Curriculum Framework

Master of Computer Application

As per NEP 2020 and Learning Outcomes-based National Curriculum Framework
(Aligned with NCrF and NHEQF)

Effective From Academic Year 2025-2026

Founded by Mahatma Gandhi in 1920

Gujarat Vidyapith
Ahmedabad

Curriculum Framework

Master of Computer Application
(MCA)
(Department of Computer Science)

As per NEP 2020 and Learning Outcomes-based National Curriculum Framework

(Aligned with NCrF and NHEQF)

Effective From Academic Year 2025-2026

GUJARAT VIDYAPITH: AHMEDABAD

Curriculum Framework of Master of Computer Application (Department of Computer Science)

Published by:

Dr. Himanshu Patel

Registrar

Gujarat Vidyapith

Near Income Tax Office, Ashram Road, Ahmedabad - 380009.

From the Desk of Vice Chancellor…

Dear All,

Any curriculum, at any level, must be firmly grounded in the objectives and goals that an educator or an educational institution aspires to achieve for its students. A course that trains students to solve mathematical equations must be very different from one that teaches them how to play a musical instrument, practice yoga, or conduct social research. Each subject requires its own methods, activities, and learning goals, which is why curriculum design is so important.

Therefore, curriculum is of utmost importance, as it determines how teachers and students will spend their time—in laboratories, in clinical practice, in creative endeavors, or in interactive lectures. It also reflects what a class, a department, a school, or an institution values; what it defines as its mission; and what it expects its graduates to accomplish. In this sense, the curriculum is the map that guides the essentials of learning from the classroom level to the institutional level.

The true success of any curriculum must be judged by its ability to achieve its intended objectives. It is a test of how well an institution—or an individual teacher—understands and articulates those objectives, and how effectively a pathway is created for students to attain success as defined by them. Curriculum is, in fact, a continuous chain of activities designed to translate broad educational goals into concrete practices, learning materials, and observable changes in behavior. A lesson plan, for instance, is curriculum at the classroom level, answering the critical questions: *What do I want my students to know? How can I engage them meaningfully? How will I measure what they have learned?*

For a society to achieve its educational aspirations, the curriculum must be both functional and relevant to its needs. Through careful management of curriculum, effective use of resources, and policies that bring systemic improvements, education can move society toward a more promising future. Indeed, curriculum is the very foundation of any academic institution—without it, the institution would lose its purpose and direction.

At Gujarat Vidyapith, established by Mahatma Gandhi in 1920 with its rich cultural and educational heritage, we remain committed to these ideals and we work with well-defined objectives to prepare our students for a brighter academic and social future.

It gives me immense pride and joy to announce the unveiling of the latest curriculum of Gujarat Vidyapith. This curriculum has been carefully designed in alignment with the objectives and guiding principles of the National Education Policy (NEP) 2020. I take this opportunity to place on record my deep appreciation for the efforts of the teaching faculty of Gujarat Vidyapith, the Members of the Board of Studies, and the Members of the Academic Council. Their dedication and vision have given shape to this comprehensive neo-curriculum, which will guide our students and our institution toward continued excellence.

With best wishes,

Dr. Harshad Patel
Vice Chancellor
Gujarat Vidyapith

Curriculum Framework

Master of Computer Application (Department of Computer Science)

Effective From Academic Year 2025-2026

Department of Computer Science

Faculty of Information, Communication and Technology

Gujarat Vidyapith

Board of Studies

Chairperson:

Prof. Ajay Parikh
Professor & Dean, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

External Experts:

1) **Prof. Rajiv Wankar**
Professor, University of Hyderabad

2) **Prof. Nilesh Modi**
Professor, Babasaheb Ambedkar Open University

Members from the Department:

1) **Prof. Dhiren Patel**
Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

2) **Dr. Neepa Shah**
Associate Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

3) **Mr. Kamaleshkumar Salunke**
Assistant Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

4) **Dr. Ruchita Shah**
Assistant Professor, Faculty of Information, Communication and Technology, Gujarat Vidyapith, Ahmedabad.

Curriculum Framework- Master of Computer Application (Department of Computer Science) - 2025

PROGRAMME STRUCTURE							
Course Code	**Course Name**	**Hours**			**Credit**	**Evaluations**	
		Theory	**Practical**	**Total**		**CCE**	**TEE**
SEMESTER-1							
256010345001	Object Oriented Programming Using JAVA	45	0	45	3	40	60
256010445002	Data Structures	60	0	60	4	40	60
256010345003	Python Programming	45	0	45	3	40	60
256010345004	Database Management System	45	0	45	3	40	60
256010245005	Lab based on Object Oriented Programming Using JAVA	0	60	60	2	40	60
256010245006	Lab based on Data Structures	0	60	60	2	40	60
256010245007	Lab based on Python Programming	0	30	30	1	40	60
256010145008	Lab based on Database Management System	0	60	60	2	40	60
Total		**195**	**210**	**405**	**20**	**320**	**480**
SEMESTER-2							
256010345009	Operating System	45	0	45	3	40	60
256010345010	Mobile Application Development						
256010345011	Web Technology-Lab Based	0	90	90	3	40	60
256010345012	Computer Network	60	0	60	4	40	60
256010345013	Software Design Pattern (GOF)	45	0	45	3	40	60
256010345014	Software Engineering	45	0	45	3	40	60
256010345015	Lab based on Operating System	0	60	60	2	40	60
256010345016	Lab based on Mobile Application Development						
256010345017	Lab based on Software Design Pattern (GOF)	0	60	60	2	40	60
Total		**195**	**210**	**405**	**20**	**280**	**420**
SEMESTER-3							
256010345018	Machine Learning & AI	45	0	45	3	40	60
256010345019	Blockchain Technology						
256010345020	Internet of Things	45	0	45	3	40	60
256010345021	Enterprise Resource Planning						
256010345022	Advanced Database Management System	60	0	60	4	40	60
256010345023	Internship	--	--	--	4	40	60
256010345024	Lab based on Machine Learning & AI	0	60	60	2	40	60
256010345025	Lab based on Blockchain Technology						
256010345026	Lab based on Internet of Things	0	60	60	2	40	60
256010345027	Lab based on Enterprise Resource Planning						
256010345028	Lab based on Advanced Database Management System	0	60	60	2	40	60
Total		**150**	**180**	**330**	**20**	**280**	**420**
SEMESTER-4							
266512045032	Internship	--	--	--	20	40	60
Total		**120**	**0**	**120**	**20**	**120**	**180**
GRAND TOTAL		**660**	**600**	**1260**	**80**	**1000**	**1500**

***CCE- Continuous Comprehensive Evaluation; **TEE- Term End Evaluation**

Programme Contents	Credits
Core Courses	**56**
Internship	**24**
Total Credits of Programme	**80**

Collaborating Organisations

- **Tiny ERP (Odoo)**
- **Tecblic India**
- **Complitech Solution Pvt. Ltd.**
- **CMExpertise Infotech Pvt.Ltd**
- **Yudiz Solutions Pvt Ltd**
- **Qurious Tech**
- **PLUSINFOSYS**
- **Addon Solutions**
- **PerceptionCare**
- **Raimptech Solutions Pvt. Ltd**
- **Xomic infotech**
- **Confidosoft**
- **Serpent Consulting Pvt. Ltd.**
- **Maxgen Technologies Ltd.**
- **Vowels digitech software Pvt. Ltd**
- **IncDesign Agency LLP**
- **Esfina Technology & Solution Pvt. Ltd.**
- **Infoware**
- **Mday Consultancy**
- **MV Clouds Private Limited**
- **NUWAVE COMMUNICATION Inc.**
- **Emerging Five**
- **Neela Spaces Limited**
- **TRENTIUM SOLUTION PRIVATE LIMITED**
- **Echobitz IT Solutions Pvt Ltd**
- **Macdroid Solutions PVT. LTD.**
- **Restrosoft Solutions Pvt. Ltd.**
- **Cilans System**
- **Wibit Solutions LLP**
- **Whitestork software solutions**

Programme Outcomes (POs)

After successful completion of the MCA program, students will be able to:

PO-1	**Advanced Knowledge of Computer Application**	Equips students with in-depth knowledge of computer applications, including software development, database management, operating systems, computer network and cyber security. It emphasizes advanced concepts in computing to build efficient, scalable, and secure solutions. Students are prepared to tackle complex IT challenges across various industry domains.
PO-2	**Research & Problem-Solving Skills**	To inculcate the ability to undertake independent and collaborative research that leads to new knowledge, innovative IT solutions, and practical applications; and to nurture an entrepreneurial mindset for creating socially responsible start-ups that address local, rural, and national challenges in alignment with Gandhian principles of self-reliance, sustainability, and service to humanity.
PO-3	**Experimental & Analytical Proficiency**	Develop strong practical skills in programming, software development, and system design through hands-on experience with various languages, tools, and platforms. At the same time, enhance analytical and problem-solving abilities to effectively analyze complex challenges and design efficient, technology-driven solutions. This integrated approach prepares students to tackle real-world computing problems with confidence and competence.
PO-4	**Interdisciplinary Approach**	Integrate knowledge from various domains, disciplines, and societal contexts to develop inclusive, people-centric IT solutions that promote rural development and digital empowerment.
PO-5	**Environmental Consciousness & Sustainability**	Understand the environmental impact of IT systems, including energy use and e-waste. Apply green computing practices in software development, cloud services, and data centers. Design ICT-based solutions to address environmental and sustainability challenges. Promote ethical responsibility and compliance with environmental regulations in IT. Contribute to sustainable development goals through eco-conscious IT innovation.
PO-6	**Ethics & Professional Values**	Instil a sense of ethical and social responsibility in students, emphasizing the importance of ethical practices, and data privacy. Apply appropriate technology in the context of society, sustainability, environment and ethical practices.
PO-7	**Effective Technical Communication**	Communicate technical information effectively in Gujarati and English, enabling outreach to local communities as well as participation in national/global digital initiatives.
PO-8	**Modern Technological Applications**	Keep students abreast of the latest developments and trends in the IT industry, including emerging technologies.
PO-9	**Teamwork & Leadership in Research**	Enhances leadership and teamwork skills in the context of software and technology projects. Prepares students to collaborate effectively in diverse development teams and manage real-world IT tasks. Encourages collective problem-solving to address complex technological challenges.

PO-10	**Lifelong Learning & Adaptability**	Recognize the need for lifelong learning and actively engage in continuous upskilling through advanced courses, certifications, and research activities, in alignment with NEP's flexible learning approach.
PO-11	**Project Management & Entrepreneurial Thinking**	Develop entrepreneurial abilities to initiate and manage start-ups or social enterprises that offer innovative applications for local, rural, and national development.
PO-12	**Social & Community Engagement**	Use computing knowledge and skills to contribute positively to society, environment, and governance, focusing on eco-friendly solutions, digital inclusion, and nation-building aligned with the vision of Gram Swaraj.

Programme Specific Outcomes (PSOs)

After successful completion of the MCA program with a specialization in Computer Science & Application, students will be able to:

PSO-1	Apply advanced computing principles, algorithms, programming languages (such as Java, Python, C++) and Web Technology to design, develop, and analyse complex software systems and data-driven solutions for industrial and societal challenges.	Aligns with **PO1 (Advanced Knowledge of Computer Application), PO2 (Research & Problem-Solving Skills),** supporting rigorous academic and professional preparation as envisioned by Gujarat Vidyapith.
PSO-2	Employ modern tools, frameworks, and technologies—including machine learning, cloud computing, IoT, Cyber Security and data analytics—to solve real-world problems, foster digital innovation, provide security and promote rural-urban technology integration.	Supports **PO8 (Modern Technological Applications),** digital literacy, and reflects **NEP 2020's vision** for technology-driven education and development.
PSO-3	Demonstrate independent and collaborative work through research projects, industrial training, and interdisciplinary approaches that advance sustainability, simplicity, and social well-being in line with Gandhian philosophy.	Support **PO5 (Environmental Consciousness & Sustainability)** and aligns with Gujarat Vidyapith's mission of rural development, service, and value-based inquiry.
PSO-4	Communicate technical concepts effectively through presentations, reports, and professional interactions, upholding ethics, cultural sensitivity, and community engagement, with emphasis on Indian knowledge systems and local languages.	Connects with **PO6 (Ethics & Professional Values), PO7 (Effective Technical Communication), PO12 (Social & Community Engagement),** and promotes Gandhian values and regional language proficiency.

CO Attainment Levels (OBE & NEP 2020 Aligned)

COs Attainment Levels	**Level**	**Description**	**Attainment Criteria**
	Level 3	High	≥ 80% of students score above a set performance benchmark
	Level 2	Moderate	60%–79% of students meet the performance benchmark
	Level 1	Low	40%–59% of students meet the performance benchmark
	Level 0	Not Attained	< 40% of students achieve the desired learning outcome

Target Attainment (Benchmark)	**Cos**	**CO-1**	**CO-2**	**CO-3**	**CO-4**
	Target Level (%)	60	60	60	60

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010345001	Name of Course Object Oriented Programming using Java	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Apply fundamental object-oriented principles such as encapsulation, inheritance, and polymorphism in Java. By writing structured programs using appropriate data types, control flow statements, Arrays and object-based constructs. Creating class, identify objects, describe, and demonstrate encapsulation mechanism

CO-2: Develop Java programs using classes, methods, constructors, inheritance, and polymorphism, demonstrating proper use of object-oriented features such as method overriding and interface implementation. Using abstract classes to design modular and reusable Java applications. Use and Create packages and classify types of packages

CO-3: Utilize built-in Java packages and effectively handle exceptions using Java's exception-handling constructs to write robust and error-resilient programs.

CO-4: Develop concurrent and file-handling applications in Java by applying multithreading concepts, stream I/O operations, and serialization techniques.

Detailed Syllabus

Unit-1.

1.1 Introduction of Object-Oriented Programming and Java: Object Oriented Overview and Concepts: Need of object-oriented programming, Object Oriented Programming vs other Paradigms, Principles of Object-Oriented Programming: Class and Objects, Encapsulation, Abstraction, Inheritance, and Polymorphism

1.2 Introduction to Java: History, Features, Program Structure, Java Virtual Machine, JRE, and J2SE/ JDK

1.3 Java Programming Constructs: Variable, Data Types: Primitive, Object Reference, String, Array etc., Identifiers, Literals, Operators, Expressions, Precedence Rules and Associativity, Type Conversion: Casting, Boxing, And Unboxing

1.4 Flow of Control: Decision Making statements: if, if else, if elseif, switch, Loop statements: do while, while, for, for-each loop. break and continue

1.5 Java Programming building blocks

1.5.1 **Class:** Introduction and Definition, Declaration, class body.

1.5.2 **Object:** Introduction and Definition, Creating Objects, Declaring, Instantiating and Initializing an Object.

Unit-2.

2.1 Java Programming building blocks

2.1.1 Methods: Declaration, Invocation & Overloading.

2.1.2 Constructors: Declaration, Constructor Overloading, "this" Keyword. Class Variable and Methods. Access Specifiers, Access Modifiers. Command Line Arguments. Garbage Collection and Finalization

2.2 Inheritance and Polymorphism

2.2.1 Inheritance Basics: Types of Inheritance, Access Control, Method Overriding, 'super' keyword, 'final' keyword

2.2.2 Polymorphism: Types of polymorphism, Abstract Method, Abstract Class

2.3 Interface and Polymorphism

2.3.1 Interface: Declaration, need, Variables and methods in Interface, Extending Interface

2.3.2 Interface Vs Abstract Class, Polymorphism with Interface

Unit-3.

- **3.1 Package:** Creating, Using and Access Protection, Importing Package, java.lang package: Object, Wrapper Classes, String, StringBuffer and StringBuilder Classes
- **3.2 java.util package:** Date, Calendar, Arrays, Scanner classes.
- **3.3 Exception Handling:** Exception and Error in Java
- **3.4 Exception Types and Exception-Handling Techniques:** try, catch, finally, throw.
- **3.5 User-Defined Exception and throws, Exception Encapsulation and Enrichment**

Unit-4.

- **4.1 Input/output & Serialization**
  - **4.1.1 Java Streams:** What is Stream, advantages,
  - **4.1.2 Types of Streams:** Character and Byte Stream
  - **4.1.3** File Class Byte and Character Stream classes hierarchy
  - **4.1.4 Reading and Writing Data:** Using Byte and Character Stream, User Input
  - **4.1.5 Serialization:** need and serialize class.
- **4.2 Multi-Threading and Multi-Thread Programming**
  - **4.2.1** Introduction, Use of Multithread programming
  - **4.2.2** The Main Thread
  - **4.2.3** Java Thread Model
  - **4.2.4** Thread class and Runnable interface
  - **4.2.5** Thread priority
  - **4.2.6** Thread synchronization and Thread communication
  - **4.2.7** Deadlock

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	1	2	2	3	2	2	2	1	2	3	2	2	1	2
CO-2	3	2	3	1	1	2	2	3	2	2	2	1	2	3	3	2	1	2.25
CO-3	3	2	3	1	1	3	2	3	2	2	2	1	2.1	3	3	3	2	2.75
CO-4	3	3	3	1	2	2	2	3	3	3	2	2	2.4	3	3	3	2	2.75
Avg	3	2.25	3	1	1.25	2.25	2	3.3	2.25	2.25	2	1.25		3	2.75	2.5	1.5	2.44

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Problem Solving, Examples, Questioning, Experiment, Demonstration, Seminar

Assessment Method

	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation/ Seminar	Involvement
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References
Books: ● Herbert Schildt - Java the Complete Reference, McGraw Hill Education ● E. Balaguruswamy, Programming with Java A Primer, Mc Graw Hill ● Herbert Schildt, Dale Skrien, Java Fundamentals A comprehensive introduction McGraw Hill Education. ● James Rumbaugh, Michael Blaha, Object-Oriented Modelling and Design, Publication - Phi. Online Resources & Tools: ● UGC Swayam Portal(Swayam Central) ● e-PGPathsala(e-PGPathshala (inflibnet.ac.in))

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010345002	Name of Course Data Structures	Compulsory
Credit: 03	Teaching Scheme: Theory (60) - Practical (0)	Teaching Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Analyze and implement fundamental linear data structures such as arrays, stacks, queues, and linked lists, including their operations and applications.

CO-2: Understand and apply binary search tree concepts, including tree traversals, insertion, deletion, and basic balanced tree mechanisms.

CO-3: Represent graphs using matrices and lists, perform graph traversals using BFS and DFS, and manage sparse matrices along with dynamic storage allocation techniques.

CO-4: Implement and compare various sorting and searching algorithms, and apply hashing techniques including collision resolution for efficient data retrieval.

Detailed Syllabus

Unit-1.

1.1 Introduction to Data Structure and Linear Data Structure: Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), Types of Data Structures- Linear & Non Linear Data Structures.

1.2 Linear Data Structure:

1.2.1 Array: Single dimensional & its addressing function, Multidimensional: two & three dimensional, Row major & column major representation & addressing functions.

1.2.2 Stack: Definition & Concept, Operations on stack, Applications of Stacks, Conversion from infix to postfix

1.2.3 Queue: Definition & Concepts, Operations on queue, Types of queue, Circular queue, Applications of Stacks priority queues, Priority queue, Process queue

1.2.4 Linked Linear List: Sequential & linked allocation, their advantages and disadvantages, Singly linked list and operations on it, Double linked list and operations on it, Circular linked list and operations on it, Applications of linked list , Linked implementation of stack & queue.

Unit-2.

2.1 Non-Linear Data Structure:

2.1.1 Binary Search tree: Definition and Concepts, Representation, Operation Like

2.1.2 Traversals: inorder, preorder, postorder, Insertion and Deletion, Copy, Searching, Sequential representation of binary tree., Some balanced tree mechanism without implementation - AVL tree, B tree, B+ Tree, Height Balance - Weight Balance

Unit-3.

3.1. **Graph:** Matrix representation of graph, Adjacency matrix, Path matrix, WARSHALL'S algorithm, MINIMAL algorithm, Adjacency list representation of graph, Operations on Graph, Breadth First Search, Depth First Search

3.2. **Multilinked structure:** Sparse matrix, Sequential & linked allocation of sparse matrix, Matrix addition using sparse matrix

3.3. **Dynamic storage management:** Fixed block storage allocation, First-fit storage allocation

Unit-4.

4.1 Sorting and Searching

4.1.1 Hashing techniques: The symbol table, Hashing Functions, Collision Resolution Techniques

4.1.2 Sorting methods: Bubble Sort, Insertion Sort, Quick sort (Partition Exchange sort), Radix sort, Heap sort, Performance comparison of sorting methods

4.1.3 Searching: Linear (sequential Search), Binary Searching

Mapping Matrix of POs, PSOs, and COs

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	–	–	1	2	1	1	–	–	1.67	3	2	2	1	2
CO-2	3	2	3	–	–	–	1	2	1	1	–	–	1.58	3	2	2	1	2
CO-3	3	3	3	1	–	–	–	2	1	1	–	–	1.67	3	2	2	1	2
CO-4	3	3	3	–	–	–	–	3	1	1	1	–	1.83	3	2	2	1	2
Avg	3	2.5	3.0	0.5	–	–	0.5	2.25	1.0	1.0	0.25	–		3	2	2	1	2

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Classroom Teaching, Group Discussion, Assignment, Examples, Questioning

Assessment Method

	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Tremblay & Sorenson, An introduction to Data Structures with applications,Tata McGrawHill
- Aaron M. Tenenbaum, Data Structures using C, PHI
- Reema Thareja, Programming in C, BPB publication, Oxford Higher Education, 2015
- Rajesh Shukla, Data Structures using C & C++ ,Wiley 2015
- નીપા શાહ , “ફ્લોચાર્ટ થી પ્રોગ્રામીંગ સુધી” , યુનિ. ગ્રંથ નિર્માણ બોર્ડ , 2024

Online Resources & Tools:

- UGC Swayam Portal(Swayam Central), e-PGPathsala(e-PGPathshala (inflibnet.ac.in))
- Virtual Lab by IIT Mumbai

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010345003	Name of Course Python Programming	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Write and execute basic Python programs using appropriate data types, control structures, and looping techniques to solve simple computational problems.

CO-2: Create and use Python functions, modules, and file-handling techniques, and apply regular expressions for efficient data processing and pattern matching.

CO-3: Apply object-oriented programming principles in Python to build modular and reusable code, and implement robust error-handling techniques to manage exceptions effectively.

CO-4: Develop and deploy interactive web applications using the Django framework, integrating front-end templates, models, forms, and database operations.

Detailed Syllabus

Unit-1.

1.1 Getting Started with Python: Introduction to Python, Installation and execution, introduction to popular IDE, Basic Data Types, Variables and print statements, Numbers, Strings

1.2 Various Operators: Assignment, Arithmetic Comparison, Logical, Bitwise, Membership and Identity Operators

1.3 Compound Data Types- Lists, Dictionaries, Tuples, Sets

1.4 Control Structures: If-elif-else Statement.

1.5 Loops: While Loops, For Loops, Nested loops and loops modifiers, Continue, Break and Pass keywords, list comprehension

Unit-2.

2.1 Functions, Modules, and Packages: Introduction to Function, built-in and User define function, Scoping, Global & Local Variables, function arguments (default, positional, keyword arguments) Scoping (global and local variable), Recursion, Lambda Functions. Introduction to Modules, Package, Working with Higher Order Functions

2.2 Files and Regular Expression: File I/O, File Opening Modes, Text Processing, String Methods, File I/O Operations. Pattern Matching and Regular Expression, Querying Publication Data.

Unit-3.

3.1 **Object Oriented Programming:** Introduction to OOP in Python, Classes and Object, Constructor, Inheritance, Subclass, Overriding, Composition, Polymorphism, Iterables, Iterators and Generators, Closers and Decorators.

3.2 **Error & Exception Handling:** Introduction to error & exception, Raising Exceptions, Exception Handling, Else and finally Clauses

Unit-4.

4.1 Python Web Application Framework- Django: Overview of Django and Web Frameworks, Setting Up Django, Installing Python, pip, and Django, URL Routing and Views, Templates in Django, Creating and using templates, Django Models and Database Operations, Django Admin Interface, Creating a superuser, Forms and User input, Mini Project / Integration

4.2 Build a small web app (e.g., a blog, to-do app, or contact form))

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	–	2	1	1	2	–	2	–	–	**2**	3	2	2	1	**2**
CO-2	3	3	3	–	–	2	–	3	–	2	–	–	**2.66**	3	3	2	1	**2.25**
CO-3	3	2	3	–	1	2	–	3	2	2	–	–	**2.25**	3	2	2	1	**2**
CO-4	3	2	3	2	–	2	2	3	3	3	2	1	**2.36**	3	3	3	2	**2.75**
Avg	**3**	**2.25**	**3**	**2**	**1.5**	**1.75**	**1.5**	**2.75**	**2.5**	**2.25**	**2**	**1**		**3**	**2.5**	**2.25**	**1.5**	**2.25**

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	● Problem Solving, Examples, Questioning, Assignment
CO-2 (Unit: 2)	● Problem Solving, Examples, Questioning, Assignment, Experimental
CO-3 (Unit: 3)	● Problem Solving, Examples, Questioning, Assignment, Experimental
CO-4 (Unit: 4)	● Problem Solving, Examples, Questioning, Assignment, Experimental, Demonstration, Project

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Presentation
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	12	8
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- Python Programming, RupeshNasre, AICTE, Oct-2020.
- Object-Oriented Python, Irv Kalb, O'Reilly, January 2022.
- Python Object-Oriented Programming, Steven F. Lott, Dusty Phillips, Packt, Fourth Edition.

Online Resources & Tools:

- ttps://www.freecodecamp.org/news/the-python-handbook/
- https://www.freecodecamp.org/learn/data-analysis-with-python/data-analysis-with-python-course/introduction-to-data-analysis

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010345004	Name of Course Database Management System	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the three-level architecture of a database system and demonstrate the role of keys and the DBMS in managing data access and integrity.

CO-2: Apply SQL commands for database creation, data manipulation, and trigger implementation, while understanding isolation levels and concurrency control through locking mechanisms.

CO-3: Construct Entity-Relationship diagrams and apply normalization techniques up to Fifth Normal Form to ensure data consistency and eliminate redundancy.

CO-4: Analyse transaction control mechanisms such as two-phase commit and resolve concurrency problems using appropriate locking and isolation techniques.

Detailed Syllabus

Unit-1.

1.1 Architecture of DBMS: The Three Levels of the Architecture. The External Level, The Conceptual Level, The Internal Level, Mappings, The Database Administrator, The Database Management System, Candidate Keys, Primary Keys, Alternate Keys, Foreign Keys

Unit-2.

2.1 Locking and Isolation: Deadlock, Serializability, Level of Isolation, Intent Locking

2.2 SQL: Database creation & management, Table creation and management, Query on tables (select, insert, delete, update statement), Triggers

Unit-3.

3.1 **ER Diagram**

3.2 **Database table Normalization:** Non-loss Decomposition and Functional Dependencies, First, Second, Third, Fourth and Fifth Normal Forms, Dependency Preservation, Boyce/Codd Normal Form.

Unit-4.

4.1 Two-Phase Commit, Concurrency Problems: Two-Phase Commit, SOL Support, Three Concurrency Problems, Locking, The Three Concurrency Problems Revisited

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	–	2	1	2	1	2	–	–	1.89	3	2	2	1	2
CO-2	3	2	3	1	1	2	–	3	2	2	–	–	2.11	3	3	2	1	2.25
CO-3	3	2	3	2	1	2	–	2	2	2	–	–	2.11	3	3	2	1	2.25
CO-4	3	2	3	1	1	2	–	2	2	2	–	–	2	3	2	2	1	2
Avg	3	2	3	1.2	1	2	1	2.25	1.7	2	–	–		3	2.5	2	1	2.12

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy	
CO-1 (Unit: 1)	• Classroom Teaching, Tutorial
CO-2 (Unit: 2)	• Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	• Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	• Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	**COs**	**Marks**	**Exam Component**		
			Class Test	**Assignment**	**Presentation**
	CO-1	10	5	5	-
	CO-2	10	5	-	5
	CO-3	10	5	2.5	2.5
	CO-4	10	5	2.5	2.5
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- An Introduction to Database Systems by C.J.Date, A. Kannan, S. Swamynathan Publisher Pearson, 8th edition
- An Introduction to Database Management System By - Bipin Desai, Publisher PHI, Edition second
- Database System Concepts By - AviSilberschatz, Henry Korth, S.Sudarshan,PublisherMcGrow-Hill, Edition 5th.

Online Resources & Tools:

- UGC Swayam Portal(Swayam Central), e-PGPathsala(e-PGPathshala (inflibnet.ac.in))

Program – MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010345005	Name of Course Lab based on Object Oriented Programming Using JAVA	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand the fundamental concepts of object-oriented programming and implement Java programs using basic syntax, data types, operators, control statements, and objects.

CO-2: Design and develop robust Java programs using classes, methods, constructors, inheritance, and polymorphism principles including abstract classes and interfaces.

CO-3: Implement modular Java applications using packages and handle runtime anomalies through exception handling techniques.

CO-4: Develop file-based and multithreaded applications in Java with efficient use of streams, serialization, synchronization, and inter-thread communication.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	–	2	–	–	1	–	2	–	1	–	–	1.80	3	2	1	2	2
CO-2	3	–	3	–	–	1	–	3	2	1	–	–	2.16	3	3	1	2	2.25
CO-3	3	–	3	–	–	2	–	3	2	2	1	–	2.28	3	3	2	1	2.25
CO-4	3	–	3	–	1	2	1	3	3	2	1	1	2	3	2	2	3	2.5
Avg	3	--	2.75	--	1	1.5	1	2.75	2.33	1.5	1	1		3	2.5	1.5	2	2.25

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Experimental Learning • Demonstration and Guided Practice • Project-Based Learning • Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010245006	Name of Course Lab based on Data Structures	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Teaching Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Develop, implement, and analyze linear data structures like arrays, stacks, queues, and linked lists with their applications.

CO-2: Construct and manipulate non-linear data structures like binary search trees and understand balancing mechanisms of advanced trees.

CO-3: Apply graph theory and multi-linked structures to solve computational problems and implement dynamic memory management techniques.

CO-4: Implement various searching and sorting algorithms, analyze their performance, and apply hashing techniques for efficient data retrieval.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	–	–	1	1	2	1	2	–	–	1.73	3	2	1	2	2
CO-2	3	2	3	–	–	1	–	2	1	2	–	–	1.64	3	3	1	2	2.25
CO-3	3	3	3	–	–	2	–	3	2	3	1	–	2.36	3	3	2	1	2.25
CO-4	3	2	3	–	–	2	–	2	2	2	–	–	2	3	2	2	3	2.5
Avg	3	2.25	3.0	–	–	1.5	0.25	2.25	1.5	2.25	0.25	–		3	2.5	1.5	2	2.25

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Experimental Learning • Demonstration and Guided Practice • Project-Based Learning • Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010345007	Name of Course Lab based on Python Programming	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Apply core Python programming constructs including data types, operators, control structures, and compound data types to solve computational problems effectively.

CO-2: Design and implement modular Python programs using functions, modules, and packages, and perform file operations and text processing using regular expressions.

CO-3: Develop object-oriented Python programs with classes, inheritance, and polymorphism, and apply exception handling mechanisms for building robust applications.

CO-4: Design and build basic web applications using Django framework, integrating models, views, templates, forms, and database operations.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	1	1	1	2	2	2	1	1	**1.67**	3	2	1	2	**2**
CO-2	3	2	3	1	1	1	1	2	2	2	1	1	**1.67**	3	2	1	2	**2**
CO-3	3	2	3	1	1	2	1	2	2	2	1	1	**1.83**	3	3	2	1	**2.25**
CO-4	3	3	3	2	1	2	2	3	3	2	2	2	**2.42**	3	2	2	3	**2.5**
Avg	**3**	**2.25**	**3**	**1.25**	**1**	**1.5**	**1.25**	**2.25**	**2.25**	**2**	**1.25**	**1.25**		**3**	**2.25**	**1.5**	**2**	**2.19**

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Experimental Learning
CO-2 (Unit: 2)	• Demonstration and Guided Practice
CO-3 (Unit: 3)	• Project-Based Learning
CO-4 (Unit: 4)	• Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010345008	Name of Course Lab based on Database Management System	Compulsory
Credit: 01	Teaching Scheme: Theory (0) - Practical (30)	Lab Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand the architecture and components of DBMS and implement various key constraints to ensure database integrity.

CO-2: Design and manipulate relational databases using SQL and apply concurrency control through locking and isolation mechanisms.

CO-3: Analyze and normalize relational schemas using ER diagrams, functional dependencies, and normal forms.

CO-4: Demonstrate transaction management and concurrency resolution techniques including two-phase commit and data consistency strategies.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	–	2	–	2	1	2	–	1	1.89	3	2	1	2	2
CO-2	3	2	3	1	–	2	–	3	1	2	1	1	1.9	3	3	1	2	2.25
CO-3	3	2	3	1	1	2	–	2	1	1	–	1	1.7	3	3	2	1	2.25
CO-4	3	2	3	1	–	2	–	3	2	2	1	1	2	3	2	2	3	2.5
Avg	3	2	3	1	1	2	–	2.50	1.2	1.75	1	1		3	2.5	1.5	2	2.25

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Experimental Learning
CO-2 (Unit: 2)	• Demonstration and Guided Practice
CO-3 (Unit: 3)	• Project-Based Learning
CO-4 (Unit: 4)	• Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010345009	Name of Course Operating System	Elective
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the fundamental concepts of operating systems, including system architecture, kernel functions, and the internal structure of files and directories.

CO-2: Describe and utilize file system calls and understand process states, transitions, and memory layout in the operating system.

CO-3: Manage processes by implementing context switching, process creation, signal handling, and process termination.

CO-4: Apply process scheduling algorithms and understand memory management concepts along with system boot procedures and initialization processes.

Detailed Syllabus

Unit-1.

1.1 **Introduction to Operating System and File Structure:** General overview of the system, System Structure, User Perspective, Operating System Service, Assumptions about Hardware, Introduction to the kernel, Architecture of the Operating System, Introduction to the system concepts, Kernel Data Structures, System Administration, Internal Representation of Files, Structure of a Regular File, Directories, Conversion of a path name, Super Block, Creation of a new file, Allocation of Disk Blocks, Other File Types

Unit-2.

2.1 **File System Calls and Process Sub System:** System Calls for the File System (without algorithm) - Open, Read, Write, File and Record Locking, Close, File Creation, Change Directory and Change Root, Change Owner and Changing Mode, The structure process, Process states and transitions, Layout of system memory

Unit-3.

3.1 **Process functions:** The context of a process, Saving the context of a process, Manipulation of the process address space, Sleep

3.2 **Control of the process:** Process Control, Process Creation, Signals, Process termination, Awaiting process termination, invoking other programs, the user ID of a process, Changing the size of a process

Unit-4.

4.1 Process Scheduling and Memory Management: Process scheduling and time, Process scheduling, System calls for time, Memory Communication, The shell, System Boot, The INIT process

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	1	1	1	1	2	1	2	1	1	1.58	3	2	1	1	1.75
CO-2	3	2	3	1	1	1	1	2	1	2	1	1	1.67	3	2	1	1	1.75
CO-3	3	3	3	1	1	1	1	2	2	2	1	1	1.83	3	2	2	1	2
CO-4	3	3	3	2	2	1	1	2	2	2	2	2	2.08	3	3	2	2	2.5
Avg	3	2.5	2.75	1.25	1.25	1	1	2	1.5	2	1.25	1.25		3	2.25	1.5	1.25	

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) **CO-2 (Unit: 2)** **CO-3 (Unit: 3)** **CO-4 (Unit: 4)**	• Classroom Teaching, Group Discussion, Assignment, Examples, Questioning

Assessment Method

	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Morris Bache, The design of Unix Operating system, PHI
- Meeta Gandhi, Tilak Shetty, Rajiv Shah,The C Odysse, BPB
- Abraham Silberschatz , Peter B. Galvin, et al, Operating System Concepts, Wiley, 2019
- Yashavant Kanetkar, Unix Shell Programming by, BPB publications, 2003

Online Resources & Tools:

- UGC Swayam Portal(Swayam Central), e-PGPathsala(e-PGPathshala (inflibnet.ac.in))

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010345010	Name of Course Mobile Application Development	Elective
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand the fundamental components of Android applications, including activities, services, and intents, and configure the AndroidManifest file to manage application behavior and permissions effectively.

CO-2: Organize and utilize Android application resources efficiently and design intuitive user interfaces using layout managers, screen elements, and animations.

CO-3: Integrate Android data storage techniques such as SQLite and content providers, and implement RESTful web services to enable seamless data exchange within and across mobile applications.

CO-4: Apply advanced Android APIs related to networking, telephony, location (Google Maps), and hardware sensors to develop feature-rich, context-aware mobile applications.

Detailed Syllabus

Unit-1.

1.1 **Android Application Design Essentials:** Anatomy of an Android applications, Application Context, Activities, Services, Intents

1.2 **Android Application Design Essentials:** Receiving and Broadcasting Intents, Android Manifest File and its common settings.

Unit-2.

2.1 **Manifest File:** Using Intent Filter, Permissions, Managing Application resources in a hierarchy, Working with different types of resources**.**

2.2 **Android User Interface Design Essentials:** User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation

Unit-3.

3.1 **Using Common Android APIs:** Using Android Data and Storage APIs, Managing data using SQLite, Webservice (SOAP and REST), REST Webservice creation and utilization of webservice in Android Application, Sharing Data between Applications with Content Providers.

Unit-4.

4.1 Using Common Android APIs: Android Networking APIs , Android Web APIs, Android Telephony APIs, Google MAP in Android application, Accessing Android's Hardware Sensors (orientation sensors, light sensors)

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	2	–	2	1	2	2	2	2	2	2.09	3	2	2	12	2.25
CO-2	3	1	3	3	2	2	2	2	1	2	2	2	2.08	3	3	2	2	2.5
CO-3	3	3	3	2	2	2	1	3	2	2	2	2	2.25	3	3	2	2	2.5
CO-4	3	2	3	2	3	2	1	3	2	2	2	2	2.25	3	3	2	2	2.5
Avg	3	2	3	2.25	2.33	2	1.25	2.50	1.75	2	2	2		3	2.75	2	2	2.44

3 = Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Classroom Teaching, Tutorial
CO-2 (Unit: 2)	• Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	• Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	• Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	**COs**	**Marks**	**Exam Component**		
			Class Test	**Assignment**	**Presentation**
	CO-1	10	5	5	-
	CO-2	10	5	-	5
	CO-3	10	5	2.5	2.5
	CO-4	10	5	2.5	2.5
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- Android Wireless Application Development by LaurenDarcey and Shane Conder, 3rd Edition, Pearson Education.
- Professional Android 2 Application Development by Reto Meier, Wiley India Pvt Ltd, 2011.
- Beginning Android by Mark L Murphy, Wiley India Pvt Ltd, 2009.
- Pro Android by Sayed Y Hashimi and Satya Komatineni, Wiley India Pvt Ltd, 2009.

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010345011	Name of Course Web Technology (Lab based)	Compulsory
Credit: 03	Teaching Scheme: Theory (0) - Practical (90)	Teaching Hours: 90

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Develop dynamic web pages using DHTML, JavaScript, and DOM. And describe and distinguish the architecture of client-side and server-side web applications. Establish database connectivity using JDBC to create data-driven applications.

CO-2: Build Java web applications using Servlets that handle HTTP requests, manage sessions through hidden form fields, URL rewriting, cookies and session API and interact with databases using JDBC for persistent data processing.

CO-3: Design interactive and responsive web applications using Java Server Pages (JSP), leveraging JSP scripting elements, session tracking, and JavaBeans for seamless data exchange and form handling.

CO-4: Implement Java web applications using the MVC design pattern and create well-structured XML documents with DTD and XML Schema for effective data representation and validation.

Detailed Syllabus

Unit-1. Data manipulation and Store data, Web Concepts, DHTML and Java Editions

1.1 **Database Handling using JDBC:** Java Database Connectivity, Driver, Driver Types, Compare and advantages of drivers, DriverManager, Connection, Statement, Prepared Statement, Callable Statement, ResultSet, Result set metadata. Overview of the Internet, Web as a platform and its components. Form processing at the client side. DHTML and its components. Dynamic page using DOM, CSS, and Java Script.

1.2 **Introduction to Request:** Response Architecture, Web application and HTTP Protocol, Tomcat application server and its structure, Java Web Application Architecture, Understanding HTTP Status Codes, HTTP Request ad Response Headers, Overview of Java Editions.

1.3 **Tomcat – The Servlet-JSP Container/Engine:** Introduction, Installation, and configuration, Understating the responsibility of Container/Engine. Create and deploy web application.

Unit-2. Servlet API and Session Management

2.1 **Servlet Model:** Servlet: What and why? Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor, Comparison with existing technologies, Servlet Interface, Servlet Context and Servlet Config interface, Generic Servlet, Http Servlet, Steps to create a Java web application in Tomcat, Handling Client Request- Reading Request Headers, reading request data in Servlet and Generate dynamic content/response. Request Redirection and Dispatching, Servlet- catch form data sent from client, process it, and store it on database. JDBC (Java Database Connectivity) and how it can be used within servlet.

2.2 **Session Tracking and Management:** Session Tracking: What and Why? Understanding Session Timeout and Session Tracking - Hidden Form Field, URL Rewriting, Cookies, HTTP Session

2.3 **Cookies:** Create Cookie, remember user data, Deleting Cookies, Sending and Receiving Cookies, Differentiating Session Cookies from Persistent Cookies, Using Cookies to Remember User Preferences.

Unit-3.

3.1 **Session API:** Session API, Session Tracking: session creation, session management, session timeout, accumulating and retrieve User Data, Encoding URLs.

3.2 **Java Server Pages (JSP):** Compare Servlet and JSP, Overview of JSP, Advantages of JSP, JSP Comment, Life Cycle of JSP page, JSP API, JSP Expression, JSP Scriptlet, JSP Declaration, JSP Directives, JSP Standard Action, JSP implicit Objects, JSP Directive, JSP Scripting elements, JSP Action Elements:

jsp:forward, jsp:include, jsp:useBean, jsp:setProperty & jsp:getProperty, Java Bean and JSP Communication, Exception Handling, JSP Session and Cookies Handling, JSP Session Tracking, JSP-catch form data sent from client, process it, and store it on database.

Unit-4.

4.1 Model-View-Controller (MVC) Application Design with Servlet-JSP: Introduction, MVC pattern Layer: Model, View, and Controller. Role of Servlet and JSP in MVC. Role and responsibility of Model, View, and Controller in MVC, Advantages of MVC. Role of Servlet, JSP, Java bean, and POJO in MVC.

4.2 XML Technology

4.2.1 Extensible Markup Language (XML): Introduction and Overview, XML, Understanding the purpose and difference of HTML and XML, History and application of XML, XML Syntax, XML Document Structure and Building Blocks of XML Documents, XML Parsers, Well-formed and valid XML Documents, XML Namespace, Understating DOM, Types of Elements

4.2.2 Document Type Definition (DTD): Introduction to DTD, Purpose of DTD, Create Internal and External DTD, referencing a DTD in an XML Document, defining building blocks of XML documents - Elements, Attributes, Entities, PCDATA, CTADA, Declaring Elements, Attributes and Entity.

4.3 XML Schema: Purpose of XML Schema, Advantages of XML Schema, Comparison with DTD, Understanding Why XML Schema is better than DTD, Create XML Schema Document (.XSD), Referencing a Schema in an XML Document, defining building blocks of XML documents using Schema, XML Schema Date Types, Understating use of Restriction, Occurrence, and Indicators with examples.

Mapping Matrix of POs, PSOs, and Cos

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	–	2	2	3	2	2	2	1	2.1	3	2	2	2	2.25
CO-2	3	3	3	1	–	3	2	3	2	2	2	1	2.27	3	3	2	2	2.5
CO-3	3	2	3	1	–	3	2	3	2	2	2	1	2.18	3	3	2	2	2.5
CO-4	3	3	3	2	1	3	2	3	2	2	2	2	2.33	3	3	2	3	2.75
Avg	3	2.5	3	1.25	1	2.75	2	3	2	2	2	1.25		3	2.75	2	2.25	2.5

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) **CO-2 (Unit: 2)** **CO-3 (Unit: 3)** **CO-4 (Unit: 4)**	• Experiential Learning • Demonstration–Practice–Reflection: Demonstration of concepts and tools, Hands-on Practice/Experiments, Debugging, Discussion, and Reflection • Collaborative Learning, Outcome-Based Learning, Questioning and Quiz, Continuous Evaluation, Project-Based Learning

Assessment Method

			Exam Component			
	COs	Marks	Quiz	Practical Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	2.5	2.5	13	7
	CO-2	10	2.5	2.5		
	CO-3	10	2.5	2.5		
	CO-4	10	2.5	2.5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- "Java Servlet Programming", by Jason Hunter, William Crawford, O'Reily Publication
- "Head First Servlets and JSP" by Bryan Basham, Kathy Sierra, Bert Bates, O'Reily Publication
- "Professional XML", by Mark Birbeck, Wrox Publication
- "Core Servlets and Java Server Pages" Volume – 2", Pearson Education
- "Java Server Programming", A Press Publication
- "Pro JSP 2" by Simon Brown, Sam Dalton, Daniel Jepp, David Johnson, Sing Li, and Matt Raible, Apress Publication
- "Web Technologies Black Book", Dreamtech Press, Edition 2010
- "Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script", by Ivan Bayross, BPB Publications, Revised Edition

Online Resources & Tools:

- **Apache Tomcat** http://tomcat.apache.org

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010345012	Name of Course Computer Network	Compulsory
Credit: 04	Teaching Scheme: Theory (60) - Practical (0)	Teaching Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the structure and purpose of layered network models (OSI and TCP/IP), describe physical transmission media, and apply basic error detection and correction techniques used in the data link layer.

CO-2: Analyze and implement data link control mechanisms and evaluate various routing algorithms and addressing schemes in both IPv4 and IPv6.

CO-3: Describe the responsibilities of the transport layer and demonstrate how reliable communication, congestion control, and connection management are achieved in computer networks.

CO-4: Examine key application layer protocols (such as DNS, SMTP, POP3) and apply foundational concepts of network security, including cryptography, digital signatures, and authentication protocols.

Detailed Syllabus

Unit-1.

1.1 **Introduction:** Need of Data Communication and Applications, Network Models, TCP/IP and OSI Layering Models

1.2 **Physical Layer:** Transmission Media, Wired and Wireless Physical Layer

1.3 **Data Link Layer – Error Detection and Correction:** Introduction and Duties of Data Link Layer, Types of Errors, Redundancy, Detection Versus Correction, Forward Error Correction Versus Retransmission, Error Detection, Error Correction, Block Coding, Linear Block Codes, Cyclic Codes

Unit-2.

2.1 **Data Link Layer – Data Link Control:** Data Link Control and Protocols, Flow and Error Control and its mechanism, Noiseless and Noisy Channels, Bluetooth, Architecture, Applications, Profiles, Pairing Process

2.2 **Network Layer:** Introduction, Duties of Network Layer, Routing, Accounting, Global Machine Level addressing, Connection Oriented and Connectionless Forwarding, Forwarding Examples, Routing Algorithms, Distance Vector Routing, Link State Routing, Border Gateway Protocol, Congestion and its Control, IPv4 Addresses, Address Space, Notations, Classful Addressing, Classless Addressing, Subnetting and Supernetting, IPv6 Addresses, Structure, Address Space, ICMP

Unit-3.

3.1 Transport Layer: Introduction, Duties of Transport Layer, Multiplexing, Demultiplexing and Port Numbers, Service to other Layers, Transport Layer of the Internet, Process Level Addressing, End to End Solutions, Connection Management at the Transport Layer, Delayed Duplicates, Connection Establishment, Connection Release, Congestion Control, Detecting Congestion, Reacting to Congestion, Fast Recovery, Flow Control, Communication Primitives

Unit-4.

4.1 Application Layer: Introduction, Domain Name System, Domain Name Space, Registration Process, Name Servers, Resource Records, Mailing System, SMTP, POP3 and IMAP, Webmail, SNMP, Network Protocol Analyzer, Wireshark and its Applications and Features

4.2 Information Security: Introduction to Network Security, Cryptography, Digital Signatures, Public Key Management, Authentication Protocol, Authentication based on Shared Secret Key, Information Security

Mapping Matrix of POs, PSOs, and Cos

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	1	2	-	1	2	1	2	-	1	-	1	1.55	3	2	1	2	2
CO-2	3	2	3	1	1	1	1	2	2	1	-	1	1.63	3	3	1	2	2.25
CO-3	3	1	3	-	-	1	1	2	1	1	-	-	1.62	3	3	2	1	2.25
CO-4	3	1	2	1	2	3	1	3	1	1	-	2	1.81	3	2	2	3	2.5
Avg	3	1.25	2.5	1	1.33	1.75	1	2.25	1.33	1	-	1.33		3	2.5	1.5	2	2.25

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Lecture, Assignment, Demonstration, Example

Assessment Method

	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Computer Network, AndrewS.Tanenbaum
- Computer Network, Bhushan Trivedi
- Introduction to Data Communication and Networking,BehrouzForouzan
- Computer Network, Natalia Olifer, VictorOlifer
- Data and Computer Communication, William Stallings

Online Resources & Tools:

- UGC Swayam Portal(Swayam Central)
- e-PGPathsala(e-PGPathshala (inflibnet.ac.in))
- NPTEL

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010345013	Name of Course Software Design Pattern (GOF)	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Analyze and model real-world systems using object-oriented principles, applying concepts such as classes, associations, generalization, inheritance, and aggregation to develop effective class diagrams.

CO-2: Identify and apply appropriate creational design patterns such as Factory Method, Abstract Factory, Singleton, and Prototype to solve recurring object creation problems in software design.

CO-3: Implement structural and behavioral design patterns, including Adapter, Decorator, Proxy, Strategy, and Observer, to enhance software flexibility and maintainability.

CO-4: Evaluate and integrate design patterns and anti-patterns within modern development frameworks (e.g., .NET, Java) through real-world case studies and practical applications.

Detailed Syllabus

Unit-1.

1.1 **Object Modeling:** Introduction to key principles of Object-oriented design, Object Orientation Analysis and Design, Object Oriented Development and Themes, Importance of Modelling, principles of modelling, Objects, Classes, Class Diagrams, Values and Attributes, Operations and Methods, Link and Association concepts -Links and Associations, Multiplicity, Association and Names, Ordering, Association Classes, Qualified Association, Generalization and Inheritance, Aggregation ,Abstract classes, Generalization as extension and Restriction, Grouping Constructs, Sample Object modelling

Unit-2.

2.1 **Design Patterns (GOF):** Introduction to design Pattern, Describing design Patterns, The catalog of Design Patterns, selecting design pattern and solve design problems

2.2 **Creational Patterns:** Abstract factory, Factory Method, Singleton, Prototype

Unit-3.

3.1 **Structural Patterns:** Adapter, Decorator, Façade, Proxy

3.2 **Behavioral Patterns:** Chain of Responsibility Pattern, State, Strategy, Observer

Unit-4.

4.1 Advanced Topics and Case Studies: Combining pattern, anti-pattern, Case Study of and Pattern in modern frameworks like .net , java etc.

Mapping Matrix of POs, PSOs, and COs

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	1	1	1	2	–	2	–	–	2	3	2	1	2	2
CO-2	3	2	3	–	–	2	–	3	–	2	1	–	2.28	3	3	2	2	2.5
CO-3	3	2	3	1	1	2	–	3	2	2	–	–	2.42	3	3	2	2	2.5
CO-4	3	3	2	1	1	2	1	3	2	3	2	1	2.09	3	2	2	3	2.5
Avg	3	2.25	2.75	1	1.5	1.75	1	2.75	2	2.25	1.5	1		3	2.5	1.75	2.25	2.38

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	● Problem Solving, Examples, Questioning, Assignment
CO-2 (Unit: 2)	● Problem Solving, Examples, Questioning, Assignment, Experimental
CO-3 (Unit: 3)	● Problem Solving, Examples, Questioning, Assignment, Experimental
CO-4 (Unit: 4)	● Problem Solving, Examples, Questioning, Assignment, Experimental, Demonstration, Project

Assessment Method

	COs	**Marks**	**Exam Component**				
			Class Test	**Assignment**	**Presentation**	**Case Study**	**Involvement**
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	5	4	5	6
	CO-2	10	5				
	CO-3	10	5				
	CO-4	10	5				
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**				
	CO-1	15	Term End Examination				
	CO-2	15					
	CO-3	15					
	CO-4	15					

References

Books:

- Object – Oriented Modeling and Design by James Rumbaugh, Michael Blaha
- Design Patterns Elements of Reusable Object-Oriented Software by Erich Gama, Richard Helm, Ralph Johnson, John Vlissides, Pearson Education
- Head First Object –Oriented Analysis & Design by Brett D. McLaughlin, Gary Pollice & David West, O'REiLLY
- Head First Design Pattern by Eric Freeman & Elisabeth Freeman, O'REiLLY

Online Resources & Tools:

- https://www.edulib.in//userLib/subjectTopics/553

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010345014	Name of Course Software Engineering	Compulsory
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the fundamental concepts of software engineering, including various software process models and agile methodologies, to understand software development life cycles.

CO-2: Analyze and document software requirements effectively using techniques such as requirement elicitation and UML modeling to create comprehensive Software Requirement Specifications (SRS).

CO-3: Apply design principles and testing strategies to develop robust software architectures and validate software quality through systematic testing approaches.

CO-4: Manage software projects by employing project planning, risk management, software metrics, and quality assurance practices to ensure timely and quality software delivery.

Detailed Syllabus

Unit-1.

1.1 **Introduction to Software and Software Engineering:** The Evolving Role of Software, Software Engineering: A Layered Technology, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models, Component-Based Development, Agility and Agile Process model, Extreme Programming

Unit-2.

2.1 **Requirement Analysis and Specification:** Understanding the Requirement, Requirement Modelling, Requirement Specification (SRS), Requirement Analysis and Requirement Elicitation, Requirement Engineering

2.2 **Introduction to UML:** UML Building Blocks, Modelling Views, Introduction to Use Case, Use Case Diagrams, State Diagrams, Sequence Diagrams, Activity Diagrams, Component Diagrams, Packages and Foundation

Unit-3.

3.1 Software Design: Design Concepts and Design Principal, Architectural Design, Component Level Design, User Interface Design, Web Application Design

3.2 Software Testing: Testing Strategies, Testing Techniques, Test Cases, Testing Conventional Applications, Testing Object Oriented Applications

Unit-4.

4.1 Software Project management: Software Metrics : Process, Product and Project Metrics, Software Project Estimations, Software Project Planning, Project Scheduling & Tracking, Risk Analysis & Management

4.2 Software Quality management: Quality Concepts and Software Quality Assurance, Software Reviews (Formal Technical Reviews), Software Reliability, The Quality Standards : ISO 9000, CMM, Six Sigma for SE, SQA Plan

Mapping Matrix of POs, PSOs, and COs

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	–	2	–	–	2	–	2	–	1	–	–	**2**	3	2	1	2	**2**
CO-2	2	2	3	1	–	2	–	2	1	–	–	–	**1.88**	3	3	1	2	**2.25**
CO-3	3	–	3	–	2	2	–	3	1	–	–	–	**2.29**	3	3	2	1	**2.25**
CO-4	2	3	2	1	–	3	2	2	3	2	3	1	**2.18**	3	3	2	3	**2.75**
Avg	**2.50**	**2.33**	**2.50**	**1**	**2**	**2.25**	**2**	**2.25**	**1.67**	**1.50**	**3**	**1**		**3**	**2.27**	**1.75**	**2**	**2.31**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	● Lecture, Seminar, Assignment, Case-Study, Examples
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Presentation
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	7	13
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- Software Engineering – A Practitioner's Approach by Roger S. Pressman, McGraw-Hill International Edition, 7th Edition.
- Software Engineering by Ian Sommarville, Printice_Hall India.
- Software Engineering by Pankaj Jalote, Narosa Publication.

Online Resources & Tools:

- UGC Swayam Portal(Swayam Central)
- e-PGPathsala (e-PGPathshala (inflibnet.ac.in))

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010245015	Name of Course Lab based on Operating System	Elective-I
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Develop and execute shell scripts for automation, file management, and demonstrate process-related commands and system programming in UNIX/Linux.

CO-2: Develop File sharing and resource sharing programs using low level system calls.

CO-3: Implement and analyze process creation, management of process using pipe and inter process communications using signals in process sub systems.

CO-4: Implement message queue and semaphore for process management and inter process communications.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	1	1	1	1	2	1	2	1	1	1.58	3	2	1	1	1.67
CO-2	3	2	3	1	1	1	1	2	1	2	1	1	1.67	3	2	1	1	1.75
CO-3	3	3	3	1	1	1	1	2	2	2	1	1	1.83	3	2	2	1	1.92
CO-4	3	3	3	2	2	1	1	2	2	2	2	2	2.08	3	3	2	2	2.17
Avg	3	2.5	2.75	1.25	1.25	1	1	2	1.5	2	1.25	1.25		3	2.25	1.5	1.25	

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Experimental Learning, Demonstration and Guided Practice • Project-Based Learning, Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010245016	Name of Course Lab based on Mobile Application Development	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand the structure and components of Android applications and apply intent-based communication between components.

CO-2: Design effective and user-friendly interfaces using Android UI components, resources, layouts, and animation techniques.

CO-3: Utilise Android APIs for local storage and integrate web services to handle data-driven mobile applications.

CO-4: Implement Android networking, telephony, and sensor APIs.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	–	2	2	3	2	2	1	1	**2**	3	3	2	2	**2.5**
CO-2	3	1	3	2	1	2	2	3	1	1	1	1	**1.75**	3	2	2	1	**2**
CO-3	3	2	3	2	–	2	1	3	2	2	2	1	**2.09**	3	3	2	2	**2.5**
CO-4	3	1	3	2	1	2	1	3	2	–	–	–	**2**	3	2	2	1	**2**
Avg	**3**	**1.50**	**3**	**1.75**	**1**	**2**	**1.50**	**3**	**1.75**	**1.67**	**1.33**	**1**		**3**	**2.5**	**2**	**1.5**	**2.25**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Experimental Learning • Demonstration and Guided Practice • Project-Based Learning • Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010245017	Name of Course Lab based on Software Design Pattern (GOF)	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Teaching Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Apply the principles of object-oriented design and develop object models using class diagrams, associations, generalization, aggregation, and other UML constructs for real-world systems.

CO-2: Design and implement solutions to software creation problems using appropriate creational patterns such as Singleton, Factory Method, Abstract Factory, and Prototype.

CO-3: Analyze software design problems and apply structural and behavioral patterns, including Adapter, Decorator, Proxy, Facade, Strategy, Observer, Chain of Responsibility, and State.

CO-4: Integrate multiple design patterns effectively in large-scale systems, identify and refactor anti-patterns, and analyse the use of patterns in modern frameworks and case studies.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	2	1	1	1	2	2	2	1	1	1.75	3	2	2	2	2.25
CO-2	3	2	3	1	1	1	1	2	2	2	1	1	1.67	3	2	2	1	2
CO-3	3	2	3	2	1	2	1	2	2	2	1	1	1.83	3	3	2	2	2.5
CO-4	3	3	3	2	1	2	2	3	3	2	2	2	2.33	3	3	3	2	2.75
Avg	3	2.25	3	1.75	1	1.5	1.25	2.25	2.25	2	1.25	1.25		3	2.5	2.25	1.75	2.375

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Experimental Learning • Demonstration and Guided Practice • Project-Based Learning • Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510345018	Name of Course Machine Learning & AI	Elective-I
Credit: 03	**Teaching Scheme: Theory (45) - Practical (0)**	**Teaching Hours: 45**

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the fundamental types of machine learning and apply the K-Nearest Neighbours (K-NN) algorithm to classify data using appropriate distance metrics and data preprocessing techniques.

CO-2: Develop and evaluate predictive models using Support Vector Machines and Simple Linear Regression, understanding their underlying mathematics, assumptions, and performance metrics.

CO-3: Apply logistic regression to classification problems and assess model performance using evaluation metrics such as the confusion matrix, precision, recall, and ROC-AUC.

CO-4: Implement unsupervised learning techniques like K-means clustering and dimensionality reduction using PCA, and describe foundational concepts in Artificial Intelligence, including neural networks and deep learning.

Detailed Syllabus

Unit-1.

1.1 Introduction: to the fundamental concepts in machine learning and machine learning algorithms, Supervised Learning, Unsupervised learning and reinforcement learning**.** Introduction to data and its attributes, Data Cleansing & prepossessing. Issues of imbalanced data set & synthetic data generation techniques.

1.2 **K-Nearest Neighbours(K-NN):** Introduction to K-NN, Distance formula (Euclidean distance, hamming distance), Significance of k, find k closest neighbours, Bias–Variance Trade-off, vote for labels or calculate the mean, Advantages and disadvantages of K-NN

Unit-2.

2.1 **Support Vector Machine:** An Introduction SVM, Hyperplane, Support Vectors, Soft Margin SVM, Regularization Parameters, Significance of C, SVM Kernels & Kernel trick, Effect of Gamma, Introduction to Multiclass SVM.

2.2 **Linear Regression:** Introduction to Simple Linear Regression, The Regression Equation, Fitted Values and Residuals, Least Squares, Prediction Versus Explanation (Profiling), Cost Function, Linear Regression using Gradient Descent Algorithm, Evaluating Metrics for Regression, and limitation of Linear Regression model.

Unit-3.

3.1 **Logistic Regression:** Logistic Regression, Logistic Response Function and Logit, Logistic Regression and the GLM, Generalized Linear Models, Predicted Values from Logistic Regression, Interpreting the Coefficients and Odds Ratios, Linear and Logistic Regression: Similarities and Differences, Assessing the Model

3.2 **Evaluating Classification Models:** Evaluating model performance, improving model performance, Confusion Matrix, The Rare Class Problem, Precision, Recall, and Specificity, ROC Curve, AUC.

Unit-4.

4.1 K-means clustering: Introduction to K-means clustering, Mathematical Representation, Expectation-Maximization, K-means clustering Algorithm, Popularity of K-means, Shortcomings Of K-means

4.2 Principle Component Analysis: Feature Reduction/Dimensionality reduction

4.3 Foundation for AI: Introduction to AI and Application Area, AI Basic, Introduction to ANN (Perceptron and MLP), Introduction to Deep learning

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	2	-	2	1	2	-	2	-	-	2.13	3	2	2	2	2.25
CO-2	3	3	3	2	2	2	-	3	2	2	2	-	2.4	3	3	2	2	2.5
CO-3	3	2	3	2	-	2	2	2	2	2	-	2	2.2	3	2	2	2	2.25
CO-4	3	2	2	3	2	2	-	3	2	2	-	2	2.3	3	3	2	2	2.5
Avg	3	2.25	2.75	2.25	2.00	2.00	1.5	2.50	2.00	2.00	2.00	2.00		3	2.5	2	2	2.375

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Problem Solving, Examples, Questioning, Assignment, Experimental, Demonstration, Project, Activity

Assessment Method

	COs	Marks	Exam Component				
			Class Test	Assignment	Presentation	Case Study	Involvement
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	5	4	5	6
	CO-2	10	5				
	CO-3	10	5				
	CO-4	10	5				
Term-End Evaluation 60 Marks	COs	Marks	Exam Component				
	CO-1	15	Term End Examination				
	CO-2	15					
	CO-3	15					
	CO-4	15					

References

Books:

- Python Machine Learning by Sebastian Raschka, Pact Publication.
- Practical Machine Learning by Sunil Gollapudi, Pact Publication.
- Building-Machine-Learning-Systems-with-Python by Richert-Coelho, Pact Publication.
- Scikit-learn: Machine learning in Python by Pedregosa Fabian, et al., Journal of Machine Learning Research 12. Oct (2011): 2825-2830.
- Mastering Machine Learning Algorithm by Jason Brownlee.

Online Resources & Tools:

- https://swayam.gov.in/nc_details/NPTEL

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510345019	Name of Course Blockchain Technology	Elective-II
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the concepts of digital currencies, e-wallets, and cryptographic techniques such as hash functions and digital signatures, and differentiate between centralized, decentralized, and distributed systems in the context of blockchain.

CO-2: Evaluate how blockchain technology functions as a distributed ledger system, analyze different consensus algorithms, and implement basic smart contracts and decentralized applications (DApps) using Ethereum and Solidity.

CO-3: Describe the structure and functioning of the Bitcoin blockchain, assess Bitcoin's approach to decentralization, and analyze mining mechanisms, including their economic and ecological impacts.

CO-4: Explore the applications of blockchain technology in financial services, supply chain, and decentralized platforms, and demonstrate understanding of advanced frameworks such as Hyperledger Fabric, Corda, and IPFS.

Detailed Syllabus

Unit-1.

1.1 Digital currency: Digital currency and its Introduction. Crypto currency. Virtual currency. E-wallets – types, examples and working. Cryptography: Hash function, Digital Signature – ECDSA, Memory Hard Algorithm, Zero Knowledge Proof. Permission-less Blockchain

1.2 Introduction to Blockchain: Introduction to Blockchain Technology. Idea of Centralized, Decentralized and Distributed system, Blockchain as a Public ledger. Problems with a centralized system.

Unit-2.

2.1 **Introduction to Blockchain:** How Blockchain as a distributed ledger solve this problem. Advantage over conventional distributed database. Consensus models – concept. Consensus Algorithms – PoW, PoS, PBFT, DpoS, PoA, PoET .Comparative study of Consensus Algorithms

2.2 **Ether:** Ethereum, EthereumBlockchain and smart contracts, solidity, Dapps. Permissioned Blockchain

Unit-3.

3.1 **BitCoin:** Introduction to Bitcoin. Working of Bitcoin Blockchain. How Bitcoin achieve Decentralization (Distributed consensus) Bitcoin transactions, Bitcoin blocks, Bitcoin scripts, Bitcoin Network, Limitation & improvements. How to store and use Bitcoins – Hot and cold storage, online wallets and Exchanges, payments services, transaction fees, currency exchange market.

3.2 **Mining Techniques:** Bitcoin Mining the tasks of bitcoin miners, Mining hardware, Energy consumption & Ecology, Mining pools, Mining incentives and strategies. Types of Blockchain and its use cases and limitations.

Unit-4.

4.1 Blockchain in Financial services: Payments and Securities Trading – cross border payments, Stellar protocol and network, Ripple protocol and network. Logistics. Supply chain. Introduction, Hyperledger, Fabric services, Fabric model & functions, Composer, Corda. Decentralized Application Platforms. Alternative Decentralized Solutions – Interplanetary File Systems (IPFS), Hashgraph

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	2	1	2	1	2	1	2	–	2	1.82	3	2	2	2	2.25
CO-2	3	3	3	2	1	2	1	3	2	2	2	2	2.17	3	3	2	2	2.5
CO-3	3	2	2	2	2	2	–	3	1	2	–	2	2.10	3	2	2	2	2.25
CO-4	3	3	2	3	2	2	1	3	2	2	2	3	2.33	3	3	3	2	2.75
Avg	3	2.50	2.25	2.25	1.50	2.00	1.00	2.75	1.50	2.00	2.00	2.25		3	2.5	2.25	2	2.44

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Classroom Teaching, Tutorial
CO-2 (Unit: 2)	• Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	• Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	• Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Presentation
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	5	-
	CO-2	10	5	-	5
	CO-3	10	5	2.5	2.5
	CO-4	10	5	2.5	2.5
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

References

Books:

- Bitcoin and Cryptocurrency Technologies by Arvind Narayanan, Joseph Bonneau, EdwardFelten, Andrew Miller and Steven Goldfeder, Princeton University Press, 2016.
- Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media, Inc., 2014.
- The Science of the Blockchain by Wattenhofer, Inverted Forest Publishing, 2016.
- Blockchain: The Blockchain for Beginners Guide to Blockchain Technology and Leveraging Blockchain Programming by Josh Thompson, CreateSpace Publishing, 2017

Online Resources & Tools:

- Mastering Ethereum by Antonopoulos, Andreas M. and Gavin Wood, O'Reilly Media, Inc., 2018. (Free draft available at https://github.com/ethereumbook/ethereumbook)
- Hyperledger Fabric, https://www.hyperledger.org/use/fabric

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510345020	Name of Course Internet of Things	Elective-I
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Define IoT and explain the physical and logical architecture of IoT systems, including key protocols, functional blocks, and communication models used in real-world applications.

CO-2: Identify and compare core enabling technologies like wireless sensor networks, cloud computing, and embedded systems, and assess their role in various IoT application domains and deployment scenarios, with an emphasis on security and privacy challenges.

CO-3: Apply the IoT platform design methodology by specifying requirements, domain models, and integrating sensors, actuators, and controllers for developing IoT-based solutions. Describe privacy, security, and design related challenges of IoT.

CO-4: Develop and test basic IoT applications using Arduino and ESP8266 boards by interfacing sensors and actuators, writing embedded code, and enabling cloud-based communication.

Detailed Syllabus

Unit-1.

1.1 **Introduction:** Definition and characteristics of Internet of Things (IoT), Importance of IoT

1.2 **Physical design of IoT:** Hardware elements of IoT and their characteristics, IoT protocols - Link Layer, Network/Internet Layer, Transport Layer, Application Layer

1.3 **Logical Design of IoT:** IoT functional blocks, IoT Communication Models – Request-Response, Publish-Subscribe, Push-Pull, IoT Communication APIs- REST-based communication APIs, WebSocket-based communication APIs, Micro services.

Unit-2.

2.1 **Introduction to IoT Enabling Technology:** Wireless Sensor Network, Cloud Computing, Big Data Analytics, Embedded Systems

2.2 **IoT Levels & Deployment Template**

2.3 **IoT Application Domains:** Home automation, Smart Cities, Environment, Retail, Agriculture, Industry, Healthcare

2.4 **IoT, M2M and IoT Security and Privacy:** Introduction, M2M, Differences and Similarities between M2M and IoT, Communication in IoT vs M2M, IoT Security & Privacy: Introduction, Security challenges & Requirements, Privacy, challenges & Requirements

Unit-3.

3.1 **IoT Platforms Design Methodology:** Purpose and requirement specification, Process Specification, Domain model Specification, Information model Specification, Service Specifications, IoT level Specification, Functional view Specification, Operational view Specification, Device and component integration, Application development.

3.2 **Things in IoT:** Introduction to microcontroller/MCU and SoC, Sensors & Actuators: IoT sensors, sensor types, sensor, characteristics, RFID, Usage & Applications, Actuators, Types of Actuators, Controlling IoT devices.

Unit-4.

3.3 **Arduino and EPS8266:** Introduction to the Arduino and EPS8266, Basic building block, Components of Board, Interfacing with the Arduino for Data Transfer and Reading/writing, General Purpose GPIO PINs,

Hardware Interfacing, Shields/Hats, Programming: Sensor, Actuator, Buzzer, LED etc., Arduino shields , Arduino programming and the Arduino IDE

3.4 **Introduction to EPS8266:** Wireless communication and programming with EPS8266, Communication with cloud, Wired/Wireless control and communications with the Arduino / Node MCU, IoT Physical Servers & Cloud Offerings

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	2	1	1	2	2	3	1	2	–	1	**1.81**	3	2	2	1	**2**
CO-2	3	3	2	2	1	3	2	3	2	2	–	2	**2.27**	3	3	2	2	**2.5**
CO-3	3	3	3	2	1	3	2	3	2	2	2	2	**2.33**	3	3	3	2	**2.75**
CO-4	3	2	3	1	–	2	1	3	2	2	2	1	**2**	3	2	2	1	**2**
Avg	**3**	**2.5**	**2.5**	**1.5**	**1**	**2.5**	**1.75**	**3**	**1.75**	**2**	**2**	**1.5**		**3**	**2.5**	**2.25**	**1.5**	**2.32**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	● Problem Solving, Examples, Questioning, Experiment, Demonstration, Seminar
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st Edition, Universities Press, 2014 , 2014
- Dr. Raj Kamal, INTERNET OF THINGS: Architecture and Design Principles, McGraw Hill India
- Donald Norris, The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi, and Beaglebone Black, McGraw-Hill Education Pub.
- Hoile C., et al.: Make – Raspberry Pi and AVR Projects, MakerMedia, 2014.
- Margolis, M.: Arduino Cookbook, O'Reilly, 2nd Edition, 2011.
- Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510345021	Name of Course Enterprise Resource Planning	Elective-II
Credit: 03	Teaching Scheme: Theory (45) - Practical (0)	Teaching Hours: 45

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the fundamental concepts of ERP systems, including their architecture, evolution, and key functional modules such as production, sales, finance, and human resources.

CO-2: Analyze business processes and describe the role of reengineering and ERP in optimizing supply chain management.

CO-3: Outline the ERP implementation lifecycle, including planning, configuration, training, testing, and post-implementation maintenance, while identifying critical success and failure factors.

CO-4: Demonstrate working knowledge of ERP software environments, including module interaction, security, and customization, as well as evaluate emerging trends in ERP systems.

Detailed Syllabus

Unit-1.

1.1 **About ERP:** Introduction, Definition, Need for ERP, Evolution, Characteristics, Architecture, Applications, Benefits

1.2 **ERP Functional Modules:** Production Planning, Purchasing, Inventory Control, Sales, CRM, Marketing, Financial, Human Resource

Unit-2.

2.1 **Business Process Reengineering:** Business Process and Practice, Reengineering, Business Process Management

2.2 **Supply Chain Management:** Processes in Supply Chain, Components of Supply Chain, Handling Supply Chain, ERP and Supply Chain Management

Unit-3.

3.1 **ERP Implementation:** Planning Evaluation and Selection of ERP, ERP Implementation Life Cycle, Pre Evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation, Implementation Team Training, Testing, Implementation, Migration, End User Training, Post Implementation, Maintenance of ERP, Organizational and Industrial Impact, Success Factors of ERP Implementation, Key Success Factors, Failure Factors of ERP Implementation

Unit-4. Android APIs

4.1 **ERP Software:** Working with ERP Software and Case Study, Architecture and Overview, Development Environment, New Application, Models And Basic Fields, About Security, User Interface, Views, Relations Between Models, Computed Fields, Working on Action, Constraints, Sprinkles, Inheritance, Interacting with Modules, QWeb, Coding Guidelines

4.2 **Future Directions:** Extended ERP Systems, New Trends in ERP

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	1	2	-	1	2	1	3	1	1	-	1	**1.6**	3	2	2	1	**2**
CO-2	3	2	2	1	1	1	-	2	2	1	-	1	**1.6**	3	2	2	1	**2**
CO-3	3	1	3	-	-	1	1	2	1	1	2	-	**1.66**	3	2	2	1	**2**
CO-4	3	1	2	1	1	3	1	3	1	1	2	2	**1.75**	3	2	3	2	**2.5**
Avg	**3**	**1.25**	**2.25**	**1**	**1**	**1.75**	**1**	**2.5**	**1.25**	**1**	**2**	**1.33**		**3**	**2**	**2.25**	**1.25**	**2.125**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Lecture, Examples, Problem Solving, Case Study, Assignments
CO-2 (Unit: 2)	
CO-3 (Unit: 3)	
CO-4 (Unit: 4)	

Assessment Method

	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Enterprise Resource Planning, Garg and Venkatakrishnan
- Enterprise Resource Planning, Thomas and Michael
- Enterprise Resource Planning, Alexis

Online Resources & Tools:

- Odoo Documentation — Odoo 15.0 documentation

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510445022	Name of Course Advanced Database Management System	Compulsory
Credit: 04	Teaching Scheme: Theory (60) - Practical (0)	Teaching Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand and define a database instance, describe its components, and design a flexible and optimal database architecture for various administrative requirements.

CO-2: Perform data export/import operations using Oracle utilities, load data from third-party systems, and write SQL stored programs including procedures and packages.

CO-3: Manage database storage, implement and monitor locking mechanisms, and use supplied Oracle packages to address storage and concurrency issues.

CO-4: Apply performance tuning techniques for SQL statements, memory components, and I/O operations using appropriate tools and strategies.

Detailed Syllabus

Unit-1.

1.1 **The Database Instance and Database Architecture:** Defining the Instance, Creating the Instance, Understanding the Instance, Defining the Database, Different schema for system administration, Understanding the Components of the Database, Understanding Database Segments, Other Database Objects, Creating the Environment, Designing an Optimal Flexible Architecture, Creating Database

Unit-2.

2.1 **Export-Import & loading data from third party s/w, SQL with Programing**

2.2 **IMPORT/EXPORT:** Export with Data pump utility, Import with Data pump utility, Loading data from third party database With various cases like truncation of data , conversion of data, filtering data with where clause, Different Loader Examples, Conventional and Direct Path Loading

2.3 **Administering SQL commands:** Create, Alter, Truncate, Drop etc. DDL and DCL SQL commands, Tracing SQL Statements

2.4 **SQL Programming:** Stored subprograms and packages, Defining Stored Subprograms., Building and Using Stored Programs

Unit-3.

3.1 **Managing Database Storage:** Administering Database Objects, Understanding Database Fragmentation, Managing Rollback Segments, Identifying Storage Problems, Administering Growing Database, Integrity Management

3.2 **Locking:** Implementing Locks, Analyzing lock table, Monitoring Locks on the System, Avoiding Locks & Possible Solutions, Implementing Locks with Latches

Unit-4.

4.1 **Performance tuning fundamentals:** Understanding need of tuning, Knowing the Tuning Principles, Tuning Goals, Using the Return on Investment Strategy, Revisiting Application Types, Using Diagnostic Tools.

4.2 **Application Tuning:** Understanding the Optimizer, SQL Trace and derivation of statistics, Understanding execution plan

4.3 **Tuning Memory:** UTLBSTAT/UTLESTAT, Tuning the Shared Pool, Tuning the Database Buffer Cache - Tuning the multithreaded Server (MTS), Tuning Locks

4.4 **Tuning I/O:** Tuning Table-spaces and Data-files, Tuning Blocks and Extents, Tuning Rollback Segments, Tuning Redo Logs

Mapping Matrix of POs, PSOs, and Cos																	
COs	Pos													PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	–	–	1	2	1	1	–	–	1.58	3	2	1	1	1.75
CO-2	3	2	3	–	–	–	1	2	1	1	1	–	1.67	3	2	1	2	2
CO-3	3	3.	3	–	–	–	–	2	1	1	1	–	1.67	3	2	2	2	2.25
CO-4	2	3	3	–	–	–	–	3	1	2	2	–	2	3	3	2	2	2.5
Avg	2.75	2.5	3	0.25	–	–	0.75	2.25	1	1.25	1	–		3	2.25	1.5	1.75	2.125

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Classroom Teaching, Group Discussion, Assignment, Examples,Questioning

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	COs	Marks	Exam Component			
			Class Test	Assignment	Presentation	Involvement
	CO-1	10	5	7	7	6
	CO-2	10	5			
	CO-3	10	5			
	CO-4	10	5			
Term-End Evaluation 60 Marks	COs	Marks	Exam Component			
	CO-1	15	Term End Examination			
	CO-2	15				
	CO-3	15				
	CO-4	15				

References

Books:

- Rajeev Parida, Oracle 10g Performance Tuning, Firewall media
- Rajeev Parida,The power of Oracle 10g, Firewall Media
- Craig S. Mullin, Database Administration: The Complete Guide to DBA Practices and Procedures, Oracle Press
- Oracle Complete Reference, Oracle press
- Oracle DBA, Oracle press

Online Resources & Tools:

- Oracle Manual from www.oracle.org

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510445023	Name of Course Internship /Minor Projects	Compulsory
Credit: 04	Teaching Scheme: Theory (0) - Practical (0)	Hours: --

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Identify and analyse a real-life problem, gather user requirements, and define system specifications.

CO-2: Design and develop software applications using suitable tools, technologies, and development methodologies.

CO-3: Collaborate effectively within a team to manage the project lifecycle, including version control, testing, and deployment.

CO-4: Demonstrate professionalism through documentation, presentation, and awareness of the ethical, social, and environmental impacts of the software developed.

Mapping Matrix of POs, PSOs, and Cos

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	3	3	2	–	2	–	2	2	2	2	2	**2.27**	3	3	2	2	**2.5**
CO-2	3	2	3	2	2	–	–	3	–	–	2	–	**2.22**	3	3	2	2	**2.5**
CO-3	--	2	3	–	–	–	2	2	3	–	3	–	**2.14**	3	2	2	2	**2.25**
CO-4	2	–	2	2	2	3	3	–	–	2	–	3	**2.33**	2	2	3	3	**2.5**
Avg	**2.67**	**2.33**	**2.75**	**2**	**1.33**	**1.67**	**1.67**	**2.33**	**1.67**	**1.33**	**2.33**	**1.67**		**2.75**	**2.5**	**2.25**	**2.25**	**2.44**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Assessment Method

Evolution as per Minor project guideline

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510245024	Name of Course Lab based on Machine Learning & AI	Elective-I
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Preprocess and prepare data for machine learning by applying data cleaning, balancing, and transformation techniques.

CO-2: Implement and evaluate supervised learning models (K-NN, SVM, linear and logistic regression) using appropriate metrics.

CO-3: Apply unsupervised learning techniques (K-means, PCA) and analyze clustering/dimensionality reduction results.

CO-4: Demonstrate foundational understanding of AI through implementation of basic ANN models including perceptron and MLP.

Mapping Matrix of POs, PSOs, and Cos

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	2	2	2	1	2	1	2	1	2	**2.0**	3	2	2	2	**2.25**
CO-2	3	3	3	2	2	2	1	3	2	2	2	2	**2.3**	3	3	2	2	**2.5**
CO-3	3	2	3	3	2	2	1	3	1	2	2	2	**2.1**	3	3	2	2	**2.5**
CO-4	3	2	3	2	2	2	2	3	1	2	1	2	**2.1**	3	3	2	3	**2.75**
Avg	**3**	**2.25**	**3.0**	**2.25**	**2.0**	**2.0**	**1.25**	**2.75**	**1.25**	**2.0**	**1.5**	**2.0**		**3**	**2.75**	**2**	**2.25**	**2.5**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Classroom Teaching, Tutorial
CO-2 (Unit: 2)	• Classroom Teaching, Tutorial, Presentation
CO-3 (Unit: 3)	• Classroom Teaching, Tutorial, Presentation, Seminar
CO-4 (Unit: 4)	• Classroom Teaching, Tutorial, Presentation, Seminar

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Presentation
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	5	-
	CO-2	10	5	-	5
	CO-3	10	5	2.5	2.5
	CO-4	10	5	2.5	2.5
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510245025	Name of Course Lab based on Blockchain Technology	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand the concepts of digital currencies, cryptographic tools, and decentralized systems fundamental to blockchain.

CO-2: Analyze blockchain architecture, consensus mechanisms, and develop smart contracts on permissioned and permission-less platforms.

CO-3: Examine the Bitcoin ecosystem including transaction models, storage, mining techniques, and evaluate its technical limitations.

CO-4: Apply blockchain technologies in real-world applications such as finance, logistics, and decentralized systems using Hyperledger, IPFS, and Corda.

Mapping Matrix of POs, PSOs, and Cos

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	2	1	2	–	3	1	2	–	2	2.10	3	2	2	2	2.25
CO-2	3	3	3	2	–	2	–	3	2	2	2	2	2.40	3	3	2	2	2.5
CO-3	3	2	3	–	–	2	–	3	1	2	1	1	2.00	3	2	2	2	2.25
CO-4	3	2	3	2	2	2	1	3	2	2	2	3	2.25	3	3	2	3	2.75
Avg	3	2.25	3.00	2.00	1.50	2.00	1.00	3.00	1.50	2.00	1.67	2.00		3	2.5	2	2.25	2.44

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Experimental Learning
CO-2 (Unit: 2)	• Demonstration and Guided Practice
CO-3 (Unit: 3)	• Project-Based Learning
CO-4 (Unit: 4)	• Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510245026	Name of Course Lab based on Internet of Things	Elective-I
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand and analyze the fundamental architecture, components, and communication models of the Internet of Things (IoT), including physical and logical design and protocols across network layers.

CO-2: Identify and evaluate the role of enabling technologies such as wireless sensor networks, cloud computing, and big data analytics in IoT applications while recognizing privacy and security challenges.

CO-3: Design IoT system architectures using a structured platform design methodology, and integrate sensors, actuators, and Microcontroller (IoT Device) for real-world applications.

CO-4: Develop and implement IoT applications using microcontroller platforms like Arduino and/or ESP8266, enabling device communication, cloud connectivity, and remote data interaction.

Mapping Matrix of POs, PSOs, and Cos

COs	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	1	2	2	1	3	–	2	–	1	**2**	3	2	2	1	**2**
CO-2	3	3	2	1	2	3	1	3	2	3	1	2	**2.16**	3	3	2	2	**2.5**
CO-3	3	2	3	2	2	2	–	3	3	2	2	2	**2.36**	3	2	2	2	**2.25**
CO-4	3	2	3	2	2	2	1	3	3	2	3	3	**2.41**	3	3	3	3	**3**
Avg	**3**	**2.25**	**2.75**	**1.5**	**2**	**2.25**	**1**	**3**	**2.66**	**2.25**	**2**	**2**		**3**	**2.5**	**2.25**	**2**	**2.44**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1)	• Experimental Learning
CO-2 (Unit: 2)	• Demonstration and Guided Practice
CO-3 (Unit: 3)	• Project-Based Learning
CO-4 (Unit: 4)	• Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	**COs**	**Marks**	**Exam Component**		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510245027	Name of Course Lab based on Enterprise Resource Planning	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand the fundamentals of ERP systems, including their architecture, evolution, functional modules, and their role in business operations.

CO-2: Analyze business processes and supply chain models, and evaluate how ERP integrates and optimizes them through Business Process Reengineering.

CO-3: Demonstrate knowledge of the ERP implementation life cycle, including planning, evaluation, configuration, training, and maintenance phases.

CO-4: Apply technical skills to work with ERP software, develop and configure modules, and explore emerging trends and technologies in ERP.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	1	2	1	1	1	1	2	1	1	2	1	1.41	3	2	2	1	2
CO-2	3	2	3	2	2	1	1	2	2	1	3	2	2	3	3	2	2	2.5
CO-3	3	2	3	2	1	2	1	3	2	2	3	2	2.16	3	3	2	2	2.5
CO-4	3	1	3	1	2	2	2	3	3	3	2	1	2.16	3	3	3	3	3
Avg	3	1.5	2.75	1.5	1.5	1.5	1.25	2.5	2	1.75	2.5	1.5		3	2.75	2.25	2	2.5

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Experimental Learning • Demonstration and Guided Practice • Project-Based Learning • Reflective Practice

Assessment Method

	Cos	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	Cos	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 256510245028	Name of Course Lab based on Advanced Database Management System	Compulsory
Credit: 02	Teaching Scheme: Theory (0) - Practical (60)	Lab Hours: 60

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Understand the fundamental components of a database system and implement a well-structured database instance, apply DDL, DCL and DML.

CO-2: Perform advanced import/export operations, load data efficiently from external sources, and develop stored procedures and packages.

CO-3: Manage and optimize database storage and locking mechanisms using built-in administrative tools and packages.

CO-4: Apply core performance tuning techniques to enhance database efficiency through memory, I/O, and SQL optimization strategies.

Mapping Matrix of POs, PSOs, and COs

COs	POs													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	–	2	–	–	1	1	2	–	1	–	–	1.18	3	2	1	1	1.75
CO-2	3	–	3	–	–	1	–	2	–	1	1	–	1.55	3	3	1	1	2
CO-3	3	–	3	–	1	2	–	3	–	1	–	–	1.73	3	3	2	1	2.25
CO-4	3	–	3	–	1	2	–	3	–	2	–	–	1.91	3	3	2	2	2.5
Avg	3	–	2.75	–	0.5	1.5	0.25	2.5	–	1.25	0.25	–		3	2.75	1.5	1.25	2.13

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Teaching Pedagogy

CO-1 (Unit: 1) CO-2 (Unit: 2) CO-3 (Unit: 3) CO-4 (Unit: 4)	• Experimental Learning, Demonstration and Guided Practice, Project-Based Learning, Reflective Practice

Assessment Method

	Cos	Marks	Exam Component		
			Class Test	Assignment	Participation/ Performance
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	5	13	7
	CO-2	10	5		
	CO-3	10	5		
	CO-4	10	5		
Term-End Evaluation 60 Marks	Cos	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Program - MCA (Faculty of Information, Communication and Technology)

Semester- 4

Course Code 266512045032	Name of Course Internship	Compulsory
Credit: 20	Teaching Scheme: Theory (0) - Practical (0)	Hours: --

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Students will be able to analyze user requirements and design software solutions that address real-world problems, particularly those relevant to local, rural, or national contexts.

CO-2: Students will be able to apply advanced programming concepts, software engineering principles, and modern tools/technologies to implement, test, and deploy software systems.

CO-3: Students will be able to demonstrate project management, teamwork, and leadership skills while collaboratively developing and delivering software solutions in alignment with ethical, sustainable, and socially responsible practices.

CO-4: Students will be able to document and communicate project deliverables effectively through technical reports, presentations, and demonstrations in both English and Gujarati, showcasing the functionality and societal impact of their work.

Mapping Matrix of POs, PSOs, and COs

Cos	Pos													PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	3	3	3	2	2	-	2	2	1	2	3	**2.27**	3	2	2	2	**2.25**
CO-2	3	2	3	1	2	2	-	3	1	2	1	1	**1.83**	3	2	2	1	**2**
CO-3	1	2	2	2	2	3	-	1	3	2	3	2	**2**	3	3	2	2	**2.5**
CO-4	--	-	-	-	-	1	3	-	-	-	-	2	**2**	2	2	1	1	**1.5**
Avg	**2.33**	**2.33**	**2.67**	**2**	**2**	**2**	**3**	**2**	**2**	**1.67**	**2**	**2**		**2.75**	**2.25**	**1.75**	**1.5**	**2.06**

3= Strong Contribution, 2 = Moderate Contribution, 1 = Slight Contribution, --- = No Significant Contribution

Assessment Method (As per the MCA Internship guideline)

Gujarat Vidyapith

Ashram Marg, Navrangpura, Ahmedabad, Gujarat, India - 380 009

Phone: +91-79 40016200 | **Email:** info@gujaratvidyapith.org | **Website:** www.gujaratvidyapith.org

@gvp1920