Course	Master of Computer Applications (MCA)	**Semester - 1**
Type of Course	Core Courses	
Prerequisite	03060302-T - DIGITAL LOGIC DESIGN	
Course Objective	1.To understand the organization of a computer system in terms of its main components. 2.To understand internal structure and operation of digital computer. 3.To Understand the translation of aSEEmbly instructions into their binary representation.	

Teaching Scheme (Contact Hours)				**ASEEssment Scheme**			
Lecture	**Tutorial**	**Lab**	**Credit**	**Theory Marks**		**LAB**	**Total Marks**
				SEE	**CIA**		
3	1	0	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal ASEEssment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Digital Logic Circuits** Digital Computers, Logic Gates, Boolean algebra. **Digital Component and Data Representation** Combinational circuits, Flip-flops, Sequential Circuits. Integrated Circuits, Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Unit, Number System.	**10**	**15**
2	**Overview of Register Transfer** Register Transfer and Register Transfer Language, Bus and Memory transfer. **Micro Operations** Arithmetic Micro Operation, Logic Micro Operation, Shift Micro Operation, Arithmetic and Logic Shift Unit. **Basic Computer Organization and Design** Instruction Codes – Register, Instruction, Time and Control. Instruction Cycle, Memory Reference Instruction, I/O and Interrupt, Design of Computer, Design of Accumulator Logic.	**15**	**20**
3	**Basic Computer Programming** Introduction, Machine Language, ASEEmbly Language, the ASEEmbler, Program Loops. **Micro Programmed Control** Programming Arithmetic and Logic Operation, Subroutines, I/O–Programming. Control Memory; Address sequencing, Micro Program Example, Design of Control Unit**.**	**15**	**20**
4	**Central Processing Unit** Introduction to Central Processing Unit, General Register Organization, Stack. Organization Instruction Formats, Addressing Modes, Data Transfer and Manipulation. Program Control, RICS and CISC.	**10**	**25**
5	**Pipeline**	**10**	**20**

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	Parallel Processing; Pipelining-Arithmetic Pipelining, Instruction Pipelining, RISC Pipelining **Vector Processing** Vector Processing, Array Processor, Asynchronous Data Transfer, DMA, Priority Interrupt.		
		Total	**60**

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	30	10	20	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Discuss Basic Attributes of computer
CO2	Understand Numbering systems and conversion of numbering systems
CO3	Analyize How Central Processing Work
CO4	Identify various part Of System memory Hirerchy
CO5	Comprehend the features and performance parameters of different types of computer architectures.

Reference Books

1.	**Computer System Architecture (TextBook)** By M. Morris Mano | Pearson
2.	**Structured Computer Organization** By Tanenbaum A. S. | Prentice-Hall of India Pvt. Ltd. | 4, Pub. Year 2002

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Course	Master of Computer Applications (MCA)	**Semester - 1**
Type of Course	Core Courses	
Prerequisite	Basic HTML concept and SQL knowledge |	
Course Objective	1.Ability to develop web based applications using PHP interacting with database. 2.Ability to set & access cookies & session variables, Upload a file in PHP. 3.Ability to integrate AJAX and JQUERY in PHP	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	Tutorial	Lab	Credit	SEE	CIA	LAB	Total Marks
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**JavaScript Overview** Understanding JavaScript, uses of JavaScript, attaching external JavaScript, validating form fields using JavaScript, extending functionalities of form fields using JavaScript **JSON** Overview, Syntax, Data Types, Objects, Schema, Serializing into JSON, Parsing JSON	15	25
2	**Introduction to PHP Introduction** Basic HTML syntax, Basic PHP Syntax, using SFTP, Testing your script, Sending text to browser, Using the PHP Manual, Sending HTML to the browser, Adding comments to Scripts, Basic debugging steps **Variables:** What Are Variables?, Variable Syntax, Types of Variables, Variable Values, Understanding Quotation Marks **Form:** Creating a Simple Form, Choosing a Form Method, Receiving Form Data in PHP, Displaying Errors, Error Reporting, Manually Sending Data to a Page **Numbers:** Creating the Form, Performing Arithmetic, Formatting Numbers, Understanding Precedence, Incrementing and Decrementing a Number, Creating Random Numbers **Strings:** Creating the HTML Form, Concatenating Strings, Handling Newlines, HTML and PHP, Encoding and Decoding Strings, Finding Substrings, Replacing Parts of a String **Control Structures:** Creating the HTML Form, The if Conditional, Validation Functions, Using else, More Operators, Using else if The Switch Conditional, The for Loop	15	25
3	**Working with Arrays, Forms and Functions Using Arrays**	10	15

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	What Is an Array?, Creating an Array, Adding Items to an Array, Accessing Array Elements, Creating Multidimensional Arrays, ~~Sorting Arrays, Transforming Between Strings and Arrays, Creating an Array from a Form~~ **Creating Web Applications:** Creating Templates, Using External Files, Using Constants, Working with the Date and Time, Handling HTML, Forms with PHP, Revisited, Making Forms Sticky, Sending Email, Output Buffering, Manipulating HTTP Headers **Creating Functions:** Creating and Using Simple Functions, Creating and Calling Functions that Take Arguments, Setting Default Argument Values, Creating and Using Functions that Return a Value, Understanding Variable Scope

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
4	**Advanced PHP Cookies and Sessions** What Are Cookies?, Creating Cookies, Reading from Cookies, Adding Parameters to a Cookie, Deleting a Cookie, What Are Sessions?, Creating a Session, Accessing Session Variables, Deleting a Session **Files and Directories:** File Permissions, Writing to Files, Locking Files, Reading from Files, Handling File Uploads, Navigating Directories, Creating Directories, Reading Files Incrementally	**10**	**20**
5	**jQuery Basics** Exploring Fundamentals of jQuery, loading and using jQuery, describing call back functions, exploring jQuery Selectors, methods, manipulators, events and effects, exploring jQuery and AJAX	**10**	**15**
	Total	**60**	

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	20	30	10	10	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Explain basic concepts of PHP, including forms, numbers, strings, and control structures.
CO2	Analyse how to work with PHP, Jquery, and JSON.
CO3	Design web-based application with different PHP programming features like function, cookies, sessions etc.
CO4	Conduct experiments with JSON and JavaScript.
CO5	Prepare small applications through Jquery, JSON, and PHP together developing, testing and deploying asp.net web application.

Reference Books

1. **HTML5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery**
Kogent Learning Solutions Inc

2. **PHP for Web (TextBook)**
By Larry Ullman | fifth Edition, Pearson

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List of Practical	
1.	Write a PHP program to display current date and time and display Good Morning / Good Afternoon / Good Evening message according to current time
2.	Create a web page for user profile and execute a PHP file on submission of the form and display the information using PHP.
3.	Write a PHP program to find out maximum and minimum number.
4.	Create an application to create a cookie, access a cookie and destroy the cookie.
5.	Write PHP code to store image in a database table.
6.	Write PHP code to develop E-mail registration form and store all the submitted data in database table.
7.	Write a program to develop student registrationform and display all the submitted data on another page.
8.	Create a Webpage which will read data from JSON file display data into HTML table (use AJAX).
9.	Write a program to swapping two images using javascript
10.	Create a Registration form with validation using AJAX.

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Course	Master of Computer Applications (MCA)	**Semester - 1**
Type of Course	Core Courses	
Prerequisite	03080101-T - PROGRAMMING IN C	
Course Objective	1. Learn how to design and develop a Web page using HTML and CSS. 2. Learn how to link pages so that they create a Web site. 3. Learn to apply CSS in a web page	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Java Fundamentals** The Origins of Java,Java's Lineage: C and C++, How Java Impacted the Internet ,Java's Magic: The Bytecode, Moving Beyond Applets, The Java Buzzwords, ObjectOriented Programming(Encapsulation, Polymorphism, Inheritance), Obtaining the Java Development Kit,A First Simple Program, Handling Syntax Errors A Second Simple Program,Another Data Type, Two Control Statements (The if Statement and The for Loop), Create Blocks of Code, Semicolons and Positioning, Indentation Practices, The Java Keywords, Identifiers in Java, The Java Class Libraries **Introducing Data Types and Operators:** Why Data Types Are Important, Java's Primitive Types(Integers, Floating-Point Types, Characters), The Boolean Type, ,Literals (Hexadecimal, Octal and Binary Literals, Character Escape Sequences, String Literals), A Closer Look at Variables(Initializing a Variable, Dynamic Initialization), The Scope and Lifetime of Variables, Operators, Arithmetic Operators (Increment and Decrement), Relational and Logical Operators, Short-Circuit Logical Operators, The Assignment Operator, Shorthand Assignments, Type Conversion in Assignments, Casting Incompatible Types, Operator Precedence, Expressions (Type Conversion in Expressions, Spacing and Parentheses) **Program Control Statements:** Input Characters from the Keyboard, The if Statement, Nested ifs, The if-else-if Ladder, The switch Statement, Nested switch Statements, The for Loop, Some Variations on the for Loop, Missing Pieces (The Infinite Loop), Loops with No Body, Declaring Loop Control Variables Inside the for Loop, The Enhanced for Loop, The while Loop, The do-while Loop, Use break to Exit a Loop, Use break as a Form of goto, Use continue, Nested Loops	**15**	**15**
2	**Class Fundamentals Introducing Classes, Objects, and Methods** Class Fundamentals (The General Form of a Class, Defining a Class), How Objects Are Created, Reference Variables and Assignment, Methods (Adding a Method to the Vehicle Class), Returning from a Method, Returning a Value, Using Parameters (Adding a Parameterized Method to Vehicle), Constructors, Parameterized Constructors, Adding a Constructor to the Vehicle Class, The new Operator Revisited, Garbage Collection, The this Keyword **A Closer Look at Methods and Classes:** Controlling Access to Class Members (Java's Access Modifiers), Pass Objects to Methods (How Arguments Are Passed), Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding static (Static Blocks), Introducing Nested and Inner Classes, Varargs: Variable-Length Arguments (Varargs Basics, Overloading Varargs Methods, Varargs and Ambiguity)	**15**	**25**
3	**Inheritance Basics Inheritance**	**10**	**25**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, Using super to Call Superclass Constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When Are Constructors Executed?, Superclass References and Subclass Objects, Method Overriding, Overridden Methods Support Polymorphism, Why Overridden Methods? (Applying Method Overriding to TwoDShape), Using Abstract Classes, Using final, (final Prevents Overriding, final Prevents Inheritance, Using final with Data Members), The Object Class **Packages:** Packages (Defining a Package, Finding Packages and CLASSPATH, A Short Package Example), Packages and Member Access (A Package Access Example), Understanding Protected Members, Importing Packages, Java's Class Library Is Contained in Packages, **Interfaces:** Interfaces, Implementing Interfaces, Using Interface References, Variables in Interfaces, Interfaces Can Be Extended, Default Interface Methods (Default Method Fundamentals, A More Practical Example of a Default Method, Multiple Inheritance Issues), Use static Methods in an Interface, Private Interface Methods, Final Thoughts on Packages and Interfaces **Exception Handling:** The Exception Hierarchy, Exception Handling Fundamentals (Using try and catch, A Simple Exception Example), The Consequences of an Uncaught Exception (Exceptions Enable You to Handle Errors Gracefully), Using Multiple catch Statements, Catching Subclass Exceptions, Try Blocks Can Be Nested, Throwing an Exception (Rethrowing an Exception), A Closer Look at Throwable, Using finally, Using throws, Three Additional Exception Features, Java's Built-in Exceptions, Creating Exception Subclasses		
4	**Autoboxing, java.lang package**	**10**	**15**
	Autoboxing, Type Wrappers, Autoboxing Fundamentals, Autoboxing and Methods, Autoboxing/Unboxing Occurs in Expressions **Java.lang package (String, String Buffer, Comparable interface) The collection Framework:** Introduction, Collection framework (Collection interface, list interface, set interface, sorted set interface), The collection class, Array list and Link list classes (maintaining the capacity and the link list class), iterating elements of collection (the list iterator interface), hash set and tree set classes		
5	**Multi-Threading, Generic, I/O Multithreaded Programming**	**10**	**20**
	Multithreading Fundamentals, The Thread Class and Runnable Interface, Creating a Thread, (One Improvement and Two Simple Variations), Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, Synchronization, Using Synchronized Methods, The synchronized Statement **Using I/O:** Java's I/O Is Built upon Streams, Byte Streams and Character Streams, The Byte Stream Classes, The Character Stream Classes, The Predefined Streams, Using the Byte Streams (Reading Console Input, Writing Console Output), Reading and Writing Files Using Byte Streams (Inputting from a File, Writing to a File), Automatically Closing a File, Reading and Writing Binary Data		
	Total	**60**	

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	20	20	30	10	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Explain java fundamentals and Object Oriented Programming features.
CO2	Analyse how to work with class, object, and methods.
CO3	Design Java programs using inheritance, package, and interface.
CO4	Conduct experiments of Java IO package, reading and writing files with byte stream.
CO5	Prepare small applications through Java concepts like inheritance, package, interface, exception handling, and thread.

Reference Books	
1.	**Java™: A Beginner's Guide (TextBook)** By Herbert Schildt | 7th Edition
2.	**The Java Language** By James Gosling, Bill Joy, Guy Steele, Gilad Bracha
3.	**The Java Programming Language** By Ken Arnold, James Gosling, David Holmes | Addison-Wesley Pearson Education (4th Edition – 2005)

List of Practical	
1.	Write a simple "Hello World" java program, compilation, debugging, executing using java compiler and interpreter.
2.	Write a java program to check whether number is palindrome or not. Input: 528 Output: It is not palindrome number Input: 545 Output: It is not palindrome number
3.	Write a java program to check Armstrong number. Input: 153 Output: Armstrong number Input: 22 Output: not Armstrong number
4.	Write a program in Java to find minimum of three numbers using conditional operator.
5.	Write a program to accept a line and check how many consonants and vowels are there in line
6.	Create a class called Student. Write a student manager program to manipulate the student information from files by using FileInputStream and FileOutputStream
7.	Write a java program static block which will be executed before main ( ) method in a class.
8.	Write programs in Java to use Wrapper class of each primitive data types
9.	Write a program in Java to demonstrate the use of 'final' keyword in the field declaration. How it is accessed using the objects.
10.	Describe abstract class called Shape which has three subclasses say Triangle, Rectangle, and Circle. Define one method area () in the abstract class and override this area () in these three subclasses to calculate for specific object i.e. area () of Triangle subclass should calculate area of triangle etc. Same for Rectangle and Circle

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Course	Master of Computer Applications (MCA)	**Semester - 1**
Type of Course	Skill Enhancement Courses	
Prerequisite	Basic understanding of communication concepts and a willingness to engage in self-reflection and personal growth.	
Course Objective	1. Develop the ability to convey ideas clearly, listen actively, and communicate confidently in various contexts. 2. Foster positive relationships by understanding communication dynamics and empathizing with others. 3.Acquire the skills to deliver engaging presentations and speeches, bolstering self-assurance. 4.Explore techniques to enhance self-awareness, emotional intelligence, and personal development. 5.Cultivate a professional persona through appropriate workplace behavior, etiquette, and grooming	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks		**LAB**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	0	0	3	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**English grammar** Parts of speech, Clauses, Formation of sentence, Tenses	**15**	**25**
2	**Business Communications** Concept of business communication & business correspondence, Classification of communication – interpersonal, intrapersonal, Oral, written, non-verbal, etc., Principles of effective writing, Introduction to business letters.	**15**	**25**
3	**Introduction To Soft Skills** Meaning, introduction to soft skills & hard skills, Interdependence and differences between soft skills & hard skills, Merits of possessing soft skills, - Significant Soft skills and ways to develop Soft skills such a Time Management & Stress Management.	**15**	**25**
4	**Presentation Skill** Presentation styles, Structure and guideline for making a presentation, Common flaws and overcoming them, Body language and tips for giving a presentation & Presentation tips, Personality development, Interview Skills: Gestures, Body Languages, Pre-interview preparation, Do & Don't at Interview.	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Analyze	Evaluate	Create
Weightage	25	25	25	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Develop the ability to convey ideas clearly, listen actively, and communicate confidently in various contexts.
CO2	Foster positive relationships by understanding communication dynamics and empathizing with others.
CO3	Acquire the skills to deliver engaging presentations and speeches, bolstering self-assurance.
CO4	Explore techniques to enhance self-awareness, emotional intelligence, and personal development.
CO5	Cultivate a professional persona through appropriate workplace behavior, etiquette, and grooming.

Reference Books

1.	**10 Skills for Effective Business Communication (TextBook)** By Jessica Higgins

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Course	Master of Computer Applications (MCA)	**Semester - 1**
Type of Course	Core Courses	
Prerequisite	03080101-T - PROGRAMMING IN C	
Course Objective	1. To organizing data for implementation of efficient algorithms and program development. 2. To develop the capability of selecting a particular data structure. 3. To develop application using array, structure, function, pointer and file	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Data Structure** Introduction to Data Structure and different types of data Data types, primitive and non-primitive Linear & Non Linear Data Structures String, Introduction, Operation performed on string Array, Introduction to Arrays, Linear array and its representation	10	15
2	**Linear data Structure** Representation of arrays, Applications of arrays, sparse matrix and its representation **Stack** Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression ,Recursion **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	15	20
3	**Non Linear Data Structure Tree** Definitions and Concepts, Representation of binary tree, Binary tree traversal (In order, post order, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications of Trees- Some balanced tree mechanism, Height Balanced, Weight Balance , **Graph** Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)	15	20
4	**Hashing ,Sorting and Searching Hashing** The symbol table, Hashing Functions, Collision-Resolution Techniques **File Organization** File Organization, Introduction to File, Types of File Organization, Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods.	10	20

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5	Sorting and Searching	10	25

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Sorting types, Insertion, sort, Selection Sort, Quick Sort, Merge Sort, Radix sort, Searching types, Sequential Search and Binary Search		
	Total	**60**	

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	30	30	10	10	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand types of data structure mechanisms
CO2	Implement various types of algorithms using Data Structures.
CO3	Implement various types of searching and sorting algorithms using Data Structures.
CO4	Compare different Sorting and Searching Algorithms.
CO5	Apply various hashing techniques.

Reference Books

1.	**An Introduction to Data Structures with Applications. (TextBook)** By Jean-Paul Tremblay & Paul G. Sorenson | Tata McGraw Hill.
2.	**Data Structures using C & C++** By Ten Baum | Prenctice-Hall International
3.	**Fundamentals of Computer Algorithms by** By Horowitz, Sahni | Galgotia Pub. 2001 ed.

List of Practical

1.	Perform string operation using c language.
2.	Algorithm to search an element using linear search.
3.	Algorithm to search an element using binary search.
4.	Write a program of matrix multiplication.
5.	Write a program of matrix addition.
6.	Write a program to implement PUSH and POP operation of STACK.
7.	Write program to implement simple queue using c language.
8.	Write program to implement single linked list.
9.	Write program to implement Bubble sort.
10.	Write program to implement Insertion sort.
11.	Write program to implement Merge sort
12.	Write program to implement Selection sort.

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Course	Master of Computer Applications (MCA)	**Semester - 1**
Type of Course	Core Courses	
Prerequisite	03080101-T - PROGRAMMING IN C	
Course Objective	1. To understand the Fundamental of Database Management System, RDBMS and locking mechanism. 2. To learn the fundamental of data models and SQL query. 3. To develop application using PL/SQL blocks.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Database System Concepts and Architecture;.** Database and Users: Introduction (Basic Concepts: Data, Database, Database systems, Database Management Systems), Characteristics of Database Approach, Advantages of using the DBMS approach Database System Concepts and Architecture, Data Models, Schemas, Instances, the three schema architectures and data independence, Database Languages and interfaces, Database System environment, Centralized and client / Server Architecture for DBMS, Classifications of Database Management Systems	**12**	**20**
2	**Entity Relationship Diagram** Entity Relationship Diagram Using high level conceptual data models for database design (Design Phases of database design), Entity types, Entity Sets, Attributes and keys, Relationship Types, Relationship sets, Roles and structural constraints, Weak entity Types, Refining the ER diagram for company Database, Entity Relationship Diagram Naming conventions Design issues, Example of other Notation: UML class diagram, Relationship types of degree higher than 2 Subclasses, Super Classes, Inheritance Specialization and Generalization Relational Database design by ER and EER to Relational Mapping, Mapping EER model construct to Relations	**12**	**20**
3	**Database Design** Database Design Informal Design Guidelines for Relational Schema, Functional Dependencies, Normal Forms based on Primary keys, General definitions of 1NF, 2NF and 3NF, Boyce-Codd Normal Forms (BCNF), Multi-valued Dependency and Fourth Normal Form	**12**	**20**
4	**Transaction processing**	**12**	**20**

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	Introduction to Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, characterizing Schedules based on recoverability and Serializability		
5	**Relational Model Concept**	**12**	**20**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Relational Model concepts: Relational Model concepts, Relational Model constraints and Relational Database Schemas		
	Total	**60**	

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	20	20	10	20	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Learn how to manage databases and their relations.
CO2	Design the database schema with the use of appropriate data types for data storage in database.
CO3	Understand the uses the database schema and need for normalization
CO4	Use different types of physical implementation of database and understand ER diagram.
CO5	Write a program using SQL queries to implement join and trigger.

Reference Books

1. **Fundamentals of relational database management systems (TextBook)**
   By S.Sumathi | Springer
2. **Relational Database**
   By Dr.ms.Manisha Bharamde and Abhijeet D.Mankar | Nirali Prakashan

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List of Practical	
1.	Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted.
2.	Consider the enitity EMPLOYEE with following attributes: Practical on RDBMS . Emp-ID Employee-Name Address Phone Dependent-Name Relationship~to~Employee Skill Designation Designation-Start-Date Salary Salary-StarLDate Using the EMPLOYEE entity, convert each of the one-to-many association into a weak entity and a relationship. Identify the discriminator of each weak entity and the attributes of each relationship.
3.	The people's Bank offers five types of accounts: loan, checking, premium savings, RDBMS daily interest saving, and money market. It operates a number of branches and a client of the bank can have any number of accounts. Accounts can be joint, i.e., more than one client may be able to operate a given account. Identify the entities of interest and show their attributes. What relationships exist anlong these entities? Draw the corresponding E-R diagram.
4.	A University decides to computerise it's registration system. Identify the possible entities and relationships and Draw the E-R Diagram.
5.	In the Database file Add these Fields: (Total: Datatype- Number 3 digits, Percentage: Datatype – Number 3 digits with 2 decimal places, Grade: Datatype- Char with 2 letters)
6.	Create Marksheet table and Insert more 3 records in MARKSHEET using SQL mode.
7.	Update the values for newly added columns i.e. Total, Percentage, Grade table using UPDATE command.
8.	Display all records of the marksheet table, write SQL command.
9.	Display all records of the marksheet table, write SQL command.
10.	Display name, rollno, marks of 3 subjects, total and percentage using design view
11.	Write SQL command to display name, rollno, grades from the marksheet table.
12.	Display the maximum and minimum marks for Sub101 using design.
13.	Display the sum of marks for Sub102 using SQL command
14.	Display the rollno, student name and percentage whose name starts with A using SQL command.
15.	Display the rollno, student name and percentage whose name second letter is i using SQL command

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	02070301-T - DATABASE MANAGEMENT SYSTEM	
Course Objective	1. To understand the basic concepts of Path testing, Logic based testing 2. To implement Data flow testing, domain testing	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	1	0	4	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**INTRODUCTION TO DATA WAREHOUSING** Introduction – What is Data Warehousing - Data Warehousing concepts, Data Warehousing building blocks : Defining features – Data Warehouse and Data Marts, Issues in Data Warehousing -Benefits of Data Warehousing, Overview of Components, Metadata : Use of metadata in Data Warehouse, Categories of Metadata – Roles of Metadata, Architecture of Data Warehouse, Data Warehouse models, Methodology for Data Warehousing	**15**	**25**
2	**DATA DESIGN AND DATA PREPARATION** ETL Process overview, Data Extraction, Data Transformation, Data Loading, Data Quality, Challenges, ETL Tools, OLAP in Data Warehouse, Features and operations of OLAP – (Drill-down, Rollup, Slice, Dice), OLAP schema design OLAP Models	**15**	**25**
3	**INTRODUCTION TO DATA MINING** Motivation for Data Mining, Data Mining: On What kind of Data?, Definition and Functionalities: What kind of patterns can be mined?, Issues in DM, KDD Process, Classification of Data Mining Systems	**10**	**15**
4	**DATA PREPROCESSING** Why Preprocess the Data?, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation, Data Mining Primitives: What Defines a Data Mining Task?	**10**	**20**
5	**CONCEPT DISCRIPTION AND ASSOCIATION RULE MINING** What is concept description?, Association Rule Mining: Market basket analysis, Basic concepts, Finding frequent item sets: Apriori algorithm, generating rules, Improved Apriori algorithm, Frequent pattern growth algorithm	**10**	**15**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	30	10	10	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand the functionality of the various data mining and data warehousing component
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analyzing techniques of various data using OLAP Cube
CO4	Describe different methodologies used in data mining and data ware housing.
CO5	Compare different approaches of data ware housing and data mining with various technologies

Reference Books

1.	**Data Mining – Concepts & Techniques (TextBook)** By o Jiawei Han o Micheline Kamber | Morgan Kaufmann Publishers
2.	**Mordern Data Warehousing, Data Mining and Visualization (TextBook)** By o George M. Marakas | Pearson
3.	**Data Mining** By o Vikram Puri o P.RadhaKrishana | Oxfrod Press
4.	**Data Mining** By o Arun K. Pujari | University Press

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	03070501-T - COMPUTER NETWORK	
Course Objective	1. To provide an introduction to the fundamental principles of cryptography and network security. 2. To study various Encryption techniques. 3. To illustrate how to prevent, detect, and mitigate security threats against the network.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to cryptography and Network Security** Roadmap, Introduction to security, Security Trends, OSI security Architecture ,Security Attacks, Security services Security Mechanisms, A model for network Security, Security Attack and Security Threat, Malicious Software Hacking, Cryptography, Digital Signature, Firewall and its types, User identification and authentication, Other security measures	**10**	**15**
2	**Encryption Techniques** Symmetric Cipher model, Substitution Techniques, Transposition Techniques Steganography Block Cipher Principles, DES (Data Encryption Standard), Strength of DES, Block Cipher design principles. AES (Advance Encryption Standard), Origin, Evaluation, AES Cipher More on Symmetric ciphers- Block cipher mode of operation	**15**	**20**
3	**Public Key Cryptography and RSA** Principles of public key cryptosystems, Applications for public key Cryptosystems, RSA Algorithm, Security of RSA, Key Management- Distribution of Public keys, Distribution of secret keys using public key cryptography, Diffie-Hellman Key Exchange	**15**	**20**
4	**Message Authentication And Hash Function** Authentication Requirements, Authentication Functions, MAC (Message Authentication Codes), Hash Functions, Birthday attacks, Secure Hash Algorithm (SHA).	**10**	**20**
5	**Electronic Mail Security –Network Security** PGP and its operation, S/MIME, MIME and its Functionality IP Security, Applications, Architecture, Services, Security Association AH,ESP, Web security threats, SSL and SET, FIREWALL and its types	**10**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Create
Weightage	20	30	20	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand different security models and attacks
CO2	Enable the students to learn fundamental concepts of computer security and cryptography and utilize these techniques in computing systems.
CO3	Understand management issues and algorithm
CO4	Understand different security issues and their types
CO5	Study and evaluate different encryption techniques of cryptography
CO6	Configuration of ecryption algorithm and check their output

Reference Books

1.	**Cryptography and Network Security (TextBook)** By William Stalling | Pearson

List of Practical

1.	Write a program to configure Caesar Cipher.
2.	Write a program to configure Monoalphabetic Cipher.
3.	Write a program to configure Poly alphabetic Cipher.
4.	Write a program to configure Play fair Cipher.
5.	Write a program to configure One Time Pad Cipher.
6.	Write a program to configure One Time Pad Cipher.
7.	Draw Feistel Cipher structure.
8.	Draw Data Encryption Standard structure.
9.	Draw Advance Encryption Standard structure.
10.	Implement RSA

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	03080301-T - OBJECT ORIENTED PROGRAMMING WITH C++	
Course Objective	Its main objective is to teach the basic concepts and techniques which form the object-oriented programming paradigm.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Object Oriented Analysis and Design** Object Oriented Fundamental. Objects, Classes. Object oriented design process. Importance of modeling. Principles of modeling. Object oriented modeling concepts, Analysis & Design	**15**	**25**
2	**Introduction to UML** Concept of UML.Basic building blocks of UML.Mechanism in UML.Architecture.SDLC in UML	**15**	**20**
3	**Structural Modeling** Notations.Terminology.Relationships.Common Mechanisms.Examples.Diagrams – “Class Diagram, Object Diagram, Package Diagram, Composite Structure Diagram, Sequence Diagram.”	**10**	**20**
4	**Behavior Modeling** Notations.Terminology.Relationships.Common Mechanism.Examples.Diagrams – “Activity Diagram, Interaction Diagram, Use case Diagram”.	**10**	**15**
5	**Architectural Modeling** Notations.Terminology.Relationships.Common Mechanism. Examples Diagrams – “Component Diagram, Deployment Diagram.”	**10**	**20**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	10	30	10	10	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Summarize The Key Concept and Principle Of Object Oriented Analysis And Design
CO2	Apply Structure Modelling Techniques To Visually Represent Object In System.
CO3	Produced Detailed UML Diagrams To Model System And Behaviour Structure
CO4	Student Will Able To Create Object Oriented Modules And Diagrams To Represent Complex System
CO5	Test the compliance of the software with the SRS

Reference Books

1.	**Object Oriented Modeling and Design with UML (TextBook)** By Michael Blaha and James Rumbaugh | Pearson
2.	**Object Oriented Systems and Development** By Ali Bahrami | Tata McGrawHill Edition

List of Practical

1.	Draw architectural diagram of SDLC
2.	Show class diagram using any example
3.	Show Object diagram using any example.
4.	Show Package diagram using any example.
5.	Show class diagram using any example.
6.	Show Composite structure diagram using any example.
7.	Show Sequence diagram using any example.
8.	Show Activity diagram using any example.
9.	Show USE CASE diagram using any example.
10.	Show Interaction diagram using any example.

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Core Courses	
Prerequisite	149901103 - OBJECT ORIENTED PROGRAMMING USING JAVA	
Course Objective	1. Design & understand the most useful scripting language for development. 2. Build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions. 3. Learn the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python. 4. Understand the different types of Python Libraries using arrays	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4	70	30	50	150

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction** What is Python and history of Python? Unique features of Python Python-2 and Python-3 differences, Install Python and Environment Setup , First Python Program Python Identifiers, Keywords and Indentation Comments and document interlude in Python Command line arguments Getting User Input Python Data Types What are variables? Python Core objects and Functions Number and Maths	**10**	**25**
2	**List Ranges and tuples in python , Input and Output in Python** Lists in Python More About Lists Understanding Iterators Generators , Comprehensions and Lambda Expressions Introduction Generators and Yield Next and Ranges Understanding and using Ranges More About Ranges Ordered Sets with tuples Reading and writing text files writing Text Files Appending to Files and Challenge Writing Binary Files Manually Using Pickle to Write Binary File	**15**	**25**
3	**Input and Output in Python** Reading and writing text files writing Text Files, Appending to Files and Challenge Writing Binary Files Manually Using Pickle to Write Binary Files.	**10**	**10**
4	**Python Object Oriented** Overview of OOP, Creating Classes and Objects Accessing attributes, Built-In Class Attributes Destroying Object	**10**	**15**
5	**Python Libraries** Introduction to numpy, Creating arrays, Using arrays and Scalars Indexing Arrays, Array Transposition Universal Array Function Array Processing, What is pandas? Where it is used? Series in pandas Index objects Reindex, Drop Entry Selecting Entries Data Alignment Rank and Sort Summary Statics Missing Data Index Heirarchy	**15**	**25**
	Total	**60**	**100**

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	30	20	10	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Learn basic programming concepts such as function, control structures and Branching Statements in python
CO2	Understand Object Oriented programming approaches
CO3	Understand the use of Testing, Debugging, Exceptions and Assertions
CO4	Compare different sorting and searching Algorithms.
CO5	Develop, Test and deploy GUI based application using Python

Reference Books

1.	**Programming through Python (TextBook)** By M. T. Savaliya, R. K. Maurya, G. M. Magar | STAREDU Solutions

List of Practical

1.	Using NumPy and Panda for Data Analysis
2.	Write a Python program to sum all the items in a list.
3.	Write a Python program to multiples all the items in a list.
4.	Write a Python program to get the largest number from a list.
5.	Write a Python program to get the smallest number from a list.
6.	Write a Python program to count the number of strings where thestring length is 2 or more and the first and last character are samefrom a given list of strings.Sample List : ['abc', 'xyz', 'aba', '1221']Expected Result : 2
7.	Write a Python program to get a list, sorted in increasing order bythe last element in each tuple from a given list of non-empty tuples.Sample List : [(2, 5), (1, 2), (4, 4), (2, 3), (2, 1)]Expected Result : [(2, 1), (1, 2), (2, 3), (4, 4), (2, 5)]
8.	Write a Python program to clone or copy a list.
9	Write a Python program to find the list of words that are longerthan n from a given list of words.
10.	Write a Python function that takes two lists and returns True ifthey have at least one common member.
11.	Write a Python program to print a specified list after removing the0th, 2nd, 4th and 5th elements.

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Project work, Seminar and Internship	
Prerequisite		
Course Objective	-	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
0	0	8	4	-	-	100	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Guidelines for Project** AIM This course provides an opportunity for students to apply the knowledge and skills acquired in the core courses to larger and more complex problems and to gain experience in working in teams. LEARNING OUTCOMES Students would have taken the project in semester V as per the guidelines of SDP Part-I and required to continue to work in developed of software in the VIth semester. This course is designed to provide the student experience in working with a client organization from the initial request through a final design and development of prototype software. The student would be able to.. • Students will be exposed to software development process by choosing a typical business/scientific/administrative/system application. • Define project scope, assess feasibility, and establish a project schedule. • Get some experience in working with a client organization. • Gain experience in working in a group for successfully developing the deliverables. Mode of study: Half / One day off to work on the project in a week. (Atleast three hours must be allotted in weekly timetable for discussion/preparation of deliverables) Course Contents: 1. Developing System Design 2. Writing code for the project 3. Doing testing of the code Deliverables by the students: ? At the end of the semester, the student should be able to successfully develop the project and prepare the documentation (hard copy) as well as presentation of the project details. ? Live Demo of the Project must be shown at the time of presentation.		
	Total		

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	05070310-T - INTRODUCTION TO ARTIFICIAL INTELLIGENCE	
Course Objective	1. Understanding of the fundamental concepts of machine learning, including supervised learning, unsupervised learning and reinforcement learning. 2. Compare supervised and unsupervised machine learning algorithms. 3. Analyse basics of feature engineering and classify different statistical tools used in machine learning. 4.Implementation of Machine learning model on real life problems. 5.Evaluating machine learning model and improving performance of the model.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Machine Learning and preparing model** Overview of Human Learning and Machine Learning, Types of Machine Learning, Applications of Machine Learning , Tools and Technology for Machine Learning . Machine Learning activities, Types of data in Machine Learning, Structures of data, Data quality and remediation, Data Pre-Processing: Dimensionality reduction, Feature subset selection	**10**	**15**
2	**Modelling and Evaluation** Selecting a Model: Predictive/Descriptive, Training a Model for supervised learning, model representation and interpretability, Evaluating performance of a model, Improving performance of a model **Basics of Feature Engineering:** Feature and Feature Engineering, Feature transformation: Construction and extraction, Feature subset selection : Issues in high-dimensional data, key drivers, measure and overall process.	**15**	**20**
3	**Overview of Probability:** Statistical tools in Machine Learning, Concepts of probability, Random variables, Discrete distributions, Continuous distributions, Multiple random variables, Central limit theorem, Sampling distributions, Hypothesis testing, Monte Carlo Approximation **Supervised Learning Algorithm K-NN(K-Nearest Neighbours)** Introduction to K-NN, Distance formula(Euclidian distance, hammig distance), Significance of k, find k closest neighbours, Bias-Variance Trade-off, Advantage and Disadvantage of K-NN.	**15**	**20**
4	**Naïve Bayes**	**10**	**20**

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	Introduction to Naïve Bayes Theorem & Assumption, The zero-frequency problem. Types of Naïve Bayes Classifier, Prons and Cons of Naïve Bayes. **Decision Trees** An introduction to Decision Tree, Types of Decision Trees based on target variable **Linear Regression and Logistic Regression** Introduction to Liner Regression, Linear Regression cost function, Linear Regression using Gradient Descent Algorithm Introduction to Logistic Regression and limitation of Linear Regression model, Sigmoid function, Decision Boundaries. Cost function		
5	**Unsupervised learning Algorithm**	**10**	**25**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	K-means clustering Introduction of K-means clustering algorithm, popularity of K-Means **Neural Network** Introduction to neural network, introduction to ANN, Implementation of ANN, Architecture of ANN		
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Evaluate	Create
Weightage	15	15	20	20	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understanding of the fundamental concepts of machine learning, including supervised learning, unsupervised learning and reinforcement learning.
CO2	Compare supervised and unsupervised machine learning algorithms.
CO3	Analyse basics of feature engineering and classify different statistical tools used in machine learning.
CO4	Implementation of Machine learning model on real life problems.
CO5	Evaluating machine learning model and improving performance of the model.

Reference Books

1.	**Machine Learning (TextBook)** By Saikat Dull, S. Chjandramouli, Das, | Pearson

List of Practical

1.	Implement a simple feedforward neural network using a library like TensorFlow or PyTorch.
2.	Explore how different evaluation metrics like mean squared error and R-squared can be used to assess the model's performance.
3.	Implement logistic regression using scikit-learn on a binary classification dataset
4.	Experiment with different regularization strengths and observe their effects on the decision boundary.
5.	Use scikit-learn to create a linear SVM classifier. Visualize the decision boundary and support vectors for different kernels (linear and polynomial).
6.	Apply the k-means clustering algorithm using scikit-learn on a synthetic dataset. Explore the number of clusters and visualize the clustered data.
7.	Implement a basic convolutional neural network (CNN) using TensorFlow or PyTorch for image classification.
8.	Implement Q-learning to solve a simple environment like the "FrozenLake" problem from OpenAI Gym.
9.	Build a simple neural network using a library like TensorFlow or PyTorch to classify images from a standard dataset like MNIST.
10.	Implement hierarchical agglomerative clustering to create a dendrogram and understand the process of hierarchical clustering.

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	Basics knowledge of security and there concepts.	
Course Objective	1.Students will gain a deep understanding of different types of vulnerabilities, their classification 2.Students will develop practical skills in both static and dynamic malware analysis. They will be able to dissect malicious code, identify infection vectors, and assess the behavior of malware in controlled environments 3. Students will be proficient in using vulnerability scanning tools and methodologies to identify security weaknesses in networks and systems. 4. Students will gain hands-on experience with a variety of analysis tools and frameworks, including Metasploit, IDA Pro, Wireshark, and Volatility. 5. Students will develop strong communication skills and the ability to document their findings effectively.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Vulnerability Analysis** Understanding the concept of vulnerabilities, Types of vulnerabilities: software, hardware, and human factors, Importance of vulnerability analysis in cybersecurity, Common Vulnerability Scoring System (CVSS), CVE (Common Vulnerabilities and Exposures) identifiers, Zero-day vulnerabilities and their significance, Vulnerability databases and resources, How vulnerabilities are discovered, Vulnerability research and disclosure, Vulnerability assessment methodologies, Vulnerability scanners and their role, Understanding the attacker's perspective, Exploit development and exploitation frameworks, Metasploit and other penetration testing tools(Burp suit,Nmap, Ettercap, Sqlmap,)	**10**	**20**
2	**Malware Analysis Fundamental** What is malware?, Types of malware: viruses, worms, Trojans, ransomware, etc., Malware propagation and infection mechanisms, Real-world examples of malware incidents, Static vs. dynamic analysis, Setting up a malware analysis environment,Tools for malware analysis: IDA Pro, OllyDbg, Wireshark, etc., Sample collection and handling, Analyzing file headers and metadata, Disassembling and decompiling malware code, Identifying malicious patterns and signatures, Detecting obfuscation and anti-analysis techniques, Monitoring malware behavior in a controlled environment, Sandboxing and virtualization for dynamic analysis, Behavioral analysis techniques, Reporting and documenting malware findings	**15**	**25**
3	**Vulnerability Analysis Tools** Introduction to Nessus, OpenVAS, and other vulnerability scanners, Configuration and usage of vulnerability scanning tools, Interpreting scan results and generating reports, Conducting vulnerability assessments, Overview of web application vulnerabilities, Tools like OWASP ZAP and Burp Suite, Scanning for SQL injection, XSS, CSRF, and other web vulnerabilities, Exploiting known vulnerabilities, Customizing exploits and payloads, Post-exploitation activities and pivoting, Importance of patch management, Automated patch management tools, Applying patches and updates, Vulnerability mitigation strategies	**10**	**15**
4	**Malware Analysis Tools**	**15**	**25**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Reverse engineering malware, Advanced debugging techniques, Analyzing packed and encrypted malware, Identifying rootkits and advanced evasion techniques, Introduction to memory forensics, Tools like Volatility, Analyzing memory dumps for malware artifacts, Detecting and analyzing malware in RAM, Writing comprehensive vulnerability assessment reports, Creating malware analysis reports,Incident response procedures, Legal and ethical considerations in malware analysis		
	Total	**50**	**85**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	20	20	20	25	15

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Students will gain a deep understanding of different types of vulnerabilities, their classification.
CO2	Students will develop practical skills in both static and dynamic malware analysis. They will be able to dissect malicious code, identify infection vectors, and assess the behavior of malware in controlled environments.
CO3	Students will be proficient in using vulnerability scanning tools and methodologies to identify security weaknesses in networks and systems.
CO4	Students will gain hands-on experience with a variety of analysis tools and frameworks, including Metasploit, IDA Pro, Wireshark, and Volatility.
CO5	Students will develop strong communication skills and the ability to document their findings effectively.

Reference Books

1. **"Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" (TextBook)**
   By Michael Sikorski and Andrew Honig
2. **"The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws"**
   By Dafydd Stuttard and Marcus Pinto

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List of Practical	
1.	Installation and configuring Kali Linux
2.	In a controlled environment, working on provided malware sample using tools like Wireshark and Process Monitor.
3.	Students set up a vulnerable web application and use tools like OWASP ZAP or Burp Suite to scan for common web vulnerabilities like SQL injection and Cross-Site Scripting (XSS).
4.	Students customize exploits and payloads for specific vulnerabilities and practice post-exploitation activities.
5.	Students are given a simple binary with obfuscated code and are tasked with reverse engineering it to understand its functionality.
6.	Create a virtualized malware analysis environment.
7.	Using memory dumps provided, students perform memory forensics using tools like Volatility.
8.	Analyze malware behavior in a sandboxed environment.
9.	Use Nessus or OpenVAS to scan and report on vulnerabilities.
10.	Identify malicious patterns in encrypted or obfuscated malware.

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	05070409-T - MACHINE LEARNING ALGORITHMS(T)	
Course Objective	1.Explain AI techniques, models, criteria, and search techniques. 2.Analyse knowledge representation. 3.Learn Symbolic reasoning and probabilistic reasoning. 4.Describe Game playing and planning of different types. 5.Understanding natural language processing and connectionist models	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	0	3	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction** The AI Problems, The Underlying Assumption, AI techniques, The Level of The Model, Criteria For Success **Problems, State Space Search & Heuristic Search Techniques:** Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics and Issues in the Design of Search Programs, Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	**10**	**20**
2	**Knowledge Representation** Representations And Mappings, Approaches To Knowledge Representation, Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions and Predicates, Resolution, Procedural versus, Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning.	**15**	**20**
3	**Symbolic Reasoning Under Uncertainty:** Introduction To Nonmonotonic Reasoning, Logics For Non-monotonic Reasoning. **Probabilistic Reasoning :** Probability And Bays' Theorem, Certainty Factors And Rule- Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic	**15**	**20**
4	**Game Playing** Overview, MiniMax Search Procedure, Alpha-Beta Cut-offs, Refinements, Iterative deepening. **Planning:** The Blocks World, Components Of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems	**10**	**20**
5	**Natural Language Processing:**	**10**	**20**

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Introduction, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking **Connectionist Models:** Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.		
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	30	10	10	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Explain AI techniques, models, criteria, and search techniques.
CO2	Analyse knowledge representation.
CO3	Learn Symbolic reasoning and probabilistic reasoning.
CO4	Describe Game playing and planning of different types.
CO5	Understanding natural language processing and connectionist models.

Reference Books

1. **Artificial Intelligence (TextBook)**
By Elaine Rich And Kevin Knight (2nd Edition) | Tata Mcgraw-Hill

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Course	Master of Computer Applications (MCA)	**Semester - 2**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	Basic knowledge of network security	
Course Objective	1.Explain AI techniques, models, criteria, and search techniques. 2.Analyse knowledge representation. 3.Learn Symbolic reasoning and probabilistic reasoning. 4.Describe Game playing and planning of different types. 5.Understanding natural language processing and connectionist models.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	0	3	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction** Systems Vulnerability Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet	15	25
2	**Firewall and its types** Network Defense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, Snort: Introduction Detection System	15	25
3	**Cyber Crime and it's laws** Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Realms of the Cyber world, Recognizing and Defining Computer Crime, Contemporary Crimes, Contaminants and Destruction of Data, Indian IT ACT 2000.	15	25
4	**Investigation of cyber crime** Introduction to Cyber Crime Investigation Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.	15	25
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate
Weightage	25	25	25	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Student will proficiently identify and address system vulnerabilities using tools like OpenVAS and Metasploit.
CO2	Students will design and configure firewalls, intrusion detection systems like Snort, and employ NAT and port forwarding for robust network security.
CO3	Student will understand various cybercrime types, hacking methods, and relevant legal frameworks, including the Indian IT Act of 2000.
CO4	Students will be skilled in investigating cybercrimes, including analyzing keyloggers, spyware, viruses, and DoS attacks.
CO5	Students will master network analysis tools like Nmap and Wireshark, enabling them to assess network security and respond effectively to threats.

Reference Books

1.	**Cyber security: Understanding cybercrimes, computer forensics and legal perspectives.** By Godbole, Nina, Belapure, Sunit (2011) | New Delhi: Wiley India

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	13990402-T - JAVA PROGRAMMING	
Course Objective	1) To Introduce Mobile Radio System and Characteristics of Radio Waves 2) To introduce of Mobile Radio Propagation and wireless system. 3) To Familarizes the Mobile Network Layer and Mobile Transport Layer.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Android & Android Application Design** The Open Handset Alliance The Android Platform, Android SDK ,Building a sample Android application, Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions, Managing Application resources in a hierarchy, Working with different types of resources	**15**	**25**
2	**Android User Interface Design** User Interface Screen elements, Designing User Interfaces with Layouts, Dialogs, Drawing and Working with Animation	**15**	**25**
3	**Database Connectivity Using SQLite and Content Provider** Using Android Data and Storage APIs Managing data using SQLite and Perform (insert update delete and select operation), Sharing Data Between Applications with Content Providers, Introduction to rest api, Introduction to Retrofit	**10**	**15**
4	**Location Based Services (LBS) Common Android API Notifications Services Deployment of applications** Using Global Positioning Services (GPS) , Geocoding Locations,Mapping Locations, Generate marker, Many more with location based services, Android networking API,Android web API, Android telephony API,Notifying the user Notifying with the status bar, Vibrating the phone,Blinking the lights,Customizing the notifications Services, Application development using JSON in MySQL, Publish android application	**10**	**20**
5	**Introduction To iPhone** Introduction To X-Code (IDE) What is Storyboard, Framework Design User Interface for button text view text field etc., Creating And Building Simple Application, Cocoa Touch And MVC	**10**	**15**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze
Weightage	30	30	10	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	How to build a sample Android application using different types of Design Essentials.
CO2	Design the User Interfaces with Layouts and Working with Animation.
CO3	Use the Android API to managing data using SQLite.
CO4	Developing a proper Android Application with can be used as a real world application.
CO5	Test application and run in different environment.

Reference Books

1.	**Android Wireless Application Development (TextBook)** By Lauren Darcey and Shane Conder | Pearson Education 2nd ed. (2011)
2.	**Mobile Computing using Android & iPhone** By Bharat & Company | An Outlook Towards Star Formation Processes in RCW79
3.	**Professional Android 2 Application Development** By Reto Meier Wiley | India Pvt Ltd (2011)

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List of Practical	
1.	Install Android Studio, Hello World, Logging, Install Android Studio
2.	Make Your First Interactive UI
3.	Working with TextView Elements, Use a scroll view for text with minor HTML formatting
4.	Create and Start Activities
5.	Create a Recycler View Create an activity that displays data in a RecyclerView, Make the items in the list clickable, and Add a floating action button to add items to the list
6.	Theme, Custom Styles, Drawables, Define and use a theme, Define and use a custom style that uses a drawable
7.	Add a FAB and Cards, Create an app that uses a Floating Action Button (FAB), and Add an activity that uses cards. Optionally, style the cards. Customize your app's theme and styles to use Material Design styles and colors
8.	Implement Localized Strings, Create localized strings in your app, and Test by changing the default language
9.	Use Espresso to test your UI, Use Espresso to Test Your UI
10.	Create an AsyncTask, Create a simple AsyncTask to do work in the background
11.	Use AsyncTaskLoader, Use AsyncTaskLoader instead of AsyncTask to show book search results in a RecyclerView
12.	BroadcastReceiver, Create an app with a BroadcastReceiver
13.	Notifications, Trigger a Notification, Add Actions to your Notification
14.	Alarm Manager, Implement an alarm manager
15.	Job Scheduler, Use JobScheduler to do background updates
16.	Firebase Job Dispatcher
17.	Get and Save User Preferences, Implement Settings menu to allow users to enter preferences, Implement code to retrieve and user preferences.
18.	Save user data in a database, Create an app that allows users to enter notes, Save the notes in a SQLite Database, Create an app that stores data in an SQL database, Displays the data in a RecyclerView, Allow users to add, delete, and edit data items.
19.	Querying and Searching a Database.
20.	Implement a Content Provider, Add a content provider for your SQLite database
21.	Use a ContentResolver to query your data, Use a content resolver to query the database, and Display the results of the query, Use the content resolver to add data to the database
22.	Beta testing your app, Running a beta test on Google Play.

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	149901204-T - APPLICATION DEVELOPMENT USING PYTHON	
Course Objective	1. Explain the concept of visualization in the processing and analysis of data. 2. Develop visualization methods and visualization systems using software applications. 3. Perform creative work in the field of visualization.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Data Analysis and Visualization** Overview of data analysis and visualization, Introduction to different types of data (structured, unstructured, semi-structured), Basics of data collection and cleaning, Understanding data analysis workflow, Introduction to data visualization techniques and best practices	**10**	**10**
2	**Data Analysis Techniques** Introduction to statistical analysis, Descriptive statistics: measures of central tendency and dispersion, Inferential statistics: hypothesis testing, confidence intervals, Exploratory data analysis: data exploration and visualization	**15**	**20**
3	**Data Visualization Tools** Introduction to Python Libraries for Data Analysis **Working on Python** Creating basic visualizations (bar charts, line graphs, scatter plots),Customizing visualizations: colors, labels, axes, and legends, Creating interactive visualizations (filters, tooltips, drill-downs), Incorporating visualizations into reports and dashboards	**15**	**30**
4	**Advanced Data Analysis and Visualization** Time series analysis and forecasting,Cluster analysis: K-means clustering, hierarchical clustering,Decision trees and random forests for predictive modeling,Network analysis and visualization, Storytelling with data: effectively communicating insights through visualizations	**10**	**25**
5	**Real world project Data Analysis and Visualization** Implementing and exploratory analysis of real world projects of data analysis	**10**	**15**
	Total	**60**	**100**

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy					
Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	20	20	15	15	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Explain the concept of visualization in the processing and analysis of data.
CO2	Understand and apply techniques for data cleaning, including handling missing values, outliers, and inconsistent data.
CO3	Learn how to preprocess and format data for analysis, such as data type conversion and normalization.
CO4	Perform data analysis using Python libraries such as Pandas for data manipulation and aggregation.
CO5	Learn how to draw meaningful conclusions from data analysis and present insights to stakeholders.

Reference Books

1.	**Data Visualization (TextBook)** By Kieran Healy | Princeton University Press
2.	**Fundamentals of Data Visualization** By Claus O. Wilke | O'Reilly Media

List of Practical

1.	Write a program for data processing using pandas library of python to convert one dimensional array of tuple and dictionary to series
2.	Write a program for data processing using pandas library of python to convert two dimensional array to dataframe and exploring different commands of data frame.
3.	Creating data frame, reading, writing, accessing, and filtering, sorting, adding and modifying data in data frame for data analysis.
4.	Data processing for sorting, adding and modifying data in data frame for data analysis.
5.	Grouping and aggregating, merging and joining, reshaping data, handling dates and times for data analysis.
6.	Basic data visualization using matplotlib library of python library bar charts, line graphs, scatter plots.
7.	Basic data visualization using plotly library of python library bar charts, line graphs, scatter plots.
8.	Basic and Customized data visualizations: colors, labels, axes, and legends and Creating interactive visualizations (filters, tooltips, drill-downs) using different library of python.
9.	Time series analysis and forecasting and using other libraries.
10.	Data exploration of real world projects.

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	03070603-T - OBJECT ORIENTED ANALYSIS AND DESIGN WITH UML	
Course Objective	1. To assist the student in understanding the basic theory of software engineering 2. To apply these basic theoretical principles to a group software development project	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Software Engineering** Software Process Structure – Process Models & Activities – Agile Development - Requirements Engineering.	15	25
2	**Software Modeling** Design Concepts - Architectural Design - Component Level Design – User Interface Design Web Application Design.	15	25
3	**Software Quality Management** Review Techniques - Software Quality Assurance – Software Testing Strategies – Software Configuration Management – Product Metrics	10	15
4	**Managing Software Projects** Project Management Concepts – Process and Project Metrics – Estimation for Software Projects – Project Scheduling - Risk Management.	10	20
5	**Software Reliability & Security** Reliability Engineering- Reliability and availability – Reliability Testing. Security Requirements & Design.	10	15
	Total	60	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	30	20	10	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Discuss Software Devlopment Life Cycle and its importance
CO2	Develop some basic level of software architecture
CO3	Understanding the concept and Importance of Software Project Managment.
CO4	List and Diffrerentiate between Various Testing Technique.
CO5	Discuss Different Software Devlopment Process Models

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Reference Books	
1.	**Software Engineering : A Practitioner's Approach (TextBook)** By Roger S. Pressman | McGraw-Hill
2.	**Fundamentals of Software Engineering** By Rajib Mall | PHI
3.	**Software Engineering : A Practitioner's Approach** By Roger S. Pressman | McGraw-Hill publisher

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Core Courses	
Prerequisite	02070503-T - COMPUTER NETWORKS	
Course Objective	1. To learn how to use Cloud Services 2. To implement Virtualization, Task scheduling algorithm and to build private network. 3. Apply Map-reduce concept to applications	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction** Cloud Computing, Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Virtualization: Virtualization of Computing, Storage and Resources. Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS	**10**	**15**
2	**Software as a Service (SaaS)** Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms. Infrastructure As a Services (IaaS): Introduction, Background & Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. Platform As a service (PaaS): Integration of Private and Public Cloud, Technologies and Tools for Cloud Computing, Resource Provisioning services	**15**	**20**
3	**Abstraction and Virtualization** Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management, Virtualization for Data Center Automation	**15**	**20**
4	**Cloud Infrastructure and Cloud Resource Management** Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards.	**10**	**20**
5	**Security** Security Overview, Cloud Security Challenges and Risks, Software-as-a Service Security, Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Data Security, Application Security, Virtual Machine Security, Identity and Presence, Identity Management and Access Control, Autonomic Security Establishing Trusted Cloud computing, Secure Execution Environments and Communications, , Identity Management and Access control Identity management, Access control, Autonomic Security Storage Area Networks, Disaster Recovery in Clouds.	**10**	**25**
	Total	**60**	**100**

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy					
Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	20	20	20	10	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Analyze the different layers Cloud computing using different architectures with it's advantages and disadvantages.
CO2	Explore the Cloud Architecture along with IaaS, SaaS, PaaS using Application Frameworks.
CO3	Use the concept of Abstraction and Virtualization of CPU, Memory , I/O Devices, Virtual Clusters and Resource management
CO4	Understand the Cloud Infrastructure and Resource Management in Cloud Computing
CO5	Learn about Cloud Security to overcome different types of Challenges and Risks.

Reference Books

1.	**1. Cloud Computing: Principles and Paradigms (TextBook)** By Rajkumar Buyya, James Broberg, Andrzej M Goscinski | Wiley publication

List of Practical

1.	Cloud SPI models.
2.	Case studies on :Infrastructure as a Service (IaaS),Virtualization, Platform as a service
3.	Case Study on: (PaaS), Cloud platform management.
4.	Case Study on: Software as a Service
5.	Data security and Storage, Data privacy, Access management, Cloud computing standards and Interoperability
6.	Case Study: Amazon Web Services
7.	Case Study on Cloud simulation Tool Kit.

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Project work, Seminar and Internship	
Prerequisite		
Course Objective	-	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
0	0	8	4	70	30	100	100

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Project Guideline**		**100**

AIM
This course provides an opportunity for students to apply the knowledge and skills acquired in the core courses to larger and more complex problems and to gain experience in working in teams.
LEARNING OUTCOMES
This course is designed to provide the student experience in working with a client organization from the initial request through a final design and development of prototype software.
The student would be able to..
• Students will be exposed to software development process by choosing a typical business/scientific/administrative/system application.
• Define project scope, assess feasibility, and establish a project schedule.
• Get some experience in working with a client organization.
• Gain experience in working in a group for successfully developing the deliverables.
Mode of study: Half / One day off to work on the project in a week. (Atleast three hours must be allotted in weekly timetable for discussion/preparation of deliverables)
Course Contents:
1. Developing System Design
2. Writing code for the project
3. Doing testing of the code
Deliverables by the students:
· At the end of the semester, the student should be able to successfully develop the project and prepare the documentation (hard copy) as well as presentation of the project details.
· Live Demo of the Project must be shown at the time of presentation.

Total		**100**

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	05070409-T - MACHINE LEARNING ALGORITHMS(T)	
Course Objective	1. Demonstrate Understanding. 2. Extract and Describe Image Features. 3. Utilize Image Recognition and Object Detection Techniques.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
Lecture	**Tutorial**	**Lab**	**Credit**	**Theory Marks**		**LAB**	**Total Marks**
				SEE	**CIA**		
3	0	0	3	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Computer Vision & Image Processing** Introduction and motivation behind computer vision and image processing, Understanding of Human vision system & computer vision, How vision works, Application of computer vision, Image processing basics steps, Components of image processing system.	**10**	**15**
2	**Image Sampling and Quantization** Image types, Sampling of image, resolution and pixels, Image Histrograms, Filters and their examples, Distance Measures between pixels, Image Enhancement in the Spatial and Frequency Domain: Image enhancement by point processing, Image enhancement by neighborhood processing, Basic Gray Level Transformations, Zooming, Basics of Spatial Filters, Smoothening and Sharpening	**15**	**35**
3	**Edge Detection for Computer Vision** Basics of edge detection, Edge Detection in Mammals, Edge Detection for Computer Vision, Simple Edge Detectors, Image Gradient, Effects of Noise, Good Edge Detector designing, Motivation for Edge Detection, Edge Basics, Finding the Gradient, Canny Edge Detector	**10**	**15**
4	**Features, Fitting, Image Segmentation and Morphological Image Processing** Template matching, Introduction to machine learning for image classification, Convolutional Neural Networks (CNNs), Object detection algorithms (e.g., YOLO, Faster R-CNN)	**15**	**15**
5	**Apply Computer Vision in Real-World Applications** Real-world applications of computer vision and their working, such as robotics, autonomous vehicles, medical imaging, and potential impact of computer vision on society and emerging trends.	**10**	**20**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	20	20	10	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understanding of Computer Vision & Human Vision
CO2	Extract and Describe Image Features
CO3	Utilize Image Recognition and Object Detection Techniques.
CO4	Learn about Image Transformation
CO5	To Learn Image Segmentaion techniques

Reference Books	
1.	**Computer Vision: Algorithms and Applications (TextBook)** By Richard Szeliski | Springer 2010
2.	**Digital Image Processing** By Rafael C. Gonzalez and Richard E. Woods | Pearson, 2018.

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	149901209-T - CYBER SECURITY CONCEPTS AND PRACTICES	
Course Objective	1.Explain cyber forensics, digital detective and various processes, policies and procedures. 2.Describe relevant legislation and codes of ethics. 3.Apply E-discovery, guidelines and standards, E-evidence, tools and environment.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	0	3	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Cyber Forensics Concepts** Cyber Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.	**10**	**15**
2	**Cyber Incident Response and Analysis** Incident- Response Methodology, Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.	**15**	**35**
3	**Cyber Incident Handling** Image Capturing, Authenticating Evidence, Hidden Data Extraction, Data Storage, File Systems, Recovery of deleted files, Cracking Passwords, Internet Crime Investigations, Web Attack Investigations.	**10**	**15**
4	**Network Forensics & Analysis** Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data. Mobile Forensics: mobile forensics techniques, mobile forensics tools.	**15**	**15**
5	**Cyber Forensics Audit** Cyber Forensics: Prepare a case audit, begin an investigation, understand computer forensics workstations and software, conduct an investigation, complete a audit, Critique a case audit.	**10**	**20**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Evaluate	Create
Weightage	20	15	20	20	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may

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vary slightly from above table.

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Course Outcomes

At the end of this course, students will be able to:	
CO1	Learn how to investigate and respond to cybersecurity incidents, including data breaches and cyberattacks.
CO2	Learn about key legal concepts such as cybercrime, intellectual property rights, privacy, and electronic evidence.
CO3	Develop hands-on skills in ethical hacking, including penetration testing, vulnerability assessment, and network reconnaissance.
CO4	Learn how to identify and exploit security vulnerabilities ethically and responsibly
CO5	Understand security best practices and principles for protecting computer systems, networks, and data

Reference Books

1.	**Network forensics: Tracking hackers through cyberspace (TextBook)** By Davidoff, S. (2012) | New Delhi: Pearson education India
2.	**Cyber security: Understanding cybercrimes, computer forensics and legal perspectives.** By Godbole, Nina, Belapure, Sunit (2011) | New Delhi: Wiley India
3.	**Cyber Laws and IT Protection (TextBook)** By Chander, H. (2012). | New Delhi: Prentice Hall India Learning Private Limited.

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	05070409-T - MACHINE LEARNING ALGORITHMS(T)	
Course Objective	1. Develop deep neural network. 2. Develop algorithms to learn linear and non-- linear models using tensor flow. 3. Perform creative work in the field DL to solve given problem.	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Deep Learning & Tensorflow** Deep Learning: A revolution in Artificial Intelligence, Machine Learning Limitations, What is Deep Learning?, Advantage of Deep Learning over Machine learning, Reasons to go for Deep Learning, Real-Life use cases of Deep Learning, Review of Machine Learning: Regression, Classification, Clustering, Reinforcement Learning, Underfitting, Overfitting and Optimization. What is TensorFlow?, How tensor flow works.	**10**	**15**
2	**Understanding Neural Network with Tensorflow** Introduction to Neural network & Tensorflow, How deep learning works, TensorFlow code-basics, Activation Functions, How Backpropagation Works, HelloWorld with TensorFlow, Linear Regression, Nonlinear Regression, Logistic Regression using Tensorflow, Types of Deep Networks	**15**	**35**
3	**Convolutional Neural Networks (CNN)** Introduction to Convolutional Neural Networks, Applications of Convolutional Neural Network, CNN Architecture, Convolution and pooling layers of CNN, Understanding and visualization of CNN using Tensorflow.	**10**	**15**
4	**Recurrent Neural Network, Restricted Boltzmann Machine (RBM) and Autoencoders** Introduction of Recurrent Neural Network model, Applications of Recurrent Neural Network and their use cases, Modelling Sequences of RNN, Training RNN model with backpropagation, Long Short-Term Memory (LSTM) , Recursive Neural Tensor Network Theory , Recurrent Neural Network Model, Introduction to RBM Model and their applications, Introduction to Autoencoders, Autoencoders applications, Understanding Autoencoders	**15**	**15**
5	**TFLearn and Real-time project Introduction to TFlearn, Model Composition with TFlearn** Sequential Composition, Functional Composition, Predefined Neural Network Layers, What is Batch Normalization, Saving and Loading a model with TFLearn Real-time Deep Learning with TensorFlow project.	**10**	**20**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create

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Weightage	10	20	20	20	20	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Develop deep neural network.
CO2	Develop algorithms to learn linear and non-- linear models using tensor flow.
CO3	Perform creative work in the field DL to solve given problem.
CO4	Understand the training process, including backpropagation, gradient descent technique
CO5	Gain knowledge of deploying models using TensorFlow Serving for real-world applications

Reference Books	
1.	**Neural Networks and Deep Learning (TextBook)** By Charu C. Aggarwal | Springer
2.	**The Art and Science of Algorithms that Make Sense of Data** By Peter Flach | First Edition, Cambridge University Press, 2012.

List of Practical	
1.	Tensor Flow working with n-dimensional array generation & exploration
2.	TensorFlow handling and manipulation.
3.	Tensor flow implementation with CNNs.
4.	Tensor flow implementation with RNNs
5.	Tensor flow implementation for Time Series Prediction with LSTM.
6.	Tensor flow implementation with Logistic regression.
7.	Tensor flow implementation with KERAs.
8.	Tensor flow implementation for Reinforcement Learning
9.	Tensor flow implementation for classification problem.
10.	Tensor flow implementation for gradient descent problem.

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Course	Master of Computer Applications (MCA)	**Semester - 3**
Type of Course	Discipline Specific Elective Courses	
Prerequisite	149901208 - T - VUNERABILITY AND MALWARE ANALYSIS TOOLS	
Course Objective	1.Demonstrate Proficiency in Web Application Security Concepts. 2.Apply Security Tools and Techniques. 3.Develop Secure Web Applications. 4.Analyze and Respond to Security Incidents. 5.Stay Current with Emerging Trends.	

Teaching Scheme (Contact Hours)				**Assessment Scheme**			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	**LAB**	**Total Marks**
3	0	0	3	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction to Web Application Security** Overview of web application security landscape, Common web vulnerabilities (SQL injection, XSS, CSRF), Importance of security in software development	**15**	**25**
2	**Web Application Architecture and Technologies** Understanding web application components, HTTP/HTTPS protocols and their security implications, Client-server interaction and communication	**10**	**15**
3	**Security Testing and Vulnerability Assessment** Types of security testing (black box, white box, grey box), OWASP Top Ten project and its significance, Introduction to penetration testing	**10**	**15**
4	**Web Application Security Tools** Automated vulnerability scanners (e.g., Burp Suite, OWASP ZAP), Authentication and authorization tools, Secure coding practices and static analysis tools	**10**	**20**
5	**Web Application Security Tools** Web Application Firewalls (WAF) and their role, Encryption and data protection techniques, Security monitoring, incident response, and emerging trends	**15**	**25**
	Total	**60**	**100**

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy					
Level	Remembrance	Understanding	Analyze	Evaluate	Create
Weightage	15	25	15	25	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Demonstrate Proficiency in Web Application Security Concepts
CO2	Apply Security Tools and Techniques.
CO3	Develop Secure Web Applications.
CO4	Analyze and Respond to Security Incidents.
CO5	Stay Current with Emerging Trends.

Reference Books

1.	**Hadoop: The Definitive Guide (TextBook)** By Tom White | Third Edit on, O'reily Media, 2012
2.	**Big Data Analytics** By Seema Acharya, Subhasini Chellappan | Wiley 2015

List of Practical

1.	Explore Burp Suite to find and fix website problems like hackers might. It's like a security check for websites
2.	Learn about OWASP Zap to look for sneaky website issues. It's like a detective tool for websites to stay safe.
3.	Use Wireshark to see how data travels on the internet. It helps you understand and fix network issues.
4.	Play with Postman to talk to websites and see how they respond. It's like having a conversation with the internet
5.	Try SQL Map to spot and fix secret problems in websites. It's like finding hidden doors in a digital house.
6.	Use Nmap to explore networks and find out what's open. It's like discovering doors and windows in a big building.
7.	Experiment with Metasploit to understand how hackers might try to break in. It's like learning how to lock your digital doors.
8.	Check out Ghidra to understand complex programs. It's like decoding puzzles in computer programs.
9.	Test Brakeman with Ruby on Rails websites to see if they're safe. It's like checking for traps in a digital adventure.
10.	Try Grafana and Prometheus to watch how websites are doing. It's like keeping an eye on a digital garden to make sure everything is growing well.

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Course	Master of Computer Applications (MCA)	**Semester - 4**
Type of Course	Project work, Seminar and Internship	
Prerequisite		
Course Objective	-	

Teaching Scheme (Contact Hours)				Assessment Scheme			
				Theory Marks			
Lecture	**Tutorial**	**Lab**	**Credit**	**SSE**	**CIA**	**LAB**	**Total Marks**
0	0	24	12	-	-	-	600

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Project Guidelines**		

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Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	AIM This course provides an opportunity for students to apply the knowledge and skills acquired in the core courses to larger and more complex problems and to gain experience in working in teams. LEARNING OUTCOMES Students would have taken the project in semester V as per the guidelines of SDP Part-I and required to continue to work in developed of software in the VIth semester. This course is designed to provide the student experience in working with a client organization from the initial request through a final design and development of prototype software. The student would be able to.. • Students will be exposed to software development process by choosing a typical business/scientific/administrative/system application. • Define project scope, assess feasibility, and establish a project schedule. • Get some experience in working with a client organization. • Gain experience in working in a group for successfully developing the deliverables. Mode of study: Half / One day off to work on the project in a week. (Atleast three hours must be allotted in weekly timetable for discussion/preparation of deliverables) Course Contents: 1. Developing System Design 2. Writing code for the project 3. Doing testing of the code Deliverables by the students: □ At the end of the semester, the student should be able to successfully develop the project and prepare the documentation (hard copy) as well as presentation of the project details. □ Live Demo of the Project must be shown at the time of presentation. □ Documentation: □ A single hard bound documentation of SDP Part-II should also consist of the documentation prepared in SDP Part-I. □ Although the students might have submitted the documentation of SDP Part-I, it should not be considered for evaluation. □ A log-sheet of reporting to college faculty must be maintain. □ A hard copy of the documentation should consist of the additional following details: • Cover Page Page 20 | 40 • Company Certificate • College Certificate • Acknowledgement • Index (with page nos.) • Screen layouts • Report layouts • Sample coding (optional) • Future Enhancements (optional) • Conclusion • Bibliography • Log-sheet of reporting		
	Total		

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