	Understand the Animation elements
3	Understand various Video compression techniques.

## Cyber Security

<b>Course: Cyber Security</b>	<b>Course Code: 24MCA4G2BL</b>
<b>Teaching Hours/Week(L-T-P):2-0-0</b>	<b>No. of Credits:02</b>
<b>Internal Assessment: 20Marks</b>	<b>Semester End Examination: 30Marks</b>

<b>UNIT1</b>	<b>Teaching Hours</b>
INTRODUCTION TO 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.	<b>08</b>
<b>UNIT2</b>	
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.	<b>09</b>
<b>UNIT3</b>	
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 Attacks, Attacks on Wireless networks.	<b>09</b>

### References:

1. Sunit Belapure and Nina 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

<b>CO</b>	<b>Statement</b>
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.

## R-Programming

<b>Course :R-Programming</b>	<b>Course Code:24MCA4G2CL</b>
<b>Teaching Hours/Week(L-T-P):2-0-0</b>	<b>No. of Credits:02</b>
<b>Internal Assessment:20Marks</b>	<b>Semester End Examination:30Marks</b>

<b>UNIT1</b>	<b>Teaching Hours</b>
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.	<b>09</b>
<b>UNIT2</b>	
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.	<b>09</b>
<b>UNIT3</b>	
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.	<b>08</b>

### 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](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

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

### Data Science Lab

<b>Course: Data Science Lab</b>	<b>Course Code: 24MCA4C12P</b>
<b>Teaching Hours/Week (L-T-P):0-0-4</b>	<b>No. of Credits :02</b>
<b>Internal Assessment: 20 Marks</b>	<b>Semester End Examination: 30 Marks</b>

SL.NO	Lab Programs 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 3. Histograms
7	Basic Visualization using matplotlib in Python 1. Bar charts 2. Pie charts 3. Box plots 4. 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:**  
**Time: 3 Hours**

**Paper Title:**  
**Max. Marks: 70**

**Part A:**

Answer any ten questions. Each question carries 2 marks. 2x10=20

- 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        |
| <b>Total</b> |                   | <b>: 30 Marks</b> |

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### Scheme for Major Project Evaluation (PG)

- |              |   |                   |
|--------------|---|-------------------|
| 1.           | Project Write Up<br>(project's scope, objectives, methodology, use-case diagrams, results etc.) | : 15 Marks        |
| 2.           | Project Demo  | : 40 Marks        |
| 3.           | Viva Voce   | : 15 Marks        |
| <b>Total</b> |   | <b>: 70 Marks</b> |

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