

First Year semester-wise structure
for
Two Year M.C.A. Program
As per NEP 2020, for Affiliated Colleges

w.e.f.– June 2024

Abbreviations:

- **T:** Theory Course
- **P:** Practical course
- **DSC:** Discipline Specific Core Course
- **DSE:** Discipline Specific Elective Course
- **OJT:** On Job Training: Internship/ Apprenticeship
- **RP:** Research Project
- **RM:** Research methodology
- **MOC:** MOOC

Master of Computer Application program is a four-year program as per National Education Policy 2020 with effect from academic year 2024-25. Curriculum designed for MCA includes fundamentals and recent technologies required in IT industries.

Program Educational Objectives (PEO)	
PEO 1	Advanced Knowledge and Technical Skills Provide a strong foundation in programming, data structures, and algorithms, enabling students to excel in the IT industry
PEO 2	Practical and Research Skills Develop the ability to apply theoretical knowledge to practical problems through hands-on projects and research, fostering innovation and problem-solving skills.
PEO 3	Professional and Ethical Practices Instill professional ethics, effective communication, and leadership skills to prepare graduates for successful careers and leadership roles.
PEO 4	Lifelong Learning and Adaptability Encourage continuous learning and adaptability to evolving technologies and methodologies in the dynamic field of computer applications

Program Outcomes (PO)	
PO 1	Technical Proficiency Gain a thorough understanding of computer science principles, programming languages, software engineering, and technology tools.
PO 2	Problem Solving and Analytical Skills Analyze complex problems, design solutions using appropriate methodologies, and evaluate their effectiveness.
PO 3	Research and Development Conduct research contribute to technological advancements and apply innovative solutions to practical problems.
PO 4	Project Management and Development Manage and lead projects, including planning, execution, and delivery within specified constraints.
PO 5	Ethical and Professional Practices Demonstrate professionalism, ethical behavior, and the ability to work collaboratively in diverse environments.
PO 6	Lifelong Learning Engage in continuous learning and adapt to new technologies and industry trends.

Program Specific Outcomes (PSO)		Cognitive Level
PSO 1	Software Development Design, develop, and maintain software applications using advanced programming languages, frameworks, and tools.	BT Level 2 ,3,6
PSO 2	Data Management and Analysis Manage and analyze large datasets using modern database systems, data science techniques, and big data technologies.	BT Level 2 ,3,4
PSO 3	Cyber security and Information Security Understand cyber security principles and practices, protecting information systems from various threats and vulnerabilities	BT Level 2 ,3,5
PSO 4	Emerging Technologies Work with emerging technologies such as artificial intelligence, machine learning, block chain, and cloud computing	BT Level 2 ,3,6

Semester-wise Code structure for M.C.A.
Program as per NEP 2020, for Affiliated Colleges w.e.f – June 2024.

MCA– First Year, SEMESTER – I, Level –6.0

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/ Week			Marks			
					T	P	Total	Internal (CA)		External (UA)	
								T	P	T	P
DSC-1	DSC	MCA-411	Object Oriented Programming Using Java	4	4	-	4	40	-	60	-
DSC-2		MCA-412	LAB on Object Oriented Programming Using Java	2	-	4	4	-	20	-	30
DSC-3		MCA-413	Data Structures and Algorithms	4	4	-	4	40	-	60	-
DSC-4		MCA-414	LAB on Data Structures and Algorithms	2	-	4	4	-	20	-	30
DSC-5		MCA-415	Python Programming	4	4	-	4	40	-	60	-
DSC-6		MCA-416	LAB on Python Programming	2	-	4	4	-	20	-	30
DSC-7		MCA-417	Artificial Intelligence	4	4	-	4	40	-	60	-
Elective DSE –I (A) DSE-II (B) Choose any one group	Elective Group1	MCA-418 (A)	Cloud Computing I	2	2	-	2	20	-	30	-
		MCA-418 (B)	LAB on Cloud Computing-I	2	-	4	4	-	20	-	30
	Elective Group2	MCA-419 (A)	Data Science I	2	2	-	2	20	-	30	-
		MCA-419 (B)	LAB on Data Science-I	2	-	4	4	-	20	-	30
	Elective Group3	MCA-420 (A)	Cyber Security	2	2	-	2	20	-	30	-
		MCA-420 (B)	LAB on Cyber Security	2	-	4	4	-	20	-	30
	Elective Group4	MCA-421 (A)	Web Technologies I	2	2	-	2	20	-	30	-
		MCA-421 (B)	LAB on Web Technologies-I	2	-	4	4	-	20	-	30

Semester-wise Code structure for M.C.A.											
Program as per NEP 2020, for Affiliated Colleges w.e.f – June 2024.											
MCA– First Year, SEMESTER – II , Level – 6.0											
Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/Week			Marks			
					T	P	Total	Internal (CA)		External (UA)	
								T	P	T	P
DSC-8	DSC	MCA-431	Database Management System (DBMS)	4	4	-	4	40	-	60	-
DSC-9	DSC	MCA-432	LAB on Database Management System (DBMS)	2	-	4	4	-	20	-	30
DSC-10	DSC	MCA-433	Software Project Management	4	4	-	4	40	-	60	-
DSC-11	DSC	MCA-434	Machine Learning	4	4	-	4	40	-	60	-
Elective DSE –III (A) DSE-IV (B) Choose any one group	Group1	MCA-435(A)	Advance Cloud Computing II	2	2	-	2	20	-	30	-
		MCA-435(B)	LAB on Advance Cloud Computing II	2	-	4	4	-	20	-	30
	Group2	MCA-436(A)	Data Science II	2	2	-	2	20	-	30	-
		MCA-436(B)	LAB on Data Science II	2	-	4	4	-	20	-	30
	Group3	MCA-437(A)	Information Security & Mitigation	2	2	--	2	20	-	30	-
		MCA-437(B)	LAB on Information Security & Mitigation	2	-	4	4	-	20	-	30
	Group4	MCA-438(A)	Web Technologies II	2	2	-	2	20	-	30	-
		MCA-438(B)	LAB on Web Technologies II	2	-	4	4	-	20	-	30
Elective DSE –V (A) DSE-VI (B) Choose any one group	Group1	MCA-439(A)	Internet of Things	2	2	-	2	20	-	30	-
		MCA-439(B)	LAB on Internet of Things	2	-	4	4	-	20	-	30
	Group2	MCA-440(A)	Big Data Analytics	2	2	-	2	20	-	30	-
		MCA-440(B)	LAB on Big Data Analytics	2	-	4	4	-	20	-	30
	Group3	MCA-441(A)	Natural Language Processing	2	2	-	2	20	-	30	-
		MCA-441 (B)	LAB on Natural Language Processing	2	-	4	4	-	20	-	30
	Group4	MCA-442(A)	Digital Image Processing	2	2	-	2	20	-	30	-
		MCA-442 (B)	LAB on Digital Image Processing	2	-	4	4	-	20	-	30
RM	RM	RM-417	Research Methodology	4	4	-	4	40	-	60	-
Cumulative Credits for First Year –52											



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-411 Object Oriented Programming Using Java
W.E.F.2024-25
[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	I	CA Marks:	40
Course Code	MCA-411	UA Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. Understand Fundamental concepts of object oriented programming using Java.
2. Develop applications using polymorphism, inheritance, interfaces and inner classes and Multi-threading.
3. Develop GUI applications and event driven applications development.

Unit-1: INTRODUCTION TO JAVA

[Lecture-10] [Marks-15]

History of Java, Features of Java (Java Buzz words), Obtaining Java Environment, Setting up Java Environment, Structure of the Java Program, Creating a Source File, Compiling the Source File into a .class file, Executing the Program, The Java Virtual Machine, Comments, Data types, variables, Keywords, Operators, Control Structures, Arrays

Unit-2: INTRODUCTION TO OOPS

[Lecture-08] [Marks-15]

OOPs concepts, Predefined classes(String, String Buffer), type casting, wrapper classes, Input and Output, User defined class, object creation and initialization, finalize() method, static fields and methods, this keyword, Access specifier Inner class

Unit-3: INHERITANCE, POLYMORPHISM AND INTERFACES

[Lecture-08] [Marks-15]

Dynamic Polymorphism (Method Overloading and Method Overriding), Static Polymorphism, final keyword, Superclass, Subclass, super keyword, Abstract classes, Methods with a Variable Number of Parameters, Enumeration Classes, Interfaces, Reflection

Unit-4: MULTITHREADING AND EXCEPTIONS

[Lecture-10] [Marks-15]

Creating Thread, Multi-Tasking using Threads, Thread Synchronization or Thread Safe, Thread Class Methods , Thread Communication, Thread Properties, Thread Group, Thread States (Life-Cycle of a Thread), Exception handling (try, catch, finally), throws clause, throw clause, Types of Exceptions(built-in, user defined), Assertions

Unit-5: GRAPHICS PROGRAMMING AND EVENT HANDLING

[Lecture-12] [Marks-20]

Introduction to swing and awt, Creating a Frame, Positioning a Frame, Displaying Information in a Component, Working with 2D Shapes, Color, Special Fonts for Text, JComponent class Methods, Creating Components in Swing (PushButton, Label, JComboBox Class , JList Class, JMenu Class), Layout Manager (Flow Layout, Border Layout, Card Layout, Grid Layout, GridBag Layout), Basics of Event Handling, Listeners and Listener Methods, Mouse Events, Keyboard Events, AWT Event Hierarchy

Unit-6: STREAMS, FILES AND JDBC

[Lecture-12] [Marks-20]

Input and output stream, Reading and Writing Binary Data, Reading and Writing text Data, File Management(File Class), The Design of JDBC, JDBC Configuration, Executing SQL Statements, Query Execution Scrollable and Updatable Result Sets, Row Sets, Metadata, Transactions, Packages.

Reference Books:

1. Horstman Cay, Cornell Gary, Core Java™2, Vol.1&2, Seventh Edition, Pearson education.

2. Herbert Schildt, the Complete Reference, Seventh Edition, Tata McGraw-Hill. 3. Steven Holzner, JAVA 2 Programming Black Book, Wiley India. 4. Ivor Horton, Beginning Java 2, JDK 5 Ed, Wiley India.	
Course Outcomes : At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Recall Java syntax rules, including data types, variables, and control structures.	Remember (1)
CO2: Create Java application development using polymorphism, inheritance, and inner classes.	Create (6)
CO3: Develop GUI interface and event driven applications.	Create (6)
CO4: Manipulate databases through java application.	Apply (4)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-412 Lab on Java Programming
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-412	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objectives:

1. Programming using inner classes and inheritance, polymorphism and interfaces.
2. Use various swing components and handle several events in the development of GUI Applications.
3. Use JDBC and package creation.

1. Implement a program that demonstrates program structure of java with use of arithmetical and 21 logical implementation.
2. Implement a program that demonstrates string operations using String and String Buffer class.
3. Implement a program that demonstrates inner class and static fields.
4. Implement a program that demonstrate inheritance, polymorphism.
5. Implement a program that demonstrates 2D shapes on frames.
6. Implement a program that demonstrates color and fonts.
7. Implement a program to illustrate use of various swing components.
8. Implement a program that demonstrates use of dialog box and menus.
9. Implement a program that demonstrates event handling for various types of events.
10. Implement a program to illustrate multithreading.
11. Implement a program to illustrate exception handling.
12. Implement a program to demonstrate use of File class.
13. Implement a program that demonstrates JDBC on application.
14. Implement a program that demonstrate package creation and use in program.

Course Outcomes: After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Write java programs using inner classes and static fields in implementation of Java application	Apply (3)
CO2: Develop Java application for GUI development and event handling.	Create (6)
CO3: Develop database application using JDBC.	Apply (3)
CO4: Students will be able to apply Java programming constructs to develop simple programs that solve basic computational problems.	Apply (3)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-413 Data Structures and Algorithms
W.E.F.2024-25

[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	I	CA Marks:	40
Course Code	MCA-413	UA Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. To impart the basic concepts of data structures and algorithms
2. To understand basic concepts about array, stacks, queues, linked lists, trees and graphs and advance topics like AVL Trees, BTrees, B* and B+ Trees
3. To understand concepts about searching, sorting and hashing techniques

Unit-1: INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS [Lecture-08] [Marks-08]

Algorithmic Notation: Format Conventions, Statement and Control Structures. Time and Space Analysis: Data types and Abstract data types, Types of Data structures; Primitive, Non primitive, Linear and Nonlinear Data structures

Unit-2: ARRAYS, STACKS AND QUEUES [Lecture-08] [Marks-15]

Array: Storage representation, operations and applications (Polynomial addition and subtraction)
Stack: operations and applications (infix, postfix and prefix expression handling), **Queue:** operations and applications, Circular Queues: operations and applications, Concept of Double ended Queue and Priority Queue, Linked representation of stack and queue.

Unit-3: LINKED LISTS [Lecture-09] [Marks-15]

Operations and Applications of Linear linked list (Polynomial addition and subtraction), Circular linked list and Doubly linked list.

Unit-4: TREES [Lecture-10] [Marks-22]

Binary Trees, Binary Tree: Representations, Operations (insert/delete), Traversal (inorder, preorder, post order, level order), Threaded Binary Tree, Search Trees: AVL Tree, single and double rotations, M-Way Search Tree (definition), B-Trees and B+: Definition, properties, insertion and deletion operation, Red-Black trees, Splay trees

Unit-5: GRAPHS AND THEIR APPLICATIONS [Lecture-09] [Marks-16]

Representation (Matrix/Adjacency) and Traversal (Depth First Search/Breadth First Search), Spanning Trees, Minimal Spanning Tree (Prim's and Kruskals's algorithm), Shortest Paths and All Pair Shortest Path: Dijkstra's, Floyd-Warshall Algorithms.

Unit-6: FILE STRUCTURES [Lecture-05] [Marks-08]

File organization: Sequential, indexed, and direct access; File operations: Creation, reading, writing, updating; Indexing and hashing in file systems

Unit-7: HASH TABLE, SEARCHING, AND SORTING [Lecture-11] [Marks-16]

Hash Function, Collision and its Resolution, Separate Chaining, Open Addressing (linear probing, quadratic probing, double hashing), Rehashing, **Extendible Hashing Searching:** Linear Search and Binary Search (array/binary tree). Sorting: General Background, **Sorting Techniques:** Bubble Sort, Insertion Sort, Selection Sort, Quicksort, Mergesort, Heapsort and Radix Sort.

Reference Books:	
1. Tremblay, J. & Sorenson, P.G., (2001), An Introduction to Data Structures with Application, Mcgraw Hill India, ISBN: 978-0074624715, 0074624717 2. Langsam, Y., Augenstein, M.J. & Tenenbaum A.M., (2015), Data Structures using C and C++, 2nd Edition, Pearson Education ISBN: 978-9332549319, 9332549311 3. Balagurusamy, E., (2013), Data Structures using C, 1st Edition, Mcgraw Hill Education, ISBN: 978-1259029547, 1259029549 4. Weiss, M.A., (2002), Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson India, ISBN: 978-8177583588, 8177583581 5. Horowitz, E., Sartaj S. & Mehta, D. (2008), Fundamentals of Data Structures in C++, Universities Press ISBN: 978-8173716065, 8173716064 6. Lafore, R., (2003), Data Structures & Algorithms in Java, 2nd Edition, Pearson India, ISBN: 978-8131718124, 8131718123 7. Kruse, R., Tondo, C.L., Leung B., & Mogalla S, (2006), Data Structures and Program Design in C, Pearson India, ISBN: 978-8177584233.	
Course Outcomes : After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.	Understand (2)
CO2: Understand data structures such as arrays, linked lists, stacks and queues, graphs, trees and hash tables.	Understand (2)
CO3: Understand about hash functions, collision resolution techniques like separate chaining and open addressing.	Understand (2)
CO4: Study binary trees: representations, operations like insert and delete, and traversal methods including in order, preorder, postorder, and level order.	Analyze (4)



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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-414 Lab on Data Structures and Algorithms
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-414	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objectives:

1. Solve real-world problems by reasoning about data structure choices, choose appropriate implementations.
2. To make the students write various programs and ADTS for all data structures.
3. Students will learn to write, debug, and test large programs systematically.

Implementation of programs based on the following

- Arrays, Multidimensional Arrays, Matrices
- Stacks, Polish Notation
- Queues, Deques
- Linear Linked List, Circular Linked List, Doubly Linked List

Implementation of programs based on Trees

- Binary Search Tree
- In-order, Pre-order and Post-order Traversals
- Heap Tree

Implementation of programs based on Graphs

- Depth First Traversal
- Breadth First Traversal
- Obtaining Shortest Path (Dijkstra and Floyd-Warshall)
- Minimum spanning tree (Kruskal and Prim)

Implementation of programs for Hash Table, Searching and Sorting techniques

- Hash Table
- Linear and Binary Search (using array)
- Bubble sort
- Selection sort
- Insertion sort
- Radix sort
- Quick sort
- Merge sort
- Heap sort

Course Outcome: After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Ability to analyze the time and space complexities of Algorithms	Understand(2)
CO2: Understand the difference between structured data and data structure.	Remember (1)
CO3: Choose the appropriate data structure and algorithm design method for a specified application.	Evaluate (6)
CO4: Ability to design programs using a variety of data structures such as stacks, queues, binary trees, search trees and etc.	Analyze (4)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-415 Python Programming
W.E.F.2024-25

[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	I	CA Marks:	40
Course Code	MCA-415	UA Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. Understand Fundamental concepts of object oriented programming using python programming.
2. Develop applications using polymorphism, inheritance, interfaces and inner classes and Multi-threading.
3. Develop GUI applications and event driven applications development.

Unit-1: INTRODUCTION AND PROGRAMMING BASICS [Lecture-05] [Marks-15]

Python Installation, Features, Application, Identifier, Identifier Naming, Data Types, Comments in Python, Keywords, Strings, Casting, Literals, Type conversion, operators and its types, Variables, Scope of Variables , Decision Making: if statement, If.. else statement, Loops: For loop, While loop, Loop control statements: break, continue, pass, Nested loop, List, Tuples, Set, Dictionaries

Unit-2: FUNCTION CLASS AND ORGANIZING PROGRAMS [Lecture-10] [Marks-20]

Python Functions, Built in Functions Types of Python Functions, Arguments and Parameters, Layers of Functions, Pass by Reference vs. Pass by Value, Local and Global Scope, Anonymous Functions, Lambda Functions, Map, Filter, Object Oriented Concepts- Class, Object, __init__() Method, Array-Methods, Modules and Packages, Re-importing Modules and Packages, Python Constructor, Types of Constructors, Python built-in class functions, Inheritance, Overloading Methods, Overriding methods, Data Hiding

Unit-3: DATA STRUCTURES IN PYTHON [Lecture-15] [Marks-20]

Strings: Creating string, indexing and splitting, accessing values in strings, reassigning strings, deleting string, Working with the Characters of a String, string operators, string formatting, Built-in String Methods, Length, The Slice Operator, String Comparison

Lists: Accessing Elements in list, list length, List Slices, list methods, List Membership, Concatenation and Repetition, Objects and References, Aliasing and Copying, Cloning Lists, list loop, mutability, List Deletion, list as parameters, List Membership, Concatenation and Repetition, Append versus Concatenate Lists

Tuples: creating Tuple, Tuple indexing and slicing, Deleting Tuple, Tuple operations and built-in functions, List Vs. Tuple, Tuples and Mutability, Tuple Assignment, Tuples as arguments, Tuples as Return Values.

Dictionaries: Accessing the dictionary values, Adding dictionary values, Operations on Dictionary, Dictionary Methods, Built-in Dictionary methods, Iterating Dictionary, Dictionary Keys, Aliasing and Copying.

Unit-4: FILE AND DIRECTORIES & EXPRESSIONS [Lecture-10] [Marks-10]

File Objects, Files and directories-Creating, Renaming, Moving, Copying, Removing, OS Module, Path and directories, File Handling, Regular Expressions, Exceptions, Standard Exceptions, The try/except/else Statement, The raise Statement, The assert Statement.

Unit-5: PYTHON GUI PROGRAMMING [Lecture-10] [Marks-15]

GUI Programming Toolkits , Tkinter Introduction, Creating GUI Widgets with Tkinter, Resizing the Widget, Configuring Widget Options, Creating Layouts, Packing Order, Controlling Widget Appearances, Radio Buttons and Checkboxes, Dialog Boxes, Other Widget Types.	
Unit-6: TEXT PROCESSING AND ACCESSING DATABASE [Lecture-10] [Marks-20]	
Introduction of Text Processing , Searching for Files, Navigating the File System with the OS Module, Regular Expressions and the re Module and functions. DBM Or Relational Database, Compare DBM and Relational Database, SQL Statements, Database Tables – Create / Setup, Creating Connections , Transactions and Committing the Results.	
Reference Books:	
1. Allen B. Downey, O'Reilly [2012], Think Python, 1st Edition, ISBN-10: 144933072X / ISBN-13: 978-1449330729 2. T Hall and J-P Stacey [2009], Python 3 for Absolute Beginners, Apress, 1st Edition, ISBN-10: 1430216328 / ISBN-13: 978-1430216322 3. Peter C. Norton, Alex Samuel and others [2005], Beginning Python, Wrox, 1st Edition, ISBN-10: 0764596543 / ISBN-13: 978-0764596544 4. Luke Sneeringer, Wrox [2015], Professional Python, ISBN-10: 1119070856 / ISBN-13:978-1119070856	
Course Outcomes: At the end of the course, student will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand the basic concept of Python Programming.	Understand(2)
CO2: Understand lists, tuples, dictionaries, strings and files efficiently for solving real world problems.	Apply (3)
CO3: Recall the concepts of object-oriented programming using python.	Remember(1)
CO4: Understand modules, packages and GUI based programming for web.	Understand(2)
CO5: Develop Database connectivity steps.	Create (6)



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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-416 Lab on Python Programming
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-416	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objectives:

1. Programming Memorize common built-in functions and methods in Python for string manipulation, list operations, and file handling.
2. Explain the concepts of object-oriented programming in Python, including classes, objects, inheritance, and polymorphism.
3. Interpret Python code snippets and trace the flow of execution, understanding function definitions, parameter passing, and variable scope.

1. Introduction to Python Programming

- a. Python Step-by-step Installation Process.
- b. Implement a program based on strings.(slicing, casting, string function)
- c. Implement a program based on Simple statements using Variables, Scope of variable, Built-in Data Types, Types of operator, etc.
- d. Implement a program based on decision and looping statements.
- e. Implement a program based on Tuples, Lists, Dictionaries and Sets etc.

2. Function and Organizing Programs

- a. Implement a program based on Functions, Function with parameters.
- b. Implement a program based on Functions Inside of Functions.
- c. Implement a program based on built-in functions.
- d. Implement a program using Anonymous Functions - Lambda and Filter.
- e. Implement a program using Maps, List Comprehension and Dictionaries.
- f. Implement a program to demonstrate Class and Object.
- g. Implement a program to demonstrate Array.
- h. Implement a program to create, import and use package and modules.

4. File And Directories

- a. Implement a program based on Writing Text Files, Appending Text to a File, Reading Text Files.
- b. Implement a program based on paths and directories, file information, naming, moving, copying, and removing files.
- c. Implement a program Based on Regular Expression and its functions.

5. Python GUI Programming

- a. Implement a program creating Types of GUI Widgets, Resizing, and Configuring Options.
- b. Implement a program Creating Layouts, Packing Order, Controlling Widget Appearances.

6. Text Processing

- a. Implement a program based on Text Processing, Searching for Files.
- b. Implement a program to demonstrate HTML Parsing.

7. Accessing Databases

a. Implement a program based on using DBM - Creating and Accessing Persistent Dictionaries. b. Implement a program based on using Relational Database - Writing SQL Statements, Defining Tables, Setting Up a Database.(Transactions and Committing the Results.)	
Course Outcomes: At the end of the course, student will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Recall Python syntax rules, including variables, data types, and basic control structures (loops, conditionals).	Remember (1)
CO2: Demonstrate use and working of various data types, control structures, files, exceptional handling etc.	Apply (3)
CO3: Create, configure and make use of modules.	Create (6)
CO4. Develop console based and GUI applications (both procedural/object oriented) to solve different problems using python programming.	Create (6)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-417 Fundamentals of Artificial Intelligence
W.E.F.2024-25

[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	I	CA Marks:	40
Course Code	MCA-417	UA Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. Gain a historical perspective of AI and its foundations.
2. Study the concepts of Artificial Intelligence and investigate applications of AI techniques in intelligent agents
3. Learn various peculiar search strategies used in AI and use of them in solving problems using Artificial Intelligence.

Unit-1: WHAT IS AI

[Lecture-06][Marks-10]

Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, AI Agents.

Unit-2: SEARCH

[Lecture-24] [Marks-38]

UNINFORMED SEARCH: State Space Representation, Depth First Search, Breadth First Search, DFID.

INFORMED SEARCH: Best First Search, Hill Climbing, Beam Search, Tabu Search.

RANDOMIZED SEARCH: Simulated Annealing, Genetic Algorithms, Ant Colony Optimization.

Unit-3: MATHEMATICAL LOGIC AND INFERENCES

[Lecture-16] [Marks-26]

Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward chaining.

PROBLEM DECOMPOSITION: Goal Trees, AO*, Rule Based Systems, Rete Net.

Unit-4: GAME PLAYING AND PLANNING

[Lecture-14] [Marks-26]

GAME PLAYING: Minimax Algorithm, AlphaBeta Algorithm, SSS*.

PLANNING: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan

Reference Books:

1. Deepak Khemani (2013). A First Course in Artificial Intelligence, McGraw Hill Education (India).
2. Elaine Rich and Kevin Knight (1991). Artificial Intelligence, Tata McGraw Hill.
3. Stuart Russell and Peter Norvig (2009). Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall.

Course Outcomes: After completion of this course students shall be able to-

**Cognitive Level
(As Per Blooms
Taxonomy)**

CO1: Understand the informed and uninformed problem types.	Understand (2)
CO2: Identify problems that are amenable to solution by AI methods.	Apply (3)
CO3: Identify appropriate AI methods to solve a given problem.	Apply (3)
CO4: Understand system using different informed search / uninformed search or heuristic approaches.	Understand (2)



**Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-418 (A) Cloud Computing-I
W.E.F.2024-25**

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-418(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objective:

1. Explain the technologies used in network-based systems and the system models for distributed and cloud computing
2. Apply knowledge of cloud service models and deployment models.
3. Evaluate different types of virtualization and their roles in achieving high availability (HA) and disaster recovery (DR)
4. Explain the importance of authentication, authorization, and accounting (AAA) in cloud security.
5. Apply parallel and distributed programming paradigms in cloud environments.

Unit-1: INTRODUCTION TO CLOUD COMPUTING [Lecture-09][Marks-15]

Definition of Cloud Computing, History of Centralized and Distributed Computing, Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network-based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.

Unit-2: VIRTUALIZATION [Lecture-08][Marks-15]

Introduction to Cloud Computing- Cloud issues and challenges – Properties – Characteristics – Service models, Deployment models. Cloud resources: Network and API – Virtual and Physical computational resources – Data-storage. Virtualization concepts – Types of Virtualization- Introduction to Various Hypervisors – High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs.

Unit-3: SERVICE MODELS [Lecture-05] [Marks-10]

Infrastructure as a Service (IaaS) – Resource Virtualization: Server, Storage, Network, Platform as a Service (PaaS) – Cloud platform & Management: Computation, Storage, Software as a Service (SaaS) – Web services – Web 2.0 – Anything as a service (XaaS) – Microservices.

Unit-4: CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENT [Lecture-05] [Marks-5]

Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Current technologies – Programming support of App Engines – Emerging Cloud software Environment.

Unit-5: CLOUD ACCESS [Lecture-3] [Marks-5]

Authentication, authorization and accounting – Cloud Provenance and meta-data – Cloud Reliability and fault-tolerance – Cloud Security.

Reference Books:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier, 2012.
2. Barrie Sosinsky, “Cloud Computing Bible”, John Wiley & Sons, 2010. 2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective Risks and Compliance”, O’Reilly, 2009.

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

**Cognitive Level
(As Per Blooms
Taxonomy)**

CO1: Apply knowledge of cloud computing fundamentals to analyze and propose appropriate deployment techniques for specific organizational needs.	Apply (3)
CO2: Demonstrate comprehension of virtualization concepts, including types (hardware, storage, and network) and their relevance to cloud computing.	Understand (2)
CO3: Describe Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) models, including their key features and use cases.	Remember (1)
CO4: Apply parallel and distributed programming paradigms in cloud environments to develop scalable applications.	Apply (3)



**Kavayitri Bahinabai Chaudhari
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MASTER OF COMPUTER APPLICATIONS
MCA-418(B) Lab on Cloud Computing-I
W.E.F. 2024-25**

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-418(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objectives :

1. Understand and perform the installation of VirtualBox or VMware Workstation with various Linux and Windows OS.
2. Install and configure JustCloud for automatic backup of files to the cloud.
3. Develop and deploy simple web applications on Google App Engine using Python or Java.
4. Deploy a static website on GitHub Pages to understand cloud-based web hosting.
5. Explore and understand CRM concepts using the Salesforce platform.
6. Implement procedures to transfer files between virtual machines efficiently.
7. Create reports, dashboards, and visualizations to effectively present data in Salesforce.

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on windows.
2. Installation and Configuration of Justcloud: (Professional Cloud Storage from JustCloud is Simple, Fast and secure. Just Cloud will automatically backup the documents, photos, music and videos stored on your computer, to the cloud so you are never without files again.)
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Setting up a Simple Website on GitHub: (To deploy a static website on GitHub Pages, demonstrating the use of cloud-based hosting for web content. Software: GitHub (<https://github.com/>)
5. Introduction to Cloud CRM (Salesforce): (Understand Customer Relationship Management (CRM) on Salesforces)
6. Find and implement a procedure to transfer the files from one virtual machine to another virtual machine.
7. Create Reports, Dashboards, and use different chart types to visualize data effectively using Sales force.

Course Outcomes: At the end of the course, students will be able to	Cognitive Level (As Per Blooms Taxonomy)
CO1: Configure various virtualization tools such as Virtual Box, VMware Workstation.	Apply (3)
CO2: Learn how to simulate a cloud environment to implement new schedulers.	Create (6)
CO3: Demonstrate the benefits of various distributed computing platforms	Apply (3)
CO4: Deploy applications in a simulated cloud environment	Apply (3)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-419 (A) Data Science-I
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-419(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	03

Course Objective :

1. To provide a strong foundation for data science and its application area.
2. To understand the underlying core concepts and emerging technologies in data science.
3. To develop applied experience with data science software, programming, applications and Processes.
4. To give a hands-on experience with real-world data science.

Unit-1: INTRODUCTION TO DATA SCIENCE

[Lecture-6][Marks 11]

Overview of Data Science, Scope of Data Science, Definition and Importance of Data Science, Data Science vs. Data Analytics vs. Data Engineering, Skills and Roles in Data Science, Applications of Data Science, Data Science Tools and Technologies : Introduction to Python for Data Science, Key Libraries: NumPy, Pandas, Matplotlib, Seaborn

Unit 2: DATA COLLECTION, CLEANING, AND PREPROCES

[Lecture-6][Marks 12]

Data Collection Methods: Data Sources: Relational Databases, APIs, Web Scraping, Tools for Data Collection: BeautifulSoup, Requests, Scrapy, **Data Cleaning and Preprocessing :** Handling Missing Data: Imputation, Deletion, Data Transformation: Normalization, Standardization, Encoding, Categorical Variables: One-Hot Encoding, Label Encoding.

Unit-3: STATISTICAL ANALYSIS FOR DATA SCIENCE

[Lecture-9][Marks 14]

Descriptive Statistics:- Measures of Central Tendency: Mean, Median, Mode, Measures of Dispersion: Variance, Standard Deviation, Understanding Data Distribution: Normal Distribution, Skewness, Kurtosis, **Inferential Statistics:-**Hypothesis Testing: Null and Alternative Hypotheses, p-values t-tests: One-Sample, Independent, Paired t-tests, Analysis of Variance (ANOVA): One-way and Two-way ANOVA, **Correlation and Covariance:-**Pearson Correlation Coefficient, Spearman's Rank Correlation, Covariance and Its Interpretation

Unit-4: DATA VISUALIZATION IN DATA SCIENCE

[Lecture-9][Marks 13]

Introduction to data visualization, Role of Visualization in Data Analysis, Principles of Effective Data Visualization, Data Visualization Tools and Libraries , Python Libraries: Matplotlib: Basic Plotting (Histograms, Box Plots, Scatter Plots, Identifying Patterns, Trends, and Outliers) , Seaborn: Statistical Plots, Heatmaps, Power BI: Business Analytics and Visualization, Linear regression and classification model .

Reference Books:

1. Data Science from Scratch: First Principles with Python, Joel Grus, 2nd Edition (2019)
2. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Wes McKinney, 2nd Edition (2017)
3. Statistics for Data Scientists: 50 Essential Concepts ,Peter Bruce and Andrew Bruce, 1st Edition (2017)

4. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python, Peter Bruce,,Andrew Bruce, and Peter Gedeck, 2nd Edition (2020)
5. Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knafllic, 1st Edition (2015)
6. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Foster Provost and Tom Fawcett, 1st Edition (2013)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://onlinecourses.nptel.ac.in/noc19_cs60/preview

2 <https://www.classcentral.com/course/swayam-python-for-data-science-14266>

Course Outcomes : At the end of the course, students will be able to	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand the fundamental concepts of data science.	Understand (2)
CO2: Apply data cleaning and preprocessing techniques.	Apply (3)
CO3: Visualize and present the inference using various tools.	Apply (3) , Analyze(4)
CO4: Evaluate relationships between variables using correlation and covariance	Analyze(4), Evaluate (5)
CO5: Create interactive visualizations and dashboards for business analytics using Power BI.	Create(6), Apply (3)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-419(B) Lab on Data Science -I
W.E.F. 2024-25

[Total Marks : External 30 + Internal 20 = Marks 50]

Semester	I	CA Marks:	20
Course Code	MCA-419(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objective :

1. Introduce basic Python programming and statistical operations using NumPy within a Jupyter Notebook.
2. Implement normalization and standardization techniques using Scikit-learn for data preprocessing.
3. Implement and interpret simple and multiple linear regression models.

1. Setting Up Python for Data Science & Install and configure Anaconda and Jupiter Notebook.
2. Create a Jupiter Notebook and perform basic Python operations & Calculate statistics (mean, median, variance) using NumPy functions.
3. Load datasets into Pandas Data Frames from CSV files & Perform basic Data Frame operations (e.g., filtering, sorting).
4. Write a program to implement Normalize and standardize numerical data using Scikit-learn
5. Write a program to implement Encode categorical variables using One-Hot Encoding and Label Encoding with Pandas and Scikit-learn.
6. Write a program to Plot histograms to visualize data distribution and calculate skewness and kurtosis of given dataset.
7. Write a program to Perform a t-test (one-sample, independent) on sample data and interpret the results.
8. Write a program to Calculate and interpret the Pearson and Spearman correlation coefficients.
9. Write a program to implement Conduct ANOVA (One-Way and Two-Way) test
10. Write a program to implement simple linear regression, Multiple Linear Regression on given dataset.
11. Write a program to implement simple logistic regression on given dataset.

Course Outcomes: At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Demonstrate Proficiency in Setting Up and Using Python Data Science Tools	Apply (3)
CO2: Apply Data Preprocessing Techniques for Machine Learning.	Apply (3)
CO3: Conduct Statistical Analysis and Interpret Results.	Analyze (4), Evaluating (5)
CO4: Develop and Evaluate Machine Learning Models.	Evaluate (5), Create(6)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-420(A) Cyber Security
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-420(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objectives:

1. **Describe** the concepts of symmetric and asymmetric cryptography, including key management and distribution.
2. Implement basic VPN configurations to secure network communications.
3. Apply password cracking techniques using tools like John the Ripper to test the strength of passwords.
4. **Describe** different types of cybercrime, including hacking, phishing, and ransomware.

UNIT-1: INTRODUCTION TO CYBER SECURITY

[Lecture-08][Marks- 16]

Introduction, Importance of Security, Threats and their types, Malware (Viruses, Worms, Trojans, Ransomware) Phishing, Spear Phishing, and Social Engineering Harm, DoS, DDoS Vulnerabilities, Cryptography(Symmetric vs. Asymmetric Cryptography, Key Management and Distribution), Web attack: Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks, Buffer Overflow, Vulnerability Assessment(Identifying Vulnerabilities, Tools and Techniques (Nessus, OpenVAS).

UNIT-2: NETWORK DEFENSE TOOLS

[Lecture-06][Marks- 08]

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, VPN: the basic of Virtual Private Networks, Firewall: Introduction, Linux Firewall, Windows Firewall.

UNIT-3: WEB APPLICATION TOOLS

[Lecture-6][Marks- 08]

Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel. Application Inspection tools Zed Attack Proxy, Sqlmap, DVWA, Webgoat, Password Cracking and Brute-Force Tools: John the Ripper.

UNIT-4: INTRODUCTION TO CYBER CRIME AND CLOUD SECURITY

[Lecture-4][Marks-08]

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, Cloud Computing Basics, Cloud Service Models (IaaS, PaaS, SaaS), Cloud Deployment Models (Public, Private, Hybrid), Cloud Security Risks and Challenges, Data Privacy and Protection in the Cloud, Cloud Security Tools and Technologies

Reference Books:

1. S. K. Saxena , Information technology law concepts, and enhancements ,Dummies , Computer Security 2. Michael E. Kabey ,Enterprise Security – protecting information assets 3. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, “Cryptography and Network Security”, 3rd Edition, Tata Mc Graw Hill, 2015. 4.Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, “Security in Computing”, Fifth Edition, Prentice Hall, New Delhi, 2015. 5. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd. 6. Fundamentals of Network Security by E. Maiwald, McGraw Hill.	
Course Outcomes : On completion of the course, learner will be able to –	Cognitive Level (As Per Blooms Taxonomy)
CO1: Describe the differences between packet filters and firewalls and how they protect networks.	Understand (2)
CO2: Describe the different types of cloud service models and deployment models, and how they impact security.	Understand (2)
CO3: Apply vulnerability assessment tools like Nessus and OpenVAS to identify vulnerabilities in a given system.	Apply (3)
CO4: Apply digital forensics techniques to a simulated cybercrime scenario.	Apply (3)
CO5: Analyze the results from web application security tools and differentiate between various types of vulnerabilities identified.	Analyze (4)



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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-420(B) Lab on Cyber Security
W.E.F. 2024-25

[Total Marks: External 30+ Internal 20= 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-420(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	3

Course Objectives :

1. Identify and use tools for analyzing web applications.
2. Understand the purpose and functionality of various Kali Linux tools.
3. Apply the impact and effectiveness of different exploitation techniques.
4. Perform buffer overflow exploitation using Kali Linux tools
15. Set up Kali Linux in a virtual machine and set up a network Adapter.
16. Demonstrate Web application Analysis using kali-Linux.
17. Crack hashed passwords using John the Ripper in Kali Linux.
18. Implement wireless intrusion detection and prevention techniques using Kali Linux tools.
19. Perform network vulnerability scanning using Kali Linux tools.
20. Exploit web application vulnerabilities using Kali Linux tools.
21. Perform buffer overflow exploitation using Kali Linux tools.

Course Outcomes: On completion of the course, learner will be able to –	Cognitive Level
CO1: Describe methods for analyzing web app security.	Understand(1)
CO2: Identify key tools available in Kali Linux for web application analysis.	Understand(1)
CO3: Implement Kali Linux in Virtual Box/VMware and set up network.	Analyze(4)
CO4: Define John the Ripper to decode hashed passwords.	Remember(1)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-421(A) Web Technologies-I
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-421(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objectives:

1. Recall the basic syntax and elements of HTML and CSS.
2. Describe how JavaScript can be used to add interactivity to web pages.
3. To understand the basics of jQuery including selecting elements, handling events, and using jQuery effects.
4. Apply Bootstrap classes to HTML elements to ensure responsiveness and consistent styling.

Unit-1: HTML and CSS

[Lecture-6][Marks-10]

HTML: Introduction to HTML, Doctype, Namespace, Meta Tag, Script Tag, Images, Tables, Div, Paragraph, Span, Pre Tags, Anchor Links and Named Anchors, Line Breaks and Horizontal Lines. Lists, Object Tag, IFrame Tag, Form Tag, Form Tag, POST and GET Method, Fieldset and Legend, Text input, Text area, Checkbox and Radio Button, Dropdown, List, File Upload and Hidden Fields, Submit, Image, Normal, Reset Button, Creating a Live Website with Form.

CSS: Introduction to CSS 2.1, CSS Selectors: Universal Selector, ID Selector, Tag Selector, Class Selector, Sub Selector, CSS Properties: Type Properties, Background Properties, Block Properties, Box Properties, List Properties, Border Properties, Positioning Properties, Conversion of Table to CSS Layout, CSS Menu Design (Horizontal, Vertical), External and Inline CSS, Introduction to CSS 3, New CSS 3 Selectors, New CSS3 Properties, CSS Gradients, Opacity Property, ,Transition effect, Transform effect, Animation effects, Css Media Queries, Creating a Live Website with CSS

Unit-2: INTRODUCTION TO JAVASCRIPT

[Lecture-10][Marks-15]

Introduction to JavaScript, Variable, statements, Operators, Comments, constructs, Functions, expressions, JavaScript console, Scope, Events, Strings, String Methods, Numbers, Number Methods, Dates, Date Formats, Date Methods, Arrays, Loops Object Prototypes, Object Oriented Programming, JavaScript Validations, Security in Java Script

Unit-3: JQUERY

[Lecture-10][Marks-15]

Basics of jQuery, jquery selection and events, jQuery Effects, jquery traversal and manipulation, Data attributes and templates, jQuery Plugins, JQuery / Google Web Toolkit

Unit-4: BASICS OF BOOTSTRAP

[Lecture-4][Marks-10]

Overview of Bootstrap, Need to use Bootstrap, Basic Structure of Bootstrap Grid, Tables, Image Alerts, Buttons.

Reference Books:

1. JohnWiley & Sons, HTML, CSS, & JavaScript for Dummies. Tittel, E., Holland, E., Minnick, C. (2018).
2. Spurlock, J. (2013), Reilly Media,Bootstrap: Responsive Web Development..
3. York, R. (2015). Wiley, Web Development with JQuery.
4. Teixeira, P. (2012).Wiley, Professional Node.js: Building Javascript Based Scalable Software.

Course Outcomes: After completion of this course student shall be able to -

**Cognitive Level
(As Per Blooms**

	Taxonomy)
CO1: Recall the basic HTML tags and their purposes	Remember (1)
CO 2: Describe how JavaScript can be used to manipulate the DOM and Handle events.	Understand(2)
CO 3: To understand jQuery selectors and methods for DOM manipulation	Understand(2)
CO 4: To analyze the responsiveness and visual appeal of web interfaces Created with Bootstrap.	Analyze(4)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-421(B) Lab on Web Technologies-I
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	I	CA Marks:	20
Course Code	MCA-421(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objective:

1. Identify arithmetic, comparison, logical, and assignment operators.
2. Develop JavaScript programs using function
3. Describe how form elements are used to collect user input and submit data.
4. Develop a webpage that demonstrates various Bootstrap table styles using different classes.

1. Design a webpage with HTML Form.
2. Design a webpage using CSS.
3. Demonstrate different operators in JavaScript.
4. Demonstrate a HTML document using JavaScript to demonstrate Conditional & Looping Statements.
5. Design a dynamic web form with validations using JavaScript
6. Design a webpage with Bootstrap.
7. Demonstrate the use of jQuery in a webpage.
8. Design a dynamic webpage using demonstrating the web technologies (HTML, JavaScript, Bootstrap, Angular JS, JQuery).

Course Outcomes: After completion of this course student shall be able to -	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand the structure of an HTML document, CSS styling and layout using CSS	Understand (2)
CO2: Recall the concept of variables, scope, functions, operators, looping, and conditional statements in JavaScript.	Remember (1)
CO3: Implement interactive web applications using advanced event handling techniques in JavaScript.	Apply (3)
CO4: Understand the basics of jQuery including selecting elements, handling events, and using jQuery effects.	Understand (2)



Kavayitri Bahinabai Chaudhari
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MASTER OF COMPUTER APPLICATIONS
MCA-431 Database Management System
W.E.F.2024-25

[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	II	CA Marks:	40
Course Code	MCA-431	UA Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. Introduction to the basic concepts of database management systems, learning to design databases using ER modeling, and decomposing data based on functional dependencies
2. Understand Relational databases, SQL, Transaction management, Query processing, concurrency control and recovery system.
3. Describe and discuss selected advanced database topics such as distributed database and XML and Web data.

Unit-1: INTRODUCTION

[Lecture-08] [Marks-08]

Database system application and purpose, Characteristics of DBMS, Database Users, 1-tier, 2-tier and 3-tier architecture of DBMS along with its advantages, Levels of Database Architecture, Data Models, Data-schemas and instances, Data Independence, Role and responsibilities of DBA.

Unit-2: DATABASE DESIGN AND E-R MODEL

[Lecture-08] [Marks-12]

Overviews of Database Design, ER Modeling concepts, ER Diagrams, Reduction to Relational Schemas, Extended ER Features, Alternative notations for Modeling, Cardinality constraints, Atomic Domains and 1NF, Decomposition using Functional Dependencies (BCNF, 3NF and 4NF)

Unit-3: RELATIONAL DATABASES

[Lecture-14] [Marks-20]

Structure of Relational Databases, Database Schemas, Keys, Schema diagrams, Relational Query Languages, Relational Operation. Overview of SQL, SQL Data Definition, Basic Structure of SQL Queries, Basic Operations, Set Operations, Null Values, Aggregate Functions, and Nested Sub queries, Modification of Databases. Join Expressions, Views, Transactions, Integrity Constraints, SQL data types and Schemas, Authorization, Accessing SQL from Programming Languages, Overview of Dynamic SQL and SQL CLI. Functions and Procedures, Triggers. The relational Algebra fundamental and extended Operations. Tuple and Domain Relational Calculus.

Unit-4: TRANSACTION MANAGEMENT AND QUERY PROCESSING

[Lecture-10] [Marks-22]

Transaction Concept, Model, Storage Structure, Atomicity and Durability, Isolation, Levels of Isolation, Overview of Query Processing, Selection Operation, Sorting, Join Operation, Other Operations and Evaluation of Expression. Overview of Query Optimization, Transformation of Relational Expression, Choice of Evaluation Plan.

Unit-5: CONCURRENCY CONTROL AND RECOVERY SYSTEM

[Lecture-10] [Marks-16]

Lock based Protocol, Timestamp based Protocol, Validation based Protocol, Deadlock Handling, Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithms, Buffer Management, Early lock release and logical undo operations, Remote Backup Systems.

Unit-6: ADVANCED TOPICS IN DATABASES

[Lecture-10] [Marks-22]

Introduction to Object Databases: Shortcomings of Relational Data Model, The Conceptual Object Data Model. Introduction to XML, Overview of XML, XML Data Definitions, XML Schema, Distributed Databases: Overview, Homogeneous and Heterogeneous Databases.

Reference Books:	
1. Michael Kifer, Arthur Bernstein, P.M, Lewis and P.K. Panigrahi (2011), “Database Systems: An Application Oriented Approach”, Second Edition, Pearson Education, 2011, ISBN: 9788131703748. 2. C. J .Date, A. Kannan and S. Swamynathan (2006), “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006, ISBN:978-81-7758-556-8 3. Silberschatz, H.F.Korth, and S.Sudarshan (2011), “Database System Concepts”, TMH Publications, Sixth Edition, 2011, ISBN: 978-007-132522-6. 4. Ramez Elmasri, Shamkant B. Navathe (2011), “Fundamentals of Database Systems” Seventh Edition, Pearson Education, 2011, ISBN: 978-0-13-397077-7.	
Course Outcomes: After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand the fundamental concepts and terminology associated with database systems, including architecture, design, and various models.	Understand (2)
CO2: Explain the fundamental concepts of Entity-Relationship (ER) modeling and its purpose in database design	Understand (2)
CO3: Apply the relational model, specify integrity constraints, and explain how to create a relational database using an ER diagram and normalization techniques.	Apply (3)
CO4: Use knowledge to implement and manipulate database schemas, perform SQL queries, and manage transactions and concurrency control.	Apply (3)
CO5: Determine partitioning and distribution of data across networked nodes of a DBMS and data optimization in a distributed environment.	Analyze (4)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-432 LAB on Database Management System
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-432	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objectives:

1. Provide foundation knowledge in database concepts, technology and practice to prepare students into expert database application developers.
2. Understand SQL programming through a variety of database problems.
3. Develop database applications using front-end tools and back-end DBMS.

1. Implement DDL Statement.
 - Create table , Modify table, Drop table
2. Implement DML Statement.
 - Adding/Modify/Delete data using Insert/ Update/ Delete
3. Implement following Constraints.
 - NULL and NOT NULL, Primary Key Constraint, Foreign Key Constraint
 - Unique Constraint, Check Constraint, Default Constraint
4. Implement following clauses.
 - Simple select clause
 - Accessing specific data with Where Clause
 - Ordered By/ Distinct/Group By Clause
5. Implement Aggregate Functions.
 - AVG, COUNT, MAX, MIN, SUM, CUBE
6. Implement all String functions.
7. Implement Date and Time Functions.
8. Implement use of UNION, INTERSECTION, SET DIFFERENCE.
9. Implement Nested Queries & all types of JOIN operation.
10. Implement practical performing different operations on a view.
11. Implement use of Procedures.
12. Implement use of Triggers.
13. Implement use of Cursor.
14. Implement use of database connectivity with front end tools like – VB.NET, C#.NET, JAVA etc.

Course Outcome: After completion of this course students shall be able to	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand and Utilize DML (Data Manipulation Language) and DDL commands to create and maintain tables.	Understand (2)
CO2: Develop a relational database schema for a given scenario, including tables, relationships, and constraints.	Create (6)
CO3: Utilize the DML/DDL commands and programming PL/SQL including stored procedures, stored functions, cursors, views and Triggers for modify data.	Apply (2)
CO4: Execute nested queries and perform various types of JOIN operations to retrieve and combine data from multiple tables.	Analyze (4)
CO5: Establish database connectivity and perform operations using front-end tools.	Apply (2)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-433 Software Project Management
W.E.F.2024-25

[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	II	CA Marks:	40
Course Code	MCA-433	UA Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. To understand the Software Project Planning.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To understand about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.

Unit-1: INTRODUCTION AND TECHNOLOGY CONTEXT [Lecture-12] [Marks-20]

What is project, What is project Management, The role of project Manager, The project Management Profession, Project life cycle, A system view of project management, Understanding organizations Stakeholder management, Project phases and the project life cycle, The context of information technology projects

Unit-2: PROJECT SCHEDULING AND MANAGEMENT [Lecture-12] [Marks-15]

Developing the project schedule, Project management software tools, Developing the project budget, Finalizing the project schedule and budget, Monitoring and controlling the project, The project communications plan, Project metrics, Reporting performance and progress, Information distribution

Unit-3: PROJECT RISK MANAGEMENT [Lecture-12] [Marks-20]

Risk management planning, Common sources of risk on information technology projects, Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk response planning, Risk monitoring and control, Using software to assist in project risk management

Unit-4: SOFTWARE QUALITY ASSURANCE [Lecture-12] [Marks-20]

Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model (CMM), SQA Activities, Formal SQA Approaches: Proof of Correctness, Statistical Quality Assurance, Product versus process quality management,

Unit-5: GLOBALIZATION ISSUES IN PROJECT MANAGEMENT [Lecture-12] [Marks-25]

Globalization issues in project management: Evolution of globalization- challenges in building global teams-models for the execution of some effective management techniques for managing global teams. Impact of the internet on project management: Introduction – the effect of internet on project management – managing projects for the internet – effect on project management activities. Comparison of project management software's: dot Project, Launch pad, openProj.

Reference Books:

1. Information Technology Project Management: Kathy Schwalbe Thomson Publication.
2. Gobalswamy Ramesh, “Managing Global Software Projects”, Tata McGraw Hill Publishing Company, 2003
3. Basics of Software Project Management, NIIT, Prentice-Hall India, Latest Edition.
4. Futrell, “Quality Software Project Management”, Pearson Education India, 2008

Course Outcomes : At the end of the course, students will be able to- **Cognitive Level**

	(As Per Blooms Taxonomy)
CO1: Understand the activities during the project scheduling of any software application.	Understand (2)
CO2: Understand about risk management activities and the resource allocation for the projects	Understand (2)
CO3: Acquire knowledge and skills needed for the construction of highly reliable software project	Apply (3)
CO4: Apply different techniques of project monitoring, control and review.	Apply (3)
CO5: Explain various project management scheduling techniques.	Analyze (4)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-434 Machine Learning
W.E.F.2024-25

[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	II	CA Marks:	40
Course Code	MCA-434	UA Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. Introduce the concepts of machine learning
2. Understand supervised and unsupervised learning algorithms
3. Gain knowledge on evaluation of the performance of the machine learning techniques
4. Learn about the advanced learning techniques

Unit-1: INTRODUCTION TO MACHINE LEARNING [Lecture-10] [Marks-12]

Overview of Machine Learning: Definition, Types of ML, Applications of ML, **Machine Learning Process:** Data Collection and Preprocessing, Feature Selection and Engineering, Model Training and Evaluation, Probability and Probability Distributions.

Unit 2: SUPERVISED LEARNING [Lecture-18] [Marks-32]

Regression Analysis :Linear Regression, Polynomial Regression, Evaluation Metrics (Confusion Matrix, Precision, Recall, F1 Score), Cross-Validation for Model Evaluation, Applications and Advantages of regression. Classification Algorithms: Logistic Regression, k-Nearest Neighbors (k-NN), Support Vector Machines (SVM), Decision Trees and Random Forests(Building Decision Trees: Gini Index, Entropy, Overfitting and Pruning Techniques), Naive Bayes .

Unit 3: UNSUPERVISED LEARNING [Lecture-18] [Marks-32]

Clustering Algorithms : k-Means Clustering, Hierarchical Clustering, DBSCAN and OPTICS, **Dimensionality Reduction:** Principal Component Analysis (PCA), t-Distributed Stochastic Neighbor Embedding (t-SNE), **Anomaly Detection:** Statistical Methods(Z-Score and Modified Z-Score), Isolation Forest, One-Class SVM, Gaussian Mixture Models (GMM), Hidden Markov Models (HMM)

Unit 4: ADVANCED MACHINE LEARNING TECHNIQUES [Lecture-14] [Marks-24]

Biological Neuron, Artificial Neural Network(ANN), Advantages & Disadvantage of Neural Network, Activation Function, **Perceptron:**-Single Layer Perceptron, Multilayered Perceptron, Multilayer Neural network, Back propagation, **Text Processing and Representation:** Tokenization, Stemming, Lemmatization.

Reference Books:

1. Tom Mitchell (1997). Machine Learning. First Edition, McGraw- Hill.
2. Ethem Alpaydin (2009). Introduction to Machine Learning Edition 2. The MIT Press.
3. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Chapman and Hall, CRC Press, Second Edition, 2014.
4. Shalev-Shwartz, Shai, Shai Ben-David, Understanding Machine Learning: From theory to algorithms, Cambridge University Press, 2014.
5. Deep Learning,Ian Goodfellow, Yoshua Bengio, and Aaron Courville,1st Edition (2016)
6. Speech and Language Processing , Daniel Jurafsky and James H. Martin,3rd Edition (2021)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- https://onlinecourses.nptel.ac.in/noc20_cs29/preview
- <https://www.coursera.org/learn/machine-learning>

Course Outcomes : At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand and implement the supervised learning algorithms.	Understand (2) Apply (3)
CO2: Analyze and apply the machine learning concepts for different problems.	Apply (3) Analyze (4)
CO3: Apply the clustering algorithms for various problems.	Apply (3)
CO4: Evaluate and test the performance of the learning algorithms.	Evaluate (5)
CO5: Design and create a learning model for real time applications.	Create (6)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-435(A)-Advanced Cloud Computing-II
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-435(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objectives:

1. Recall the fundamental concepts, evolution, characteristics, and service models of cloud computing.
2. Explain the benefits, challenges, and deployment models of cloud computing.
3. Identify key components of data centers, virtualization techniques, and types of cloud storage.
4. Describe networking concepts, services, cloud security risks, and mitigation strategies.
5. List major cloud service platforms such as AWS, Azure, Google Cloud, and IBM Cloud.
6. Explain the concepts of building cloud-native applications, micro services, containers, server less computing, and cloud-based databases.
7. Identify techniques for cloud resource management, auto-scaling, load balancing, and monitoring.
8. Explain cost management, cloud performance tuning, SLA management, and multi-cloud strategies.
9. Recognize emerging technologies such as edge computing, IoT, AI, machine learning, block-chain, and quantum computing.
10. Discuss the integration and applications of these technologies in cloud computing.

Unit-1: CLOUD INFRASTRUCTURE

[Lecture-10][Marks-15]

Data Centers and Cloud Infrastructure, Cloud Storage: Types, Architecture, and Key Technologies; Networking in Cloud: Concepts, Services, and Techniques; Cloud Security: Risks, Mitigation Strategies, and Best Practices; Disaster Recovery and Business Continuity in Cloud.

Unit-2: CLOUD SERVICES AND APPLICATIONS

[Lecture-10][Marks-13]

Cloud Service Platforms: AWS, Azure, Google Cloud, IBM Cloud; Building Cloud-native Applications, Micro services and Containers: Docker, Kubernetes; Server less Computing: Concepts; Cloud-based Databases: Types, Examples, and Management; DevOps in Cloud: Tools, Practices, and Benefits; Big Data and Analytics in Cloud.

Unit-3: CLOUD MANAGEMENT AND OPTIMIZATION

[Lecture-05][Marks-10]

Cloud Resource Management and Scheduling, Auto-scaling and Load Balancing, Monitoring and Logging in Cloud, Cost Management and Optimization in Cloud, SLA Management and Compliance in Cloud, Multi-cloud and Hybrid Cloud Management.

Unit-4: EMERGING TRENDS AND FUTURE DIRECTIONS IN CLOUD COMPUTING

[Lecture-05] [Marks-

12]

Edge Computing and Fog Computing, Internet of Things (IoT) and Cloud, Artificial Intelligence and Machine Learning in Cloud, Blockchain and Cloud Integration, Quantum Computing and Cloud, Green Cloud Computing.

Reference Books:

1. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture". 2. Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi, "Mastering Cloud Computing". 3. Rajkumar Buyya, James Broberg, and Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms". 4. Michael J. Kavis, "Architecting the Cloud". 5. Andreas Wittig and Michael Wittig, "Amazon Web Services in Action". 6. Vitthal Srinivasan, "Google Cloud Platform for Architects". 7. Kelsey Hightower, Brendan Burns, and Joe Beda, "Kubernetes: Up and Running". 8. Gene Kim, Jez Humble, Patrick Debois, and John Willis, "The DevOps Handbook". 9. Martin Kleppmann, "Designing Data-Intensive Applications".	
Course Outcomes : At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Explain the evolution, characteristics, service models, and deployment models of cloud computing, analysing its benefits, challenges, and architecture through real-world applications.	Analysis(4)
CO2: Describe data centers, cloud infrastructure, virtualization, cloud storage, networking, security, and disaster recovery in the cloud.	Remembering(2)
CO3: Compare major cloud service platforms, develop cloud-native applications, and implement micro services, containers, server less computing, cloud databases, and Dev Ops practices.	Analysis(4)
CO4: Apply cloud resource management, auto-scaling, load balancing, monitoring, cost optimization, performance tuning, SLA management, and multi-cloud strategies.	Apply(3)
CO5: Understand and explore emerging trends like edge computing, IoT, AI, machine learning, block chain, quantum computing, green cloud practices, and future innovations in cloud computing.	Understanding(1) Evaluating(4)



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North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-435(B) –Lab on Advanced Cloud Computing
W.E.F. 2024-25
[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-435(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03
Course Objectives: 1. Study configurations of cloud infrastructure. 2. Analyze and monitor the cloud. 3. Handle and backup real time warehouse data.			
1. Create Free Accounts on AWS and Google Cloud Platform (GCP). 2. Explore services like EC2 (Elastic Compute Cloud), S3 (SimpleStorage Service), and RDS (Relational Database Service) on AWS and GCP services such as Compute Engine, Cloud Storage, and Cloud SQL. 3. Study and do the Configuration of CCloudSim. Also execute & check the performance of existing algorithms. 4. Install a Cloud Analyst and Integrate with Eclipse/Netbeans. Monitor the performance of an Existing Algorithms. 5. Creating a Warehouse Application in Salesforce.com. 6. Creating an Application in Salesforce.com using Apex programming Language. 7. Implementation of SOAP Web services in C#/JAVA Applications.			
Course Outcomes: At the end of the course, students will be able to-			Cognitive Level (As Per Blooms Taxonomy)
CO1: Configure cloud infrastructure.			Apply (3)
CO2: Monitor load on cloud, balance load by analyzing.			Analyze (4)
CO3: Work with real time cloud solutions.			Apply (3)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-436 (A) Data Science II
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA 436(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	03

Course Objective :

1. To provide a strong foundation for advance data science and its application area.
2. Gain knowledge on evaluation of the performance of the machine learning techniques .
3. To develop applied experience with data science software, programming, applications and processes.
4. Learn about the advanced learning techniques.

Unit 1: MACHINE LEARNING BASIC [Lecture-08][Marks-14]

Review of Data Science –I, Overview of Machine Learning, Types of ML, Supervised Learning Algorithms, Unsupervised Learning Algorithms, **Libraries and Frameworks:** Using scikit-learn (Python) or caret (R),

Unit 2: ADVANCED MACHINE LEARNING [Lecture-06][Marks-12]

Ensemble Learning (Bagging and Boosting & Stacking), Support Vector Machines, Neural Networks and Deep Learning, **Libraries and Frameworks:** TensorFlow, Keras, PyTorch.

Unit 3: BIG DATA TECHNOLOGIES [Lecture-08][Marks-12]

Introduction to Big Data, Hadoop Ecosystem, Apache Spark, NoSQL Databases (**Databases:** MongoDB, Cassandra)

Unit 4: ADVANCED DATA SCIENCE TECHNIQUES [Lecture-08][Marks-12]

Time Series Analysis, Natural Language Processing (NLP), Reinforcement Learning, **Libraries and Tools:** NLTK, spaCy (for NLP), OpenAI Gym (for RL).

Reference Books:

1. Tom Mitchell (1997). Machine Learning. First Edition, McGraw- Hill.
2. Ensemble Methods: Foundations and Algorithms, Zhi-Hua Zhou, 1st Edition (2012)
3. Deep Learning with Python, François Chollet, 1st Edition (2017)
4. Hadoop: The Definitive Guide, Tom White, 4th Edition (2015)
5. Time Series Analysis and Its Applications: With R Examples, Robert H. Shumway and David S. Stoffer, 4th Edition (2017)
6. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, and Edward Loper
7. Reinforcement Learning: An Introduction, Richard S. Sutton and Andrew G. Barto, 2nd Edition (2018)
8. Learning Spark: Lightning-Fast Data Analytics, Holden Karau, Andy Konwinski, Patrick Wendell, and Matei Zaharia, 2nd Edition (2020)
9. Ethem Alpaydin (2009). Introduction to Machine Learning Edition 2. The MIT Press.

10. Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1 st edition, 2016	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1. https://onlinecourses.nptel.ac.in/noc19_cs60/preview 2. https://www.coursera.org/learn/machine-learning	
Course Outcomes : At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand fundamental concepts of data science and machine learning.	Understand (2)
CO2: Apply machine learning algorithms to solve practical problems using appropriate libraries and frameworks.	Apply (3)
CO3: Utilize big data technologies to process and analyze large datasets.	Apply (3), Analyze(4)
CO4: Analyze advanced machine learning techniques and frameworks.	Analyze(4)
CO5: Develop and implement advanced data science techniques, including time series analysis, natural language processing, and reinforcement learning.	Create (6) Apply (3)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-436(B) Lab on Data Science -II
W.E.F. 2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-436(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objective:

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. The main objective of the course is to inculcate the basic understanding of Data Science and it's practical implementation using Python.

1. Write a program to implementing and evaluating a Linear Regression model.
2. Write a program to implementing and evaluating a Logistic Regression model.
3. Write a program to implementing and evaluating a Decision Tree classifier.
4. Write a program to implementing Clustering using the K-means algorithm
5. Write a program to implementing Dimensionality reduction using PCA.
6. Write a program to implementing Bagging using Random Forest.
7. Write a program to implementing Boosting using AdaBoost.
8. Write a program to implementing SVM for classification tasks.
9. Write a program to implementing a simple neural network using TensorFlow/Keras.
10. Write a program to implementing with big data concepts using sample datasets & Setting up a Hadoop environment.
11. Write a program to implementing CRUD operations in MongoDB
12. Write a program to implementing with NLTK: Tokenization, stemming, and lemmatization.

Course Outcomes: At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Explore the fundamental concepts of data science & Machine Learning	Understand (2)
CO2: Understand data analysis techniques for applications handling large data.	Understand (2) Analyze (4)
CO3. Understand various machine learning algorithms used in data science process	Understand (2)
CO4. Visualize and present the inference using various tools.	Apply(3)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-437(A) Information Security and Mitigation
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-437(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objectives :

1. Identify and define the key principles of the Bell-LaPadula, Biba, and Clark-Wilson models.
2. Describe how encryption and decryption processes work.
3. Apply risk assessment techniques to identify and evaluate risks in a given scenario.
4. Configure and troubleshoot TCP/IP settings on network devices.

Unit-1: INTRODUCTION TO INFORMATION SECURITY [Lecture-10][Marks-12]

Introduction to Information Security, History and Evolution of Information Security, Security Models and Frameworks (Bell-LaPadula Model, Biba Model, Clark-Wilson Model), Security Policies and Procedures.

Unit-2: OVERVIEW OF THREATS, VULNERABILITIES, AND RISK MANAGEMENT [Lecture-06][Marks-11]

What is Threats, Types of Threats (Cyber Threats: Malware, Ransomware, Denial of Service (DoS), Insider Threats and Social Engineering, Vulnerability Assessment (Vulnerability Scanning Tools, Penetration Testing Techniques), Risk Management (Risk Analysis and Assessment, Risk Mitigation Strategies and Controls).

Unit-3: CRYPTOGRAPHY, ENCRYPTION AND DECRYPTION [Lecture-06][Marks-12]

Cryptography, Encryption, Decryption, Cryptographic Algorithms: - Symmetric Encryption (AES, DES), Asymmetric Encryption (RSA, ECC), Hash Functions and Digital Signatures (SHA-256, MD5), Digital Certificates and PKI.

Unit-4: NETWORK AND DATABASE SECURITY [Lecture-08][Marks- 15]

Network Security Fundamentals, TCP/IP Protocol Suite, Network Attacks and Defense Mechanisms, Firewalls, Types of Firewalls, Intrusion Detection Systems, Database Security Models, Access Control Models (DAC, MAC, RBAC), SQL Injection and Mitigation.

Reference Books:

1. Atul Kahate (2008), Cryptography and Network Security, McGraw Hill. ISBN : 9780070648234.
2. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.
3. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
4. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Course Outcomes : On completion of the course, learner will be able to –

**Cognitive Level
(As Per Blooms
Taxonomy)**

CO1: Identify key concepts related to information security, including confidentiality, integrity, and availability.

Remember (1)

CO2: Describe fundamental principles and practices of network security.	Understand (2)
CO3: Apply vulnerability scanning tools and penetration testing techniques to assess security in a controlled environment.	Apply (3)
CO4: Analyze firewall rules and configurations to identify potential weaknesses.	Analyze (4)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-437(B) Lab on Information Security and Mitigation
W.E.F. 2024-25
[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA 437(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objective:

1. Identify the DES, AES, RSA algorithm and its key components.
2. Describe the process and significance of hashing in SHA-256.
3. Analyze how digital signatures ensure data authenticity and integrity.

1. Implement DES Encryption and Decryption.
2. Implement the AES Encryption and decryption.
3. Implement RSA Encryption Algorithm.
4. Implement SHA-256 algorithm.
5. Implement the Digital signature scheme.
6. Write a program to perform Encryption/Decryption using Caesar cipher.
7. How To Setup The Ultimate Penetration Testing.
8. Using SQL Map in Kali Linux, explain the procedure to detect and exploit SQL injection vulnerabilities in a web application.

Course Outcome: On Completion of the course learner will be able to -	Cognitive Level (As Per Blooms Taxonomy)
CO1: Identify the basic structure and components of the DES encryption algorithm.	Remember (1)
CO2: Describe the AES encryption and decryption processes, including key sizes and block modes.	Understand (2)
CO3: Implement a digital signature scheme in a program and test it for signing and verifying data.	Apply (3)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-438(A) Web Technologies-II
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-438(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objectives:

1. Understand the Angular Forms, inputs, Components and Directives
2. Analyze the performance and efficiency of data binding and expressions in AngularJS.
3. Apply the knowledge of AngularJS directives, including attribute and structural directives.
4. Understand the structure and usage of JSON in MongoDB.

Unit-1: FUNDAMENTALS OF ANGULAR AND DIRECTIVES

[Lecture-6][Mark-15]

FUNDAMENTALS OF ANGULAR: What is Angular, Advantage of Angular JS, Angular JS MVC Architecture, Angular JS Data Binding, and Angular JS Expressions.

DIRECTIVES :Angular Directives, Attribute Directives, Built-In Attribute Directives, Structural Directives, Built-In Structural Directives, Custom Directives,

Unit-2: CONTROLLERS AND MODULE

[Lecture-6][Mark-12]

Angular JS Controllers, methods (variables as functions), Angular JS Controller in external files
 Angular JS Module: How to create a module, How to add controller to a module.

Unit-3: JSON

[Lecture-6][Mark-8]

JSON: Introduction, Need of JSON, JSON Syntax Rules, JSON Data - a Name and a Value, JSON Objects, JSON Arrays, JSON Uses JavaScript Syntax, JSON Files, JSON & Security Concerns, Cross Site Request Forgery (CSRF), Injection Attacks ,Responsive Web Design

Unit-4: BASICS OF MONGODB

[Lecture-12][Mark-15]

Overview of MongoDB and NoSQL databases, installing and setting up MongoDB, advantages over RDBMS, MongoDB basics: Databases, collections, documents, CRUD operations in MongoDB, create database, create collections, Insert, Update, Delete, MongoDB Query operators.

Reference Books:

1. Karpov, V, Netto, D. (2015). Wiley, Professional AngularJS.
2. Smith, B. (2015). Apress, Beginning JSON.
3. ShyamSeshadri and Brad Green , "AngularJS: Up and Running"
4. Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow:Published by O'Reilly Media
 MongoDB The Definitive Guide" by

Course Outcomes: After completion of this course student shall be able to -

**Cognitive Level
 (As Per Blooms
 Taxonomy)**

CO1: Identify the advantages of Angular JS and its MVC architecture.	Remember(1)
CO2: Describe how to create and use Angular JS modules.	Understand(2)
CO3: Implement controllers in Angular JS, including methods and external controller files.	Apply(3)

CO4: Develop MongoDB queries to perform CRUD operations.	Apply(3)
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	Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon Faculty of Science and Technology MASTER OF COMPUTER APPLICATIONS MCA-438(B) Lab on Web Technologies-II W.E.F. 2024-25 [Total Marks: External 30 + Internal 20 = 100 Marks]		
Semester	II	CA Marks:	20
Course Code	MCA-438(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03
Course Objective 1. Implement a simple AngularJS application using Model, View, and Controller components. 2. Develop an AngularJS script that demonstrates the use of expressions to display data dynamically. 3. Recall the syntax for creating tables in HTML and binding data in AngularJS.			
1. Demonstrate print "Hello Word" with Angular js. It specifies the Model, View, Controller part of an Angular js app. 2. Demonstrate angular js script to implement Built-in Directives. 3. Demonstrate angular js script to add modules and controller. 4. Demonstrate simple form using angular js script. 5. Demonstrate the use of JSON in a webpage. 6. Demonstrate Installation steps of MongoDB and Connect to the database 7. Demonstrate Create a Table in MongoDB 8. Demonstrate CRUD Operations on MongoDB tables			
Course Outcomes: After completion of this course student shall be able to -			Cognitive Level (As Per Blooms Taxonomy)
CO 1: Identify the syntax and basic usage of expressions in AngularJS.			Remember(1)
CO 2: Develop a form that includes various validation rules to ensure data integrity.			Apply(3)
CO 3: To understand the designing library like Bootstrap.			Understand(2)
CO 4: Describe the usage of insert and delete commands to manipulate data in MongoDB.			Understand(2)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-439(A) Internet of Things(IOT)

W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-439(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objectives :

1. To understand communication protocols(e.g., MQTT, CoAP, HTTP) and their suitability for IoT applications.
2. Evaluate IoT platforms (e.g., Arduino, Raspberry Pi, ESP8266/ESP32) and their capabilities.
3. To understand sensor types (e.g., temperature, humidity, motion) and their applications.
4. Analyze case studies to understand successful IoT implementations and challenges faced.

Unit-1: INTRODUCTION TO IOT [Lecture-06][Marks-12]

Definition and characteristics of IoT, Technical Building blocks of IoT, Device, Communication Technologies , IoT Issues and Challenges- Planning, IoT Issues and Challenges- Planning, Costs and Quality ,Security and Privacy, Risks.

Unit-2: SENSORS AND BOARDS [Lecture-06][Marks-12]

Working of Sensors: Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera.

Development boards: Types of boards - Arduino, Raspberry pi, Beagle bone, ESP8266, selection criteria.

Unit-3: COMMUNICATION UNDER IOT [Lecture-04][Marks-06]

IoT Protocols:MQTT, CoAP, XMPP and AMQT, IoT communication models, IoT Communication technologies: Bluetooth, BLE, Zigbee, Zwave, NFC, RFID, LiFi, Wi-Fi, Interfacing of wifi, RFID, Zigbee,NFC with development board.

Unit-5: IOT SECURITY [Lecture-05][Marks-08]

Vulnerabilities Security Requirements and Threat Analysis, Misuse Cases, IoT Security Tomography, and Layered Attacker Model, Identity Management and Establishment, Access Control, and Secure Message Communication, Security Models, IoT Security Protocols.

Unit-4: SECURING THE INTERNET OF THINGS & SECURITY ARCHITECTURE [Lecture-05][Marks-08]

Introduction, Security Requirements in IoT Architecture, Security in Enabling Technologies, Security Concerns in IoT Applications, Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability , Attacks Specific to IoT

Unit-5: IOT CASE STUDIES [Lecture-04][Marks-04]

Smart Cities, Agriculture, Health and Lifestyle, Industry, Home Automation

Reference Books:

1. David Hanes, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017.
2. Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345 3.

3. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012, ISBN:978-1-119-99435-0	
Course Outcomes : At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Recall fundamental concepts and understanding basic principles related to IoT security.	Remember (1)
CO2: To understand essentials of IoT Security.	Understand (2)
CO3: Implement interfacing of various sensors, actuators to the development boards.	Apply (3)
CO4: Implementing IoT systems using standard communication protocols and analyzing their effectiveness for interoperability and data exchange.	Apply (3)
CO5: Compare various IoT communication technologies and Design various IoT applications.	Analyze (4)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-439(B) Lab on Internet of Things(IOT)
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-439(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objectives:

1. Understand the process of installing different operating systems (like Raspbian for Raspberry Pi) on the Raspberry Pi.
2. Acquire knowledge about various sensors such as temperature sensors, bio-sensors, IR sensors, pH sensors, gauge sensors, ultrasonic sensors, etc.
3. Develop proficiency in wiring IR sensors to Raspberry Pi or Arduino boards.
4. Build an application using Raspberry Pi or Arduino for monitoring health parameters such as heart rate and temperature.

1. Study of Raspberry Pi 4, Arduino board and Operating systems for the same. Understand the process of OS installation on the Raspberry Pi.
2. Study of different sensors: - temperature sensor, bio-sensor, IR sensor, chemical sensor(PH), gauge sensor, ultrasonic sensor etc.
3. Interface IR sensor to Raspberry Pi/ Arduino. Write a program to detect obstacle using IR sensor and notify it using LED.
4. Write an application using Raspberry Pi/Arduino for streetlight control system. System consists of smart streetlights that have external light sensing that automatically turns on at desired intensity based on amount of lighting needed.
5. Write an application using Raspberry Pi/Arduino for traffic signal monitoring and control system.
6. Write an application using Raspberry Pi/Arduino for smart health monitoring system which records heartbeat rate and temperature and also sends SMS alerts if readings are beyond critical values.
7. Implement a weather monitoring system using humidity, temperature and raindrop sensor and Raspberry Pi/Arduino board.
8. Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.

Course Outcomes: At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Recall the steps involved in installing operating systems on the Raspberry Pi	Remember (1)
CO2: Describe how each type of sensor works and its applications.	Understand (2)
CO3: Apply Wire IR sensors to a Raspberry Pi or Arduino board and ensure proper connections and functionality.	Apply (3)



Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-440(A) Big Data Analytics
W.E.F.2024-25

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-440(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02

Course Objectives:

1. To understand the Big Data challenges & opportunities, its applications.
2. Understanding of concepts of map and reduce and functional programming.
3. Gain conceptual understanding of Hadoop Distributed File System.
4. To solve the case studies related to real life situations.
5. To bridge the gap between academics and industry needs.

Unit-1: INTRODUCTION TO BIG DATA

[Lecture-04][Marks: 10]

Data Storage and Analysis, Characteristics of Big Data, Big Data Analytics, Typical Analytical Architecture, Requirement for new analytical architecture, Challenges in Big Data Analytics, Need of big data frameworks.

Unit-2: HADOOP FRAMEWORK

[Lecture-06][Marks: 10]

Hadoop – Requirement of Hadoop Framework, Design principle of Hadoop – Comparison with other system - Hadoop Components – Hadoop 1 vs. Hadoop 2 – Hadoop Daemon's – HDFS Commands – Map Reduce Programming: I/O formats, Map side join, Reduce Side Join, Secondary sorting, Pipelining Map Reduce jobs.

Unit-3: HDFS (HADOOP DISTRIBUTED FILE SYSTEM)

[Lecture-04][Marks:05]

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system Interfaces

Unit-4: MAP REDUCE

[Lecture-04]

[Marks:05]

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit-5: [Lecture-06] [Marks:15]

Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction

Unit-6: DATA ANALYTICS WITH R MACHINE LEARNING [Lecture-06] [Marks:05]

Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with Big R

Reference Books:

1. Provost, F., & Fawcett, T. (2013). Data Science for Business. O'Reilly Media.
2. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An Introduction to Statistical Learning. Springer.

3. Han, J., Kamber, M., & Pei, J. (2011). Data Mining: Concepts and Techniques. Morgan Kaufmann. 4. McKinney, W. (2017). Python for Data Analysis. O'Reilly Media. 5. Marz, N., & Warren, J. (2015). Big Data: Principles and best practices of scalable real-time data systems. Manning Publications.	
Course Outcomes: At the end of the course, students will be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Recognize the characteristics, applications of big data that make it useful to real world problems.	Remember (1)
CO2: Discuss the challenges and their solutions in Big Data	Understand (2)
CO3: Understand and work on Hadoop Framework and eco systems.	Understand(2)
CO4: Explain and analyze the Big Data using Map-reduce programming in Hadoop	Understand (2)



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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-440(B) Lab on Big Data Analytics
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	II	CA	20
Course Code	MCA-440(B)	UA	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03

Course Objectives:

1. Perform basic HDFS operations such as creating directories, uploading files, listing files, and deleting files.
2. Develop a Java program to read from and write to HDFS.
3. Use Hadoop's built-in commands to manage files and directories in HDFS.
4. Implement and compare Map Side Join and Reduce Side Join in Hadoop.
5. Implement secondary sorting in Hadoop Map Reduce jobs.
6. Chain multiple Map Reduce jobs to create a processing pipeline.
7. Create and use User Defined Functions (UDFs) in Pig Latin scripts.
8. Integrate UDFs into Pig scripts for enhanced functionality.
9. Write and execute HiveQL queries for data retrieval and manipulation.
10. Perform joins, group by, and aggregations in Hive.

1. Use Hadoop File System (HDFS) commands to perform basic operations like creating directories, uploading files, listing files, and deleting files in HDFS.
2. Implement a Java program to interact with HDFS (reading and writing files).
3. Use Hadoop's built-in commands to manage files and directories.
4. Implement Map Side Join and Reduce Side Join.
5. Implement Secondary Sorting.
6. Pipeline multiple Map Reduce jobs.
7. Create and use UDFs in Pig Latin scripts.
8. Integrate UDFs to enhance the functionality of Pig scripts.
9. Implement and execute HiveQL queries to perform data retrieval and manipulation.
10. Perform operations like joins, group by, and aggregations in Hive.

Course Outcomes: After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Apply HDFS commands to manage file systems in a distributed environment.	Apply (Level 3)
CO2: Develop Java applications for interacting with HDFS to perform file operations.	Apply (3)
CO3: Utilize Hadoop's built-in commands for efficient file and directory management.	Apply (Level 3)
CO4: Design and implement a pipeline of multiple MapReduce jobs for complex data workflows.	Apply (3)
CO5: Formulate and execute HiveQL queries to retrieve and manipulate data stored in Hive.	Apply (Level 3)



**Kavayitri Bahinabai Chaudhari
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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-441(A) Natural Language Processing
W.E.F.2024-25**

[Total Marks : External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-441(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	03

Course Objectives:

1. The prime objective of this course is to introduce the students to the field of Language Computing and its applications ranging from classical era to modern context.
2. Course also aims to provide understanding of various NLP tasks and NLP abstractions such as Morphological analysis, POS tagging, concept of syntactic parsing, semantic analysis etc.
3. Course provide knowledge of different approaches/algorithms for carrying out NLP tasks; it also discusses concepts of Language grammar and grammar representation in Computational Linguistics.

Unit-1: INTRODUCTION TO NLP AND NLP APPLICATIONS [Lecture-04] [Marks-09]

Introduction to NLP, brief history, NLP applications: Speech to Text(STT), Text to Speech(TTS), Story Understanding, NL Generation, QA system, Machine Translation, Text Summarization, Text classification, Sentiment Analysis, Grammar/Spell Checkers etc., challenges/Open Problems, NLP abstraction levels, Natural Language (NL) Characteristics and NL computing approaches/techniques and steps, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, Web 2.0 Applications: Sentiment Analysis;

Unit-2: TEXT PROCESSING AND LANGUAGE SCRIPTS [Lecture-6] [Marks-10]

Text Processing Challenges, Overview of Language Scripts and their representation on Machines using Character Sets, Language, Corpus, Segmentation: word level (Tokenization), Sentence level. Regular Expression and Automata Morphology, Morphological parsing FSA and FST, Human Morphological Processing,

Unit-3: WORD CLASSES AND PART-OF-SPEECH TAGGING (POS) [Lecture-06][Marks-9]

Word Classes and Part-of-Speech tagging(POS), survey of POS tagsets,

Unit-4: NL PARSING BASICS, GRAMMAR FORMALISMS AND SEMANTIC ANALYSIS [Lecture-14] [Marks-22]

NL parsing basics, approaches: TopDown, BottomUp, Overview of Grammar Formalisms: constituency and dependency school, Feature Unification, overview of English CFG

CONCEPTS AND ISSUES IN NL AND SEMANTIC ANALYSIS : Concepts and issues in NL, Theories and approaches for Semantic Analysis, Meaning Representation, word similarity, Lexical Semantics, word senses and relationships, WordNet (English), Word Sense Disambiguation, Coreferences Resolution:Anaphora, Cataphora.

Reference Books:

5. Indurkha, N., & Damerau, F. J. (2010), Handbook of Natural Language Processing, 2nd Edition. New York: CRC Press Taylor and Francis Group, Boca Raton London, New York. ISBN-10: 1420085921, ISBN-13: 978-1420085921
6. Martin, J. H., & Jurafsky, D.(2013), Speech and Language Processing, Pearson Education

India; 2nd edition, ISBN-10: 9332518416, ISBN-13: 978-9332518414

7. Manning, Christopher and Heinrich, Schutze(1999), Foundations of Statistical Natural Language Processing”, MIT Press, ISBN-10: 0262133601, ISBN-13: 978-0262133609.
8. Akshar Bharati, Chaitanya, V., Kulkarni, A., & Sangal, R. (July 1997). Machine translation in Stages (Vol. 10 no. 3). Mumbai: NCST, Mumbai.
9. Bharati, A., Chaitanya, V., & Sangal, R. (1995). Natural Language Processing: A Paninian Perspective, New Delhi: Prentice Hall of India, ISBN 10: 8120309219, ISBN 13: 9788120309210.
10. Steven Bird, Edward Loper (2016), Natural Language Processing With Python, Ed. 2nd, O'Reilly Media, ISBN 1491913428, 9781491913420

Auxiliary Resources:

Web Links

- <https://see.stanford.edu/Course/CS224N>
- <https://web.stanford.edu/~jurafsky/NLPCourseraSlides.html>
- <https://stp.lingfil.uu.se/~nivre/docs/ACLslides.pdf>

Video Links

- <http://www.nptelvideos.in/2012/11/natural-language-processing.html>
- 2. <https://www.youtube.com/playlist?list=PL6397E4B26D00A269>

Course Outcomes : After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO 1: Understand issues and challenges in Natural Language Processing and NLP applications and their relevance in the classical and modern context.	Understand (2)
CO 2: Apply text processing techniques and handle language scripts	Apply (3)
CO 3: Understand Semantic Analysis theories and approaches, including Meaning representation, Lexical Semantics, word similarity, and relationships.	Understand (2)
CO 4: Study different word classes and their roles in Part-of-Speech (POS) tagging.	Understand (2)



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Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-441(B) Lab on Natural Language Processing
W.E.F. 2024-25

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-441(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:4	Exam Hours:	03
1. Course Objectives: 2. Course provides knowledge of installation and use of NLTK in python. 3. Course provides knowledge of implementation of text files processing operations and Regular Expressions in NLP 4. Course provide knowledge of implementation of dependency parser, porter stemmer, Morphology, PoS Tagging			
1. Install NLTK and perform basic preprocessing steps of NLP like tokenization, stemming, lemmatization, chunking etc using NLTK in python. 2. Implement a program to perform text files statistical operation like count number of lines in files, number of words in file. 3. Implement program to count number of articles (a, an, the) in file. 4. Implement a program to perform tokenization and filtering stopwords in file. 5. Implement a program which makes use of basics in regular expressions like /a*/ , /a+/, /a? /, /[^AZ]/, /[^Ss]/, etc. 6. Implement a program for Tagging Sentences which takes input as sentence and performs PoS Tagging.			
Course Outcome: After completion of this course students shall be able to-			Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand installation and use of NLTK in python.			Understand (2)
CO2: Implement python program to process text files, morphology of Marathi words			Apply (3)
CO3: Understanding text files processing operation and Regular Expressions in NLP			Understand (2)
CO4: Understanding Morphology, PoS Tagging			Understand (2)

	Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon Faculty of Science and Technology MASTER OF COMPUTER APPLICATIONS MCA-442(A) Digital Image Processing W.E.F.2024-25 [Total Marks : External 30 + Internal 20 = 50 Marks]		
Semester	II	CA Marks:	20
Course Code	MCA-442(A)	UA Marks:	30
Contact Hours(L.T.P)	2:0:0	Exam Hours:	02
Course Objectives: 1. Define basic concepts related to digital image processing. 2. Understand elements of visible perception and image models. 3. Apply point operations to improve image quality. 4. Explain image observation models.			
Unit-1: INTRODUCTION [Lecture-06] [Marks-10]			
Definition of image, generation of image, steps in image processing, elements of digital image processing systems, image enhancements, restoration and analysis.			
Unit-2: DIGITAL IMAGE FUNDAMENTALS [Lecture-06] [Marks-10]			
Elements of visible perception, image model, sampling and quantization, relationships between pixels, imaging geometry.			
Unit-3: IMAGE ENHANCEMENTS [Lecture-06] [Marks-10]			
Point operations, histogram modeling, spatial filtering-smoothing, sharpening, low pass, high pass, homomorphic filtering.			
Unit-4: IMAGE RESTORATION [Lecture-06] [Marks-10]			
Image observation models, inverse and wiener filtering, filtering using image transforms, least squares filters, generalized inverse, , recursive filtering, causal models, digital processing of speckle images, maximum entropy restoration			
Unit-5: IMAGE SEGMENTATION [Lecture-06] [Marks-10]			
Detection of discontinuities, age linking and boundary detection, thresholding, region oriented segmentation.			
Reference Books:			
1. R. C. Gonzalez (1999), Image Processing, 2nd edition, Pearson Education, ISBN: 9780201180756 2. A. K. Jain (1995), Fundamental of Digital Image Processing, 2nd edition, Prentice Hall India (PHI) , ISBN: 9788120309296 3. C. Phillips ,(1995), Image Processing in C, BPB Publication, ISBN: 8170295157, 9788170295150 4. D. Dutta Majumdar, B. Chanda (2000), Digital Image processing, 2nd Edition, Prentice Hall India, ISBN : 8120316185, 9788120316188			
Course Outcomes : At the end of the course, students will be able to-			Cognitive Level (As Per Blooms Taxonomy)
CO1: Students will recall the fundamental elements of digital image perception and models.			Remember (1)

CO2: Students will analyze various methods of image enhancement, restoration, and analysis and understand their applications.	Analyze (4)
CO3: Students will understand how point operations and histogram modeling contribute to image enhancement.	Understand (2)
CO4: Students will recall models and techniques used in image restoration.	Remember (1)



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North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
MCA-442(B) LAB on Digital Image Processing
W.E.F. 2024-25**

[Total Marks: External 30 + Internal 20 = 50 Marks]

Semester	II	CA Marks:	20
Course Code	MCA-442(B)	UA Marks:	30
Contact Hours(L.T.P)	0:0:04	Exam Hours:	02

Course Objectives:

- Recall fundamental terminology and principles related to the field.
 - Explain core concepts and technical terminology in Digital Image Processing.
 - Explain recent advancements and technologies in Digital Image Enhancement, Restoration, Segmentation, Color Image Processing, and Morphological Image Processing.
- Read an 8 bit image and then apply different image enhancement techniques:
(a) Brightness improvement (b) Brightness reduction (c) Thresholding (d) Negative of an image
(e) Log transformation (f) Power Law transformation.
 - Read an image, plot its histogram then do histogram equalization.
 - (a) Implement Gray level slicing (intensity level slicing) in to read cameraman image.
(b) Read an 8 bit image and to see the effect of each bit on the image.
(c) Read an image and to extract 8 different planes i.e. ‘bit plane slicing.’
 - Implement various Smoothing spatial filter.
 - Read an image and apply
(a) Gaussian 3x3 mask for blurring
(b) High pass filter mask with different masks
(c) Laplacian operator with centre value positive and negative
(d) High boost filtering.
 - Write a program to implement various low pass filters and high pass filter in frequency domain.
 - Implement and study the effect of Different Mask (Sobel, Prewitt and Roberts)

Course Outcomes: After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Identify different image enhancement techniques and their purposes.	Remember (1)
CO2: Apply histogram equalization to an image and plot its histogram.	Apply (3)
CO3: Develop gray level slicing (intensity level slicing) on an image and analyze its effects.	Create (6)
CO4: Develop various smoothing spatial filters (e.g., mean, median, Gaussian filters) on images.	Create (6)



Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon
Faculty of Science and Technology
MASTER OF COMPUTER APPLICATIONS
RM-417 Research Methodology

W.E.F.2024-25

[Total Marks : External 60 + Internal 40 = 100 Marks]

Semester	II	CIE Marks:	40
Course Code	RM-417	SEE Marks:	60
Contact Hours(L.T.P)	4:0:0	Exam Hours:	03

Course Objectives:

1. To study and understand the research issues & challenges, research goals, scientific methods
2. To study Sampling, External Validity, Levels of Measurement, Scaling and Qualitative Measures. Data Preparation, Descriptive Statistics and Correlation; and Inferential Statistics
3. Reviewing Literature and Research Papers; Writing Research Papers, Thesis, Reports and Project Proposals Plagiarism and Copyrights.

Module-1 **[Lecture-08] [Marks-10]**

Research Foundations: Research, Research Goals and Quality Research, Types of Research, Variables, Hypotheses and Data; Structure, Positivism and Post-Positivism; Scientific Methods, Reasoning and Arguments; Mathematical Methods of Proof and Research Fallacies.

Module-2 **[Lecture-08] [Marks-15]**

CS Research Context: Nature of Computer Science, Scientific Methods in Computer science, Types of Research in CS, Research Methods in Computer Science, Research Paradigms in CS, Grand Challenges for CS Research.

Module-3 **[Lecture-10] [Marks-12]**

Measurements: Sampling, External Validity, Levels of Measurement, Scaling and Qualitative Measures.

Research Design: Internal Validity, Types of Designs, Experimental Design, Probabilistic Equivalence, Hybrid Experimental Designs and Quasi-Experimental Design.

Module-4 **[Lecture-11] [Marks-25]**

Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.

Module-5 **[Lecture-11] [Marks-20]**

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

Module-6 **[Lecture-12] [Marks-18]**

Research Skills: Reviewing Literature and Research Papers; Writing Research Papers, Thesis, Reports and Project Proposals; Formatting, Appendices, Citation Formats and Style; General Conventions, Issues, Plagiarism and Copyrights.

Reference Books:

1. Research Methodology: a step-by-step guide for beginners, Kumar, Pearson Education.
2. Kothari C.K. (2004) 2/e, Research Methodology – Methods and Techniques (New Age International, New Delhi).
3. Practical Research Methods, Dawson, C., UBSPD Pvt. Ltd.

Course Outcomes : After completion of this course students shall be able to-	Cognitive Level (As Per Blooms Taxonomy)
CO1: Understand the basic concepts of research and its methodologies, identify appropriate research topics, select and define appropriate research problem and parameters	Remember(1)
CO2: Prepare a research proposal.	Understand (2)
CO3: Organize and conduct research in a more appropriate manner, writing research report and thesis.	Apply(3)
CO4: Carry out sampling and data analysis	Apply(3)