Curriculum Framework

Master of Science in Information Technology

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 Science in Information Technology
(M.Sc. IT)
(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 Science in Information Technology (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 Science in Information Technology (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 Science in Information Technology - 2025

PROGRAMME STRUCTURE							
Course Code	**Course Name**	**Hours**			**Credit**	**Evaluations**	
		Theory	**Practical**	**Total**		**CCE**	**TEE**
SEMESTER-1							
256010344001	Object Oriented Programming (JAVA)	45	0	45	3	40	60
256010444002	Data Structures	60	0	60	4	40	60
256010444003	Management Information System	60	0	60	4	40	60
256010344004	Database Management System	45	0	45	3	40	60
256010244005	Lab based on Object Oriented Programming (JAVA)	0	60	60	2	40	60
256010244006	Lab based on Data Structures	0	60	60	2	40	60
256010244007	Lab based on Database Management System	0	60	60	2	40	60
Total		**210**	**180**	**390**	**20**	**280**	**420**
SEMESTER-2							
256010344008	Operating System	45	0	45	3	40	60
256010344009	Web Technology-Lab Based	0	90	90	3	40	60
256010444010	Computer Network	60	0	60	4	40	60
256010344011	SQL for Data Science	45	0	45	3	40	60
256010344012	Software Engineering	45	0	45	3	40	60
256010244013	Lab based on Operating System	0	60	60	2	40	60
256010244014	Lab based on SQL for Data Science	0	60	60	2	40	60
Total		**195**	**210**	**405**	**20**	**280**	**420**
GRAND TOTAL		**405**	**390**	**795**	**40**	**560**	**840**

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

Programme Contents	Credits
Core Courses	**40**
Total Credits of Programme	**40**

Programme Outcomes (POs)

After successful completion of the M.Sc. (IT) program, students will be able to:

PO-1	**Advanced Knowledge of Information and Computing Technologies**	Apply advanced knowledge of information and computing technologies, balancing core concepts and specialized skills, to address complex problems in academia, industry, and society.
PO-2	**Research & Problem-Solving Skills**	Undertake quality research in core and emerging areas of information technology, such as network systems, data science, AI, and cybersecurity, with an aim to contribute to knowledge creation and social upliftment in line with Gandhian ideals.
PO-3	**Experimental & Analytical Proficiency**	Develop the ability to design, conduct, and evaluate IT experiments using analytical tools and data-driven techniques, enabling critical assessment, validation, and optimization of software systems, algorithms, and research models.
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**	Apply professional ethics, constitutional values, and Gandhian principles—such as simplicity, self-reliance, and service to the community—in all IT practices and solutions.
PO-7	**Effective Scientific 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**	Apply emerging technologies such as AI, IoT, cloud computing, and data analytics to develop innovative, socially relevant IT solutions, guided by Gandhian values of sustainability, self-reliance, and community welfare.
PO-9	**Teamwork & Leadership in Research**	Communicate technical concepts effectively through written reports and oral presentations, and demonstrate leadership and teamwork skills in multidisciplinary and multicultural settings.
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 and project management skills to conceive, plan, and execute innovative IT solutions or social enterprises that support local needs, rural development, and national progress in alignment with Gandhian principles.
PO-12	**Social & Community Engagement**	Utilize computing knowledge and skills to address societal and environmental challenges through eco-friendly innovations, promote digital inclusion, and actively contribute to nation-building in alignment with Gandhian ideals and the vision of Gram Swaraj.

Programme Specific Outcomes (PSOs)

After successful completion of the M.Sc. (IT) program with a specialization in Computer Science & Information Technology, students will be able to:

PSO-1	Apply advanced information technology concepts, programming languages (such as Python, Java), and algorithms to design, develop, and evaluate software systems, data solutions, and IT applications that address complex industrial and societal needs.	Aligns with **PO1 (Advanced Knowledge of Information and Computing Technologies)** and **PO2 (Research & Problem-Solving Skills)**, supporting strong academic and practical foundations as per Gujarat Vidyapith's objectives.
PSO-2	Utilize modern tools, technologies, and platforms—such as data analytics, artificial intelligence, cloud computing, and cyber security—to solve real-world problems and support sustainable digital transformation in both rural and urban contexts.	Supports **PO8 (Modern Technological Applications)**, enhances digital competencies, and reflects **NEP 2020's vision** of integrating emerging technologies in higher education.
PSO-3	Conduct independent and collaborative research, field studies, and interdisciplinary projects that promote sustainability, simplicity, and societal well-being in line with Gandhian principles.	Fulfills **PO5 (Environmental Consciousness & Sustainability)** and strengthens Gujarat Vidyapith's mission of service, rural development, and value-based inquiry.
PSO-4	Effectively communicate IT concepts and solutions through reports, presentations, and professional dialogue, upholding ethics, cultural sensitivity, and community engagement, while promoting Indian knowledge systems and local languages.	Connects with **PO6 (Ethics & Professional Values)**, **PO7 (Effective Scientific Communication)**, **PO12 (Social & Community Engagement)**, and reinforces Gandhian educational values and regional relevance.

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 – M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010344001	Name of Course Object Oriented Programming (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 Initialising 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	1	2	2
CO-2	3	2	3	1	1	2	2	3	2	2	2	1	2	3	2	1	2	2
CO-3	3	2	3	1	1	3	2	3	2	2	2	1	2.1	3	2	2	2	2.25
CO-4	3	3	3	1	2	2	2	3	3	3	2	2	2.4	3	3	2	3	2.75
Avg	3	2.25	3	1	1.25	2.25	2	3.3	2.25	2.25	2	1.25		3	2.25	1.75	2.25	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)	• Problem Solving, Examples, Questioning, Experiment, Demonstration, Seminar

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:

- 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 – M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010444002	Name of Course Data Structures	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: 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	3	3	1	–	–	1	2	1	1	–	–	1.75	3	2	1	2	2
CO-2	3	3	3	–	–	–	1	2	1	1	–	–	1.67	3	2	1	2	2
CO-3	3	3	3	1	–	–	–	2	1	1	–	–	1.67	3	2	1	2	2
CO-4	3	3	3	–	–	–	–	3	1	1	1	–	1.83	3	3	2	3	2.75
Avg	3	3	3	0.5	–	–	0.5	2.25	1	1	0.25	–		3	2.25	1.25	2.25	2.19

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 – M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010444003	Name of Course Management Information System	Compulsory
Credit: 04	Teaching Scheme: Theory (60) - Practical (0)	Teaching Hours: 90

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Analyze and design information systems using system development lifecycle models and structured analysis tools, ensuring appropriate implementation and maintenance strategies.

CO-2: Evaluate various types of information systems and their components to support decision-making, strategic planning, and enterprise-level operations.

CO-3: Apply MIS tools and techniques in real-world domains through case studies and understand the use of ICT-based systems in governance and development planning.

CO-4: Demonstrate an understanding of knowledge management processes, emerging technologies like AI, data science, and blockchain, and their applications in business and decision-making contexts.

Detailed Syllabus

Unit-1.

1.1 SYSTEM ANALYSIS AND DEVELOPMENT: Information Concept, Classification, Element, Characteristics and Types, Attributes and Qualities of Information. System Concepts, Role, Attributes and Tasks of a System Analyst. System Development lifecycle method (SDLC). Software Development Model, Logic Representation Technique: Data Flow Diagrams - Data Dictionary. Structured Analysis Tools: Structured English- Decision Table - Decision Tree. Input-Output-Form Design, Testing and Quality Assurance, Software-Hardware Selection, System Implementation and Maintenance, System Security and Audit.

Unit-2.

2.1 **INFORMATION MANAGEMENT AND SYSTEM:**

2.1.1 **MIS:** Definitions, Benefits, functions, Characteristics, Role, Components of Information System- Three Dimension of IS. Elements of Information System Model, MIS as a Pyramid, Implementing an MIS, MIS and Information Resources Management (IRM), Modules of MIS, MIS Tools and Selection.

2.1.2 **Transaction-Level Systems:** Transaction Processing System (TPS), Office Automation System (OAS). Knowledge and Content Management Systems: Knowledge Management System (KMS), Content Management System (CMS), Decision Support and Analytical Systems: Decision Support System (DSS), Business Intelligence System (BIS), Executive Support System (ESS).

2.1.3 **Strategic and Enterprise-Level Systems:** Strategic Information System (SIS), Enterprise Resources Planning (ERP), Enterprise Application Integration (EAI),

2.1.4 **Customer and Supply Chain Systems:** Customer Relationship Management (CRM), Supply Chain Management (SCM),

2.1.5 **Business Process and Risk Management Systems:** Business Process Reengineering (BPR), Business Continuity Planning (BCP).

Unit-3.

3.1 MIS APPLICATIONS AND TOOLS: Application of MIS in various sector (Personal, Marketing, Finance, Production, Service, etc.), Case studies of Various Portal (Education, health, Development, HR, etc). ICT based MIS Scheme in Government (MGNREGA, PM-Kisan, etc.) Data warehouse, Data Mining

and Visualization tools. Basics of GIS, GPS, and remote sensing, Spatial data collection, mapping, and interpretation, Use of GIS in planning.

Unit-4.

4.1 KNOWLEDGE AND ENHANCE MANAGEMENT: Knowledge Management: Types of Knowledge, Processes, Life cycle, Challenges Expert Systems: Definition and components, Applications in decision-making, Limitations and future scope Artificial Intelligence (AI): Introduction, Role of AI, Business applications: Chatbots, predictive analytics, virtual assistants. Data Science and Analytics: Overview, Data collection, cleaning, visualization, and interpretation, Use of tools, Real-world use cases. Blockchain Technology: Basics, Components, Applications and Challenges.

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	1	2	2	1	**1.81**	3	2	1	2	**2**
CO-2	3	3	2	2	1	2	2	3	1	2	2	2	**2.08**	3	2	2	2	**2.25**
CO-3	2	2	2	3	2	2	2	2	2	2	3	3	**2.25**	3	3	2	2	**2.5**
CO-4	3	3	3	2	1	2	2	3	2	3	2	2	**2.33**	3	3	3	3	**3**
Avg	**2.75**	**2.5**	**2.5**	**2.25**	**1.33**	**1.75**	**1.75**	**2.5**	**1.5**	**2.25**	**2.25**	**2**		**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) **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
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:

- Jawadekar, Management Information System, Tata McGraw Hill, 2008, 7th Edition, New Delhi
- Laudon, Kenneth C. and Jane P. Laudon (2007). Management Information System- Managing the Digital Firm, 9/e; New Delhi: Prentice Hall
- Analysis and Design of Information Systems, Rajaraman, Prentice Hall
- Management Information System by Dr. Satish Patel, Self & Pothi.com Publication.

Online Resources & Tools:

- System Analysis and Design by Dr. Satish Patel, Self & Pothi.com Publication
- https://www.tutorialspoint.com/

Program – M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010344004	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 DBMS and demonstrate understanding of key concepts such as candidate keys, primary keys, and foreign keys, along with the roles of DBMS components and administrators.

CO-2: Design Entity-Relationship diagrams and normalize relational schemas up to Fifth Normal Form to ensure data consistency, and perform fundamental SQL operations for effective database creation and management.

CO-3: Analyze the importance of transaction management, understand the two-phase commit protocol, and identify concurrency problems with locking mechanisms and their resolutions.

CO-4: Apply transaction isolation techniques and intent locking to handle deadlocks and ensure serializability, and implement advanced SQL constructs such as triggers, stored procedures, and user-defined functions.

Detailed Syllabus

Unit-1.

1.1 Architecture of DBMS: The Three Levels of 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 **ER Diagram**

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

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

Unit-3.

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

Unit-4.

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

4.2 SQL: Triggers, Stored Procedures & functions

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	2	–	1	1.63	2	2	1	2	1.75
CO-2	3	2	3	1	–	–	–	2	1	2	2	2	2	3	2	2	2	2.25
CO-3	3	3	3	–	–	1	–	2	2	2	1	1	2	3	3	2	2	2.5
CO-4	3	2	3	–	–	1	–	2	2	2	2	1	2	3	3	3	2	2.75
Avg	3	2.25	2.75	1	–	1	–	1.75	1.50	2	1.67	1.25		2.75	2.5	2	2	2.31

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 - Avi Silberschatz, Henry Korth, S.Sudarshan, PublisherMcGrow-Hill, Edition 5th.

Online Resources & Tools:

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

Program – M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010244005	Name of Course Lab based on Object Oriented Programming (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 and apply fundamental object-oriented programming concepts and Java programming constructs such as variables, data types, control structures, classes, and objects.

CO-2: Design robust Java applications using advanced object-oriented features including methods, constructors, inheritance, polymorphism, abstract classes, and interfaces.

CO-3: Develop modular Java applications using packages and implement effective exception handling mechanisms using built-in and user-defined exceptions.

CO-4: Implement file handling and multithreading capabilities in Java applications using streams, thread classes, synchronization, and serialization techniques.

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	–	3	–	1	–	–	2	2	2	1	1	1.5
CO-2	3	2	3	–	–	2	–	3	2	1	1	–	2.12	3	2	2	2	2.25
CO-3	3	–	3	–	–	2	–	3	2	2	1	–	2.28	3	3	2	2	2.5
CO-4	3	–	3	–	1	2	–	3	3	2	1	1	2.11	3	3	3	2	2.75
Avg	3	2	2.75	--	1	1.75	--	3	2.33	1.5	1	1		2.75	2.5	2	1.75	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

			Exam Component		
	COs	Marks	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 – M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010244006	Name of Course Lab based on Data Structures	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: 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	2	2	1	2	1.75
CO-2	3	2	3	–	–	1	–	2	1	2	–	–	1.64	2	2	1	2	1.75
CO-3	3	3	3	–	–	2	–	3	2	3	1	–	2.36	3	3	2	2	2.5
CO-4	3	2	3	–	–	2	–	2	2	2	–	–	2	3	3	2	2	2.5
Avg	3	2.25	3	–	–	1.5	0.5	2.25	1.5	2.25	0.25	–		2.5	2.5	1.5	2	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)	• 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 – M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 1

Course Code 256010244007	Name of Course Lab based on 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 and explain DBMS architecture, its levels, and implement data integrity using various key constraints.

CO-2: Design relational databases using ER modeling and normalization techniques; implement and manage databases using SQL.

CO-3: Demonstrate concurrency control and transaction management including commit protocols and concurrency problem resolution.

CO-4: Apply advanced SQL constructs such as triggers, procedures, functions, and manage data integrity through isolation and locking techniques.

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	–	2	--	2	–	1	--	1	1.75	3	2	1	1	1.75
CO-2	3	2	3	1	1	2	--	3	--	1	1	1	1.8	3	3	2	1	2.25
CO-3	3	2	3	–	--	2	--	3	1	1	--	--	2.14	2	3	1	1	1.75
CO-4	3	2	3	–	--	2	--	3	1	1	--	--	2.14	2	3	1	1	1.75
Avg	3	2	2.75	1	1	2	--	2.75	1	1	1	1		2.5	2.75	1.25	1	1.88

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 - M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010344008	Name of Course Operating System	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 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 by applying sustainability challenges 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	2	2	2	1	2	1	1	1.83	3	2	1	1	1.75
CO-2	3	2	3	1	1	2	2	2	2	2	1	1	2	3	2	1	1	1.75
CO-3	3	3	3	1	1	2	2	2	2	2	1	1	2.08	3	2	2	1	2
CO-4	3	3	3	2	2	2	2	2	2	2	1	2	2.25	3	3	2	1	2.25
Avg	3	2.5	2.75	1.25	1.25	2	2	2	1.75	2	1	1.25		3	2.25	1.5	1	

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, Presentation, 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 - M.Sc.IT (Faculty of Information, Communication and Technology)
Semester- 2

Course Code 256010344009	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 **Request-Response:** Introduction, 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 ServletConfig 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.

4.2.3 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	1	2	1	1	1	2	3	1	1	1	1	1.5	3	2	2	1	2
CO-2	3	2	2	1	1	1	2	3	1	1	1	1	1.6	3	2	2	1	2
CO-3	3	1	2	1	1	1	2	3	1	1	1	1	1.5	3	2	2	1	2
CO-4	3	2	3	2	1	1	2	3	1	1	1	1	1.8	3	3	2	2	2.5
Avg	3	1.5	2.25	1.25	1	1	2	3	1	1	1	1		3	2.25	2	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)**	• 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 - M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010444010	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 need for data communication, compare network models and apply error detection and correction techniques at Physical and Data Link layers.

CO-2: Analyze data link control mechanisms and apply suitable routing, addressing and congestion control strategies within Network layer.

CO-3: Describe functions of Transport layer and evaluate connection management, congestion control and flow control mechanisms.

CO-4: Illustrate key Application layer services and apply foundational information security concepts such as 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.

2.1 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	2	2	-	-	-	-	1	-	-	-	-	2.00	3	2	1	1	1.75
CO-2	3	3	3	-	-	-	-	2	-	-	-	-	2.75	3	3	2	1	2.25
CO-3	2	3	3	-	-	-	-	1	1	-	-	-	2.00	3	2	2	1	2
CO-4	2	2	1	1	1	2	1	1	-	-	-	2	1.55	2	2	2	2	2
Avg	2.5	2.5	2.25	1	1	2	1	1.25	1	0	0	2		2.75	2.25	1.75	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)	• 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 - M.Sc.IT (Faculty of Information, Communication and Technology)
Semester- 2

Course Code 256010344011	Name of Course SQL for Data Science	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 structure of data models and differentiate between SQL and NoSQL environments to store and manage data.

CO-2: Apply SQL and NoSQL techniques for filtering, sorting, grouping, and optimizing queries to prepare data for analysis.

CO-3: Clean and transform structured and semi-structured datasets using SQL functions, handling messy values, types, and duplicates.

CO-4: Create visualizations and apply basic data governance principles using SQL tools, pivots, views, and database interoperability features.

Detailed Syllabus

Unit-1.

1.1 Understanding the Data Model with SQL & NoSQL

Introduction to Data and Types of Data, Evolution of Data Models: hierarchical, network, relational, document-based, Relational vs. Transactional Models, SQL: Understanding Information Schema Tables
NoSQL: History, Features, Types, Key-Value Stores, Document Databases, Columnar Databases, Graph Databases
Advantages and Limitations of NoSQL, SQL Basics: Retrieving, Updating, Deleting Data, Comments & Wildcards in SQL Queries

Unit-2.

2.1 Filtering, Sorting for Data Preparation and Calculating Data with SQL & NoSQL

SQL Filtering and Conditional Operators, Slicing Data and Projection of Attributes, Sorting Operations (ASC/DESC), Mathematical Calculations & Expressions, Grouping Data using GROUP BY, Aggregate Functions: SUM(), AVG(), MIN(), MAX(), COUNT(), Combining Aggregates with Conditions
Query Optimization Fundamentals: Indexing Concepts, Efficient Filtering, Cost-Based Query Planning
NoSQL Query Concepts (based on Database types)

Unit-3.

3.1 Cleaning and Transforming Data with SQL

Understanding Messy Data and Heterogeneous Types
Data Type Issues: Undesired type, Type mismatch, Null handling & COALESCE()
Cleaning Numeric Data: Normalization, Default/derived values
Handling Messy Strings: Trimming, Substring operations, Pattern extraction
Date & Time Challenges: Parsing messy timestamps, Formatting functions
Removing Duplicates (DISTINCT, CTEs, Keys)
Data Transformation Techniques: Casting, Pivoting / Reshaping, Computed Columns

Unit-4.

4.1 Modifying and Analyzing Data with SQL

SQL-based Data Visualization (Pivot, cross-tab queries), Understanding Query Execution Plans
Working with Views: Virtual Tables, Security and Performance Impacts
Exposure to Data Visualization Tools (Tableau, Power BI, Excel), Database/Table Exporting: SQL / CSV
Importing Data from SQL / CSV, Data Governance Basics: Quality, Security, Compliance, Data Profiling and Metadata Awareness

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	2	1	1	2	2	1	2	1	1	1.58	3	2	1	2	2
CO-2	3	2	3	2	1	1	2	2	1	2	1	1	1.75	3	3	2	2	2.5
CO-3	2	2	3	2	1	1	2	2	1	2	1	1	1.67	3	2	2	2	2.25
CO-4	2	1	3	2	2	2	3	2	2	2	2	2	2.00	3	2	3	3	2.75
Avg	2.5	1.5	2.75	2.0	1.25	1.25	2.25	2.0	1.25	2.0	1.25	1.25		3	2.25	2	2.25	

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:

- Silberschatz, Korth & Sudarshan — Database System Concepts
  - Strong fundamentals of data models, relational algebra, normalization, SQL.
  - Very useful for Unit I & II.
- Ramakrishnan & Gehrke — Database Management Systems
  - Modern database architecture, query optimization, transaction processing.
  - Best for understanding query execution plans and indexing (Unit II & IV).
- C. J. Date — An Introduction to Database Systems
  - Classic theoretical foundation of data models, schemas, relational data.
  - Supports conceptual clarity for Unit I.
- O'Reilly – SQL Cookbook (Anthony Molinaro / Kevin Kline – newer edition)
  - Practical problem–solution format.
  - Great for filtering, sorting, aggregation, string cleanup, transformations (Unit II & III).
- Bill Karwin — SQL Antipatterns
  - Common mistakes and best practices.
  - Excellent for real-world modeling and cleaning tasks (Unit III).
- O'Reilly – NoSQL Distilled (Sadalage & Fowler)
  - Lightweight yet thorough on NoSQL types, CAP theorem, schema-free concept.
  - Helpful for Unit I and Unit II.

Program - M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010344012	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	1	1	2	2	2	1	2	1	1	1.83	3	2	1	2	2
CO-2	3	3	3	2	1	2	3	2	2	2	1	1	2.08	3	3	2	2	2.5
CO-3	3	2	3	1	1	2	2	3	2	2	1	1	1.92	3	2	2	2	2.25
CO-4	3	3	3	2	1	2	2	2	3	2	3	2	2.33	3	3	3	3	3
Avg	3	2.5	2.75	1.5	1	2	2.25	2.25	2	2	1.5	1.25		3	2.5	2	2.25	

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 - M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010244013	Name of Course Lab based on Operating 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: 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	3	1	1	1	1	2	1	2	1	1	1.67	3	2	2	1	2
CO-2	3	2	3	1	1	1	1	2	1	2	1	1	1.67	3	2	2	1	2
CO-3	3	3	3	1	1	1	1	2	2	2	1	1	1.83	3	2	3	1	2.25
CO-4	3	3	3	2	1	1	1	2	2	2	2	2	2	3	3	3	2	2.75
Avg	3	2.5	3	1.25	1	1	1	2	1.5	2	1.25	1.25		3	2.25	2.5	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 - M.Sc.IT (Faculty of Information, Communication and Technology)

Semester- 2

Course Code 256010244014	Name of Course Lab based on SQL for Data Science	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: Students will be able to retrieve, insert, update, and delete data using SQL queries and compare SQL & NoSQL data models through hands-on practice.

CO-2: Students will be able to filter, sort, group, and aggregate data using SQL queries and perform basic NoSQL data retrieval operations for data preparation.

CO-3: Students will be able to clean, normalize, transform, and reshape messy datasets using SQL functions such as trimming, casting, substring, COALESCE, DISTINCT, and pivoting.

CO-4: Students will be able to create views, analyze execution plans, generate pivot/cross-tab outputs, and import/export datasets to perform data analysis and governance tasks.

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	1	2	1	1	1.83	3	3	2	2	2.5
CO-2	3	3	3	1	1	2	2	3	2	2	1	1	2.00	3	3	2	2	2.5
CO-3	3	2	3	1	1	2	2	2	2	2	1	2	1.92	3	2	2	2	2.25
CO-4	3	3	3	2	1	2	2	3	2	2	2	2	2.25	3	3	3	3	3
Avg	3	2.5	3	1.25	1	2	2	2.75	1.75	2	1.25	1.5		3	2.75	2.25	2.25	

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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			

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