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 2026-2027

GUJARAT VIDYAPITH: AHMEDABAD

Curriculum Framework of Master of Science in Information Technology

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

Effective From Academic Year 2026-2027

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. Rajeev 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.

PROGRAMME STRUCTURE							
Course Code	Course Name	Hours			Credit	Evaluations	
		Theory	Practical	Total		CCE	TEE
SEMESTER-1							
266010444008	Data Structure	60	0	60	4	40	60
266010444009	Computer Network	60	0	60	4	40	60
266010344010	Python Programming and Application Development	45	0	45	3	40	60
266010344011	Linux System Administration	45	0	45	3	40	60
266010244012	Lab based on Data Structures	0	60	60	2	40	60
266010244013	Lab based on Python Programming and Application Development	0	60	60	2	40	60
266010244014	Lab based on Linux System Administration	0	60	60	2	40	60
-	Community Living	*	60	60	2*	Grade	Grade
Total		**210**	**240**	**450**	**20+2***	**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**
SEMESTER-3							
266510244015	Big Data Analytics	30	0	30	2	40	60
266510244016	Cloud Architecture & DevOps	30	0	30	2	40	60
266510244017	Cyber Security	30	0	30	2	40	60
266520244018	MOOC-Python for Data Science Appendix-A	30	0	30	2	40	60
266510244019	Lab Based on Big Data Analytics	0	60	60	2	40	60
266510244020	Lab Based on Cloud Architecture & DevOps	0	60	60	2	40	60
266510244021	Lab Based on Cyber Security	0	60	60	2	40	60
266510444022	Case Study / Internship	0	120	120	4	40	60
266510244023	MOOC-Lab Based on Python for Data Science-Appendix - B	0	60	60	2	40	60
-	Community Living	*	60	60	2*	Grade	Grade
Total		**120**	**420**	**540**	**20+2***	**360**	**540**
GRAND TOTAL		**525**	**870**	**1395**	**20**	**920**	**1380**

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

Programme Contents	Credits
Core Courses	**60**
Total Credits of Programme	**60**

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 266010444008	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**

Stack - Definition & Concept, Operations on stack, Applications of Stacks, Conversion from infix to postfix Queue - Definition & Concepts, Operations on queue, Types of queue, Circular queue, Applications of Stacks priority queues, Priority queue, Process queue

1.3 **Linked Linear List -** Sequential & linked allocation, their advantages and disadvantages, Singly linked list and perations on it, Double linked list and operations on it, Circular linked list and operations on it, Applications of linked list.

Unit-2

2.1 **Non-Linear Data Structure:** Binary Search tree - Definition and Concepts, Representation, Operation Like

2.2 **Traversals**: Inorder, Preorder, Postorder, Insertion and Deletion in BST , Searching.in BST

2.3 **Introduce** Abstract Data Types (ADT), generic data structures, amortized analysis, recursion and recurrence relations, C++ STL, and Java Collections Framework.

2.4 **Some balanced tree mechanism:** AVL tree, B tree, B+ Tree, Segment Tree, Red-Black Tree

Unit-3.

3.1. **Graph -** Matrix representation of graph, Adjacency matrix, Path matrix, Dijkstra's algorithm, MINIMAL algorithm, Adjacency list representation of graph, Breadth First Search, Depth First Search, Floyd-Warshall algorithm, Kruskal's algorithm

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

Unit-4.

4.1 **Hashing techniques -** Hashing Functions, hashing techniques – Bloom filters & Consistent hashing

4.2 **Sorting methods -** Insertion Sort, Quick sort (Partition Exchange sort), Radix sort, Heap sort, Merge sort and Performance comparison of sorting method.

4.3 **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	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	**1.58**	**3**	**2**	**1**	**1**	**1.75**
CO-3	3	3	3	2	1	1	1	2	2	2	1	1	**1.83**	**3**	**2**	**2**	**1**	**2**
CO-4	3	3	3	1	1	1	1	3	1	2	1	1	**1.75**	**3**	**3**	**2**	**2**	**2.5**
Avg	**3.00**	**2.50**	**3**	**1.25**	**1**	**1**	**1**	**2.25**	**1.25**	**2**	**1**	**1**	**1.69**	**3**	**2.25**	**1.5**	**1.25**	**2.00**

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

Teaching Pedagogy

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

- 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

Online Resources & Tools:

3 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 266010444009	Name of Course Computer Networks	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: Explain the fundamental concepts of computer networks, networking models, transmission media, data communication techniques, and data link layer protocols for reliable data communication.

CO-2: Analyze medium access control mechanisms, routing algorithms, IP addressing schemes, and network layer protocols to design and manage interconnected networks.

CO-3: Evaluate transport layer and application layer protocols, including TCP/IP services, congestion control mechanisms, DNS, e-mail, file transfer, and network applications for efficient end-to-end communication.

CO-4: Apply network security principles, cryptographic techniques, authentication mechanisms, and emerging networking technologies to secure and optimize modern computer networks.

Detailed Syllabus

Unit-1.

1.1 Introduction to Computer Networks

- 1.1.1 Introduction to Computer Networks: Definition, History and goals of computer networks, Network applications, Social and business implications of networking, Internet, Intranet, and Extranet
- 1.1.2 Network Hardware: Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN) , Personal Area Networks (PAN), Wireless Networks, Interconnection of Networks
- 1.1.3 Network Software: Protocols and protocol hierarchies, Services and interfaces, Connection-oriented and connectionless services
- 1.1.4 Reference Models: OSI Reference Model, TCP/IP Reference Model,
- 1.1.5 Network Standardization: IEEE standards, ISO standards, ITU-T, IETF and RFCs

1.2 Physical Layer

- 1.2.1 Transmission Media: Guided Transmission Media: Twisted Pair Cable, Coaxial Cable, Fiber Optic Cable, Unguided Transmission Media: Radio Waves, Microwaves, Infrared Communication, Satellite Communication
- 1.2.2 Data Communication Concepts: Analog and Digital Signals, Bandwidth, Data Rate, Transmission Impairments
- 1.2.3 Multiplexing Techniques: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Wavelength Division M
- 1.2.4 Switching Techniques: Circuit Switching, Packet Switching, Message Switching

1.3 Data Link Layer

- 1.3.1 Introduction and Duties of Data Link Layer
- 1.3.2 Design Issues: Framing, Error Control, Flow Control
- 1.3.3 Error Detection and Correction: Types of Errors, Redundancy, Detection Versus Correction, Forward Error Correction Versus Retransmission, Error Detection, Error Correction, Block Coding, Linear Block Codes, Cyclic Codes, Parity Check, Checksum, CRC (Cyclic Redundancy Check), Hamming Code
- 1.3.4 Data Link Protocols: Stop-and-Wait Protocol, Sliding Window Protocol, Go-Back-N ARQ, Selective Repeat ARQ

Unit-2.

2.1 Medium Access Control (MAC)

2.1.1 Channel Allocation: Static Allocation, Dynamic Allocation

2.1.2 Multiple Access Protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA

2.1.3 Ethernet: Ethernet Architecture, Ethernet Frame Format, Fast Ethernet, Gigabit Ethernet

2.1.4 Wireless LANs: IEEE 802.11 Architecture, Wi-Fi Standards, Wireless LAN Security

2.1.5 Bluetooth: Architecture, Piconet and Scatternet

2.2 Network Layer

2.2.1 Network Layer Design Issues: Store-and-Forward Packet Switching, Virtual Circuit Networks, Datagram Networks

2.2.2 Routing Algorithms: Shortest Path Routing, Distance Vector Routing, Link State Routing, Hierarchical Routing

2.2.3 Congestion Control: Causes of Congestion, Prevention Policies, Traffic Shaping

2.2.4 Internet Protocol: IPV4, IPv4 Addressing, Subnetting and Supernetting, CIDR, IPV6, IPv6 Addressing

2.2.5 Internet Control Protocols: ARP, RARP, ICMP, DHCP,

2.2.6 Mobile Networking: Mobile IP, Mobile Communication Concepts

Unit-3.

3.1 Transport Layer

- 3.1.1 Transport Services: Services provided to upper layers, Service primitives
- 3.1.2 Elements of Transport Protocols: Addressing, Connection Establishment, Connection Release, Flow Control, Buffer Management, Multiplexing, Demultiplexing
- 3.1.3 Transport Layer Primitives
- 3.1.4 Transport Protocols: User Datagram Protocol (UDP)-Features, Header Format, Applications, Transmission Control Protocol (TCP)- Features, TCP Header, Sequence Numbers, Acknowledgments, Window Management, Flow Control, Communication Primitives
- 3.1.5 TCP Congestion Control: Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery
- 3.1.6 Quality of Service (QoS): Delay, Jitter, Throughput, Reliability

3.2 Application Layer

- 3.2.1 Domain Name System (DNS): DNS Architecture, Name Resolution Process, DNS Records
- 3.2.2 Electronic Mail: Architecture, SMTP, POP3, IMAP
- 3.2.3 File Transfer: FTP, TFTP
- 3.2.4 Network Applications: Remote Login (Telnet, SSH), Peer-to-Peer Networks, Client-Server Computing

Unit-4.

4.1 Introduction to Network Security and Emerging Trends

- 4.1.1 Introduction to Network Security: Security Requirements, Threats and Attacks
- 4.1.2 Cryptography: Symmetric Key Cryptography, Asymmetric Key Cryptography, Public Key Infrastructure (PKI), Digital Signatures
- 4.1.3 Authentication Protocols: Password-Based Authentication, Challenge-Response Authentication, Kerberos
- 4.1.4 Network Security Mechanisms: Firewalls, VPN (Virtual Private Network), IDS (Intrusion Detection System), IPS (Intrusion Prevention System)
- 4.1.5 Wireless Security: WEP, WPA, WPA2, WPA3

4.2 Emerging Networking Technologies:

- 4.2.1 Internet of Things (IoT)
- 4.2.2 Software Defined Networking (SDN)
- 4.2.3 Network Function Virtualization (NFV)
- 4.2.4 Network performance analysis-Wireshark and its Applications and Features
- 4.2.5 Cloud Computing Basics: Cloud Services, Virtualization, Data Centers

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	1.5	3	2	1	1	1.75
CO-2	3	3	3	2	1	1	1	2	2	2	1	1	1.83	3	3	2	1	2.25
CO-3	3	3	3	1	1	1	1	2	1	2	1	1	1.67	3	3	2	1	2.25
CO-4	3	3	3	2	2	3	1	3	2	2	1	2	2.25	3	3	3	2	2.75
Avg	3	2.75	2.75	1.5	1.25	1.5	1	2.25	1.5	2	1	1.25	1.81	3	2.75	2	1.25	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:

- Tanenbaum, Andrew S., Feamster, Nick, and Wetherall, David J., *Computer Networks*, 4th Edition, Pearson Education, 2021.
- Trivedi, Bhushan, *Computer Networks*, 2nd Edition, Oxford University Press, 2012.
- Forouzan, Behrouz A., *Introduction to Data Communications and Networking*, 1st Edition, McGraw-Hill Education.
- Olifer, Natalia and Olifer, Victor, *Computer Networks: Principles, Technologies and Protocols for Network Design*, Wiley India.
- Stallings, William, *Data and Computer Communications*, 10th Edition, Pearson Education.

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

Semester- 1

Course Code 266010344010	Name of Course Python Programming and Application Development	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 core Python programming constructs and object-oriented principles - data types, control flow, functions, file handling and exception handling - to write modular, well-structured programs, and implement encapsulation, inheritance and polymorphism using classes and objects.

CO-2: Develop dynamic, database-driven web applications using the Flask framework by implementing routing, Jinja2 templates, forms, session management, CRUD operations with SQLite/MySQL, and basic REST APIs.

CO-3: Design, validate, document and test modern asynchronous REST APIs using the FastAPI framework, applying Pydantic models, dependency injection, authentication and automatic API documentation.

CO-4: Deploy and maintain Python web applications using professional practices including version control with Git, containerization with Docker, deployment with Gunicorn/Nginx, CI/CD pipelines, and responsible AI-assisted development.

Detailed Syllabus

Unit-1.

1.1 Introduction to Python: History, Features, Applications in Industry, Installing Python and VS Code, Interactive Mode vs Script Mode, Comments and Documentation,

1.2 Programming Constructs: Variables and Constants, Data Types, Type Casting, Input and Output, String Formatting (f-strings), Operators, Expressions.

1.3 Flow of Control: Decision Making statements: if, if-else, nested if, elif; Loop statements: for, while; break, continue, pass; enumerate, zip, range.

1.4 Built-in Data Structures: Strings, Lists, Tuples, Sets, Dictionaries, List / Dictionary / Set Comprehensions.

1.5 Functions: User-Defined Functions, Parameters and Return Values, *args and **kwargs, Variable Scope, Recursion, Lambda Functions, map and filter, Introduction to Decorators, Generators and Iterators.

1.6 Modules and Exception Handling: Creating and Importing Modules, Standard Library Overview; Exception Handling: try, except, finally, raise, User-Defined Exceptions; Type Hints and Annotations.

1.7 File Handling: Text Files, Context Managers (with statement), CSV Files, JSON Files.

1.8 Object-Oriented Programming: Classes and Objects, Constructors (__init__), Instance and Class Attributes, Encapsulation, Inheritance, Polymorphism, Dunder Methods (__str__, __repr__).

1.9 Environment and Tooling: pip, Virtual Environments (venv), requirements.txt

1.10 Problem Solving: Pattern Programs, Searching Techniques, Sorting Techniques,

Unit-2.

- **2.1 Database Fundamentals:** DBMS Concepts, SQLite, MySQL, CRUD Operations, Basic SQL.
- **2.2 Flask Framework:** Introduction to Python Web Frameworks and Their Applications, Installation and Project Structure, Routing, Dynamic Routes, Templates using Jinja2, Forms and Request Handling, Blueprints.
- **2.3 Database Integration:** SQLite with Flask, MySQL with Flask, Introduction to ORM (SQLAlchemy Basics).
- **2.4 Session and File Management:** Cookies, Sessions, File Uploading, Error Handling, Custom Error Pages.
- **2.5 REST API Fundamentals:** JSON, HTTP Methods: GET, POST, PUT, DELETE; Status Codes, Building a REST API in Flask, Testing with Postman Client.

Unit-3.

- **3.1 Introduction to FastAPI:** Comparison with Flask, Synchronous vs Asynchronous, Performance, Installation, Uvicorn, Project Structure.
- **3.2 Building APIs:** Path Parameters, Query Parameters, Request Bodies, Pydantic Models, Type Hints for Validation, Response Models, Status Codes.
- **3.3 Automatic Documentation:** Interactive Swagger UI, ReDoc, OpenAPI Specification.
- **3.4 Asynchronous Programming:** async and await, Async Endpoints, When to Use Async.
- **3.5 Data Layer:** Database Integration with SQL Alchemy, CRUD Service Layer, Dependency Injection (Depends).
- **3.6 Security and Middleware:** Authentication: JWT and OAuth2 Basics; CORS, Middleware, Request Lifecycle.
- **3.7 Testing and Quality:** Testing with pytest and FastAPI TestClient, Structuring an API Project for Maintainability, Applied Mini-Project (optionally serving a simple AI model).

Unit-4.

- **4.1 Project Organization:** Folder Structure, Configuration Files, Environment Variables, .env and python-dotenv, Secrets Handling, Twelve-Factor App Principles.
- **4.2 Version Control:** Git Basics, GitHub, Branching, Pull Requests, Collaboration, .gitignore and Commit Hygiene.
- **4.3 Linux Essentials:** File System Commands, Permissions, Process Management.
- **4.4 Deployment Fundamentals:** WSGI vs ASGI, Gunicorn, Uvicorn / Gunicorn Workers, Nginx Basics, Reverse Proxy, Domain Configuration, HTTPS and SSL, Logging and Monitoring.
- **4.5 Containerization:** Introduction to Docker, Images and Containers, Dockerizing Flask and FastAPI Applications, Docker Compose (app + database).
- **4.6 CI/CD (Introductory):** Automated Testing and Deployment with GitHub Actions.
- **4.7 Capstone Project:** Development and Deployment of a Database-Driven Web Application / REST API — a FastAPI backend (with a Flask app or simple frontend as client), containerized, deployed behind Nginx with HTTPS, and version-controlled with a CI pipeline.

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	2	1	---	1.45	3	2	1	1	1.75
CO-2	3	3	3	2	---	1	1	3	2	2	2	1	1.92	3	3	2	1	2.25
CO-3	3	3	3	2	---	2	1	3	2	2	2	1	2	3	3	2	2	2.5
CO-4	3	3	2	2	1	3	1	3	2	3	3	1	2.25	3	3	2	2	2.5
Avg	3	2.75	2.5	1.75	0.25	1.75	1	2.75	1.75	2.25	2	0.75	1.91	3	2.75	1.75	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)	• Classroom Teaching, Tutorial, Presentation, 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:

- Automate the Boring Stuff with Python, Third Edition by AL Sweigart
- Flask Web Development DEVELOPING WEB APPLICATIONS WITH PYTHON By Miguel Grinberg
- Building Python Web APIs with FastAPI By Abdulazeez Abdulazeez Adeshina

Online Resources & Tools:

- API: https://www.youtube.com/watch?v=0PaWV3wIfkM
- Flask : https://www.youtube.com/watch?v=oA8brF3w5XQ
- FastAPI: https://www.youtube.com/watch?v=Lu8lXXlstvM
  - https://www.youtube.com/watch?v=foGkldu xhM0
  - https://www.youtube.com/playlist?list=PLsyeobzWxl7qF4ASwCZZDXor_Y0YJ3Qfc
- Analytics Vidhya:
  - FastAPI: https://courses.analyticsvidhya.com/courses/take/fastapi-for-ai-engineers-the-complete-guide-to-building-scalable-ai-apis

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

Semester- 1

Course Code 266010344011	Name of Course Linux System Administration	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 Linux operating system architecture, installation process, boot procedures, file system hierarchy, and user/group management concepts required for Linux system administration.

CO-2: Apply Linux administrative commands and shell scripting techniques to manage processes, automate system tasks, monitor system performance, and administer software packages.

CO-3: Configure and manage Linux network services, including TCP/IP networking, DNS, DHCP, SSH, web servers, and remote administration services in a Linux environment.

CO-4: Implement Linux server administration, security, backup and recovery, firewall configuration, log monitoring, access control, and system troubleshooting practices to maintain secure and reliable systems.

Detailed Syllabus

UNIT-1: Linux Fundamentals and System Administration

1. **Introduction to Linux and System Administration**

   1.1. System Administrator-

   1.2. Definition

   1.3. Responsibility- User account management, Installing software and updates, Server maintenance, Network administration, Security management, Backup and recovery, Performance monitoring, Troubleshooting hardware and software issues

   1.4. Skills- Networking concepts, Shell scripting, Security administration, Problem-solving abilities and software issues

2. Open-Source Software- Free to use, Community-driven development, Transparency, Security through peer review, No vendor lock-in

3. Linux Operating System –

   3.1. Features- Multiuser, Multitasking, Portable, Secure, Stable, Open-source

   3.2. Advantages – Free, High performance, Excellent server platform, large community support

   3.3. Linux architecture: Kernel, Shell, File System

   3.4. Linux distributions (Ubuntu, Debian, Fedora, CentOS, Red Hat)

4. Linux Installation and Boot Process

   4.1. Linux installation- Download ISO image, create bootable USB, Boot from USB, Partition disk, Install Linux packages, Reboot system

   4.2. Boot process- **BIOS/UEFI-**Hardware initialization, **Bootloader (GRUB)-** Loads Linux Kernel, **Kernel-**Loads device drivers, **Init/Systemd-** Starts system services, **Login Prompt/Shell-** System becomes ready for users.

5. System startup and shutdown procedures

6. Linux File System and User Management/Administration

6.1 Linux directory structure- hierarchical file system, Important Directories or partitions- / - Root directory, /bin - Essential commands, /boot- Boot files, /dev - Device files, /etc - Configuration files, /home- User (home) directories, /lib- Shared libraries, /opt- Optional software, /root- Root user home, /tmp- Temporary files, /usr- User programs, /var - Variable data/logs

6.2 File and directory operations

6.3 Disk Management and file systems – LVM (Logical Volume Management), partitions, mount points, fstab

6.4 Mounting and unmounting file systems

6.5 User and Group administration/management

6.6 Password management

6.7 File Permissions and Ownership

6.8 File permissions Permission Types- Read (r = 4), Write (w = 2), Execute (x = 1), and Ownership- Owner, Group, Others

UNIT-2: Process Management and Shell Programming

2.1. Process management - ps, top, nice, kill, background jobs

2.2. Job scheduling (cron, at)

2.3. Shell and Shell Scripting - Shell environment, Shell scripting – ed of Shell Scripting- Automation, System administration, Backup management, Monitoring,

2.4. Bash Scripting, Data types and variables, Execute shell command, Loops function, conditions, and arithmetic comparisons, I/O Manipulation, I/O Redirections

2.5. System monitoring tools

2.6. Package Management YUM, DNF, RPM, APT, repository configuration

UNIT–3: Network and Service Administration

3.1 TCP/IP fundamentals

3.2 Internet services configuration, Network configuration - IP, DNS, DHCP, hostname, network scripts.

3.3 Linux Services - Web server (Apache/Nginx), SSH, SCP, FTP, Telnet

3.4 NFS and NIS services

3.5 Remote administration

3.6 System Boot and Services - Boot process, GRUB- Kernel selection, Boot parameters, Recovery mode, systemd, journald, cron, systemctl

3.7 Backup and recovery

UNIT–4: Server Administration, Security and Troubleshooting

4.1 Linux security concepts- Principles, Least Privilege, defence in Depth, Authentication-Password, SSH Keys, MFA, Authorization, Accountability

4.2 Access control

4.3 Log Monitoring and Troubleshooting - log files, System Logs, Authentication Logs, Kernel Logs, Journal Logs, dmesg, journalctl

4.4 Security and Firewalls - SELinux, firewalld, iptables, Basic Security Audits-Checks: Open ports, User accounts, Failed logins, File permissions, Installed packages

4.5 System hardening- Hardening Techniques: Disable unnecessary services, Strong passwords, Regular updates, enable firewall, Configure SELinux, Use SSH keys, Remove unused accounts, File integrity monitoring

4.6 Troubleshooting- Troubleshooting Methodology: Identify problem, Collect logs, analyze root cause, Apply fix, and Verify solution.

	POs													PSOs				
COs	**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	2	1	---	1.45	3	2	1	1	1.75
CO-2	3	3	3	1	---	1	1	2	1	2	1	---	1.5	3	2	2	1	2
CO-3	3	3	3	2	---	1	1	3	2	2	1	1	1.83	3	3	2	1	2.25
CO-4	3	3	3	2	1	3	1	3	2	2	1	1	2.08	3	3	2	2	2.5
Avg	3	2.75	2.75	1.5	0.25	1.5	1	2.5	1.5	2	1	0.5	1.72	3	2.5	1.75	1.25	2.13

Teaching Pedagogy

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

References

Books:

- UNIX and Linux System Administration Handbook by Evi Nemeth (Author), Garth Snyder (Author), Trent Hein (Author), Ben Whaley (Author), Dan Mackin (Author), Publisher Addison-Wesley
- How Linux Works: What Every Superuser Should Know, 3rd Edition, by Brian Ward (Author), Publisher No Starch Press
- The Linux Command Line: A Complete Introduction by Williams E. Shotts (Author), Publisher No : Starch Press

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

Semester- 1

Course Code 266010244012	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	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	1.58	3	2	1	1	1.75
CO-3	3	3	3	2	1	1	1	2	2	2	1	1	1.83	3	2	2	1	1.92
CO-4	3	3	3	1	1	1	1	3	1	2	1	1	1.75	3	3	2	2	2.17
Avg	3	2.50	3.00	1.25	1.00	1.00	1.00	2.25	1.25	2.00	1.00	1.00	1.69	3	2.25	1.5	1.25	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		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
	COs	Marks	Exam Component		
Term-End Evaluation 60 Marks	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 266010244013	Name of Course Lab based on Python Programming and 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: Implement Python programs using variables, control structures, functions, built-in data structures, file handling, exception handling, and object-oriented programming concepts to solve computational problems.

CO-2: Develop and execute dynamic, database-driven web applications using the Flask framework, implementing routing, Jinja2 templates, forms, session management, and CRUD operations with SQLite/MySQL.

CO-3: Build, validate, document, and test asynchronous REST APIs using the FastAPI framework, applying Pydantic models, dependency injection, authentication, and interactive API documentation (Swagger/Postman)

CO-4: Deploy and manage Python web applications in a production-like environment using Git/GitHub, Docker, Gunicorn/Nginx, and CI/CD pipelines, while using AI-assisted development tools responsibly.

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	1	2	1	2	1	---	1.5	3	2	1	1	1.75
CO-2	3	3	3	2	---	1	1	3	2	2	2	1	1.92	3	3	2	1	2.25
CO-3	3	3	3	2	---	2	1	3	2	2	2	1	2	3	3	2	2	2.5
CO-4	3	3	3	2	1	3	1	3	2	3	3	1	2.33	3	3	2	2	2.5
Avg	3	3	3	1.75	0.25	1.75	1	2.75	1.75	2.25	2	0.75	1.85	3	2.75	1.75	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		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
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 **266010244014**	**Name of Course** **Lab based on Linux System Administration**	**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: Install and configure Linux operating systems in virtualized environments and perform basic system administration tasks, including user, group, file system, and permission management.

CO-2: Develop and execute shell scripts to automate administrative tasks, manage processes, and monitor system performance in a Linux environment.

CO-3: Configure and manage Linux networking services, including IP addressing, SSH-based remote access, and web server deployment using Apache.

CO-4: Perform system maintenance activities such as backup and recovery, troubleshooting, and implementation of basic security measures to ensure system reliability and availability.

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	1	2	1	2	1	---	1.5	3	2	1	1	1.75
CO-2	3	3	3	1	---	1	1	2	1	2	1	---	1.5	3	2	2	1	2
CO-3	3	3	3	2	---	1	1	3	2	2	1	1	1.83	3	3	2	1	2.25
CO-4	3	3	3	2	1	2	1	2	2	2	1	1	1.92	3	3	2	2	2.5
Avg	3	3	3	1.5	0.25	1.25	1	2.25	1.5	2	1	0.5	1.69	3	2.5	1.75	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		
			Practical Test	**Journal**	**Viva**
Continuous Comprehensive Evaluation 40 Marks	**CO-1**	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
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	2.04	3	2.25	1.5	1	1.94

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)	Lab 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	1.60	3	2.25	2	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)**	• 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: 60

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	2.08	2.75	2.25	1.75	1.25	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)	• 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	1.25	1.25	2.25	2	1.25	2	1.25	1.25	1.75	3	2.25	2	2.25	2.38

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:

- 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	2.04	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)	● Lecture, Seminar, Assignment, Case-Study, Examples

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	1.79	3	2.25	2.5	1.25	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)	• Experimental Learning, Demonstration and Guided Practice • Project-Based Learning, Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
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	2	3	2.75	2.25	2.25	2.56

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		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
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- 3

Course Code 266510244015	Name of Course Big Data Analytics	Compulsory
Credit: 02	Teaching Scheme: Theory (30) - Practical (0)	Teaching Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the concepts, characteristics, and architecture of big data and distributed computing systems.

CO-2: Apply Hadoop and Spark-based techniques for distributed storage and batch data processing.

CO-3: Develop real-time data streaming applications using Apache Kafka and Spark Structured Streaming.

CO-4: Design and evaluate an end-to-end big data analytics pipeline for a real-world use case.

Detailed Syllabus

Unit 1: Big Data Foundations and Distributed Systems

1.1 Introduction to Big Data and its evolution.

1.2 Characteristics of Big Data: Volume, Velocity, Variety, Veracity, and Value.

1.3 Challenges in handling large-scale data.

1.4 Business and industry applications of Big Data.

1.5 Limitations of traditional data management systems.

1.6 Distributed systems fundamentals.

1.7 Scalability, fault tolerance, replication, and partitioning.

1.8 CAP theorem and consistency models.

1.9 Overview of the modern Big Data ecosystem.

Unit 2: Hadoop Ecosystem and Distributed Storage

2.1 Introduction to Hadoop and its ecosystem.

2.2 Hadoop Distributed File System (HDFS).

2.3 HDFS Architecture: NameNode, DataNode, and Secondary NameNode.

2.4 Data blocks, replication mechanisms, and fault tolerance.

2.5 Data ingestion techniques and storage strategies.

2.6 Data formats: CSV, JSON, Avro, Parquet, and ORC.

2.7 MapReduce programming model.

2.8 Mapper, Reducer, Combiner, and Partitioner.

2.9 MapReduce execution workflow.

2.10 Limitations of MapReduce and evolution toward Spark.

2.11 Introduction to Hive and distributed data warehousing.

Unit 3: Batch Analytics using Apache Spark

3.1 Apache Spark architecture and execution model.

3.2 Spark Core concepts and cluster management.

3.3 Resilient Distributed Datasets (RDDs).

3.4 Transformations and actions.

3.5 DataFrames and Datasets.

3.6 Spark SQL architecture and query processing.

3.7 Data loading, cleaning, and preprocessing.

3.8 Filtering, aggregation, joins, and window operations.

3.9 Performance optimization concepts.

3.10 Introduction to Spark MLlib.

3.11 Industry applications of batch analytics.

Unit 4: Real-Time Streaming and Big Data Pipeline Design

4.1 Batch processing versus stream processing.

4.2 Event-driven architecture fundamentals.

4.3 Apache Kafka architecture.

4.4 Topics, partitions, brokers, and clusters.

4.5 Producers, consumers, and consumer groups.

4.6 Offset management and message retention.

4.7 Delivery semantics and fault tolerance in Kafka.

4.8 Spark Structured Streaming fundamentals.

4.9 Window-based stream processing.

4.10 End-to-end big data pipeline architecture.

4.11 ETL and ELT methodologies.

4.12 Data quality, monitoring, and governance fundamentals.

4.13 Data visualization and reporting concepts.

4.14 Industry applications and case studies in Big Data Analytics

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	3	1	2	1	1	1.58	2	3	1	1	1.75
CO-2	3	3	3	1	1	1	1	3	2	2	1	1	1.83	2	3	2	1	2
CO-3	3	3	3	1	1	1	1	3	2	2	1	1	1.83	2	3	2	1	2
CO-4	3	3	3	2	1	1	1	3	2	2	3	2	2.17	2	3	3	2	2.5
Avg	3	2.75	2.75	1.25	1	1	1	3	1.75	2	1.5	1.25	1.85	2	3	2	1.25	2.06

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

1. White, T. *Hadoop: The Definitive Guide* (4th Edition). O'Reilly Media.
2. Karau, H., Konwinski, A., Wendell, P., & Zaharia, M. *Learning Spark: Lightning-Fast Data Analytics* (2nd Edition). O'Reilly Media.
3. Narkhede, N., Shapira, G., & Palino, T. *Kafka: The Definitive Guide: Real-Time Data and Stream Processing at Scale*. O'Reilly Media.
4. Kleppmann, M. *Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems*. O'Reilly Media.
5. Chambers, B., & Zaharia, M. *Spark: The Definitive Guide: Big Data Processing Made Simple*. O'Reilly Media.
6. Acharya, S., & Chellappan, S. *Big Data Analytics*. Wiley India.
7. Minelli, M., Chambers, M., & Dhiraj, A. *Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*. Wiley.
8. Leskovec, J., Rajaraman, A., & Ullman, J. D. *Mining of Massive Datasets* (3rd Edition). Cambridge University Press.

Online Resources:

1. Official Apache Hadoop, Spark, and Kafka documentation.
2. NPTEL / SWAYAM – Big Data Computing.

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

Semester- 3

Course Code 266510244016	Name of Course Cloud Architecture & DevOps	Compulsory
Credit: 02	Teaching Scheme: Theory (30) - Practical (0)	Teaching Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: **Analyze cloud computing models and AWS architecture**
CO-2: **Implement and manage core AWS services for infrastructure setup**
CO-3: **Apply security, monitoring, and cost optimization strategies**
CO-4: **Design scalable and fault-tolerant cloud infrastructure**

Detailed Syllabus

Unit-1. Cloud Fundamentals

- **1.1** Evolution of cloud computing
- **1.2** Traditional vs cloud computing
- **1.3** Cloud Service Models (IaaS, PaaS, SaaS)
- **1.4** Cloud Deployment Models (Public, Private, Hybrid)
- **1.5** AWS Global Infrastructure
- **1.6** AWS Shared Responsibility Model
- **1.7** AWS Management Console overview

Unit-2. Core AWS Services

- **2.1** Compute: EC2 instance types, pricing, AMI, Security groups and key pairs
- **2.2** Storage: S3 (advanced concepts, storage classes, policies), EBS (volumes and snapshots)
- **2.3** Networking: VPC basics, Subnets and routing, Internet Gateway
- **2.4** Database: RDS configuration, DynamoDB basics
- **2.5** Security: IAM fundamentals

Unit-3. Security, Billing & Monitoring

- **3.1** IAM deep dive
- **3.2** MFA and security best practices
- **3.3** AWS pricing and cost optimization
- **3.4** Budget setup
- **3.5** CloudWatch monitoring
- **3.6** Logs and alerts
- **3.7** Introduction to AI/ML services

Unit-4. AWS for Application Development

- 4.1 Advanced VPC design
- 4.2 Public/private subnets
- 4.3 Route tables and NAT Gateway
- 4.4 Load Balancing concepts
- 4.5 Auto Scaling
- 4.6 High availability and fault tolerance
- 4.7 Backup and disaster recovery
- 4.8 Cost 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	2	2	-	-	-	2	-	2	-	-	1.08	2	2	-	-	1
CO-2	3	3	3	-	2	-	-	3	2	2	-	-	1.5	3	3	2	-	2
CO-3	2	3	3	-	3	3	-	2	2	2	-	2	1.83	3	3	3	2	2.75
CO-4	3	3	3	3	2	2	2	3	3	2	3	2	2.58	3	3	3	3	3
Avg	2.75	2.75	2.75	1.25	1.75	1.75	0.5	2.5	1.75	2	0.75	1	1.75	2.75	2.75	2	1.25	2.18

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:

- Rajkumar Buyya – Cloud Computing: Principles and Paradigms
- Thomas Erl – Cloud Computing Concepts
- AWS Training Documentation (Official)
- Distributed Systems & Cloud Architecture reference

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

Semester- 3

Course Code 266510244017	Name of Course Cyber Security	Compulsory
Credit: 02	Teaching Scheme: Theory (30) - Practical (0)	Teaching Hours: 30

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: Explain the fundamentals of cybersecurity, security goals, risk management concepts, cybercrimes, and the roles of various types of cybercriminals and hackers.

CO-2: Identify and analyse different cyber-attacks, malware, social engineering techniques, network threats, and the phases involved in cybercrime planning and execution.

CO-3: Apply network security mechanisms, secure communication protocols, VPN technologies, and cryptographic techniques to protect information and network resources.

CO-4: Evaluate system and application security measures, perform basic vulnerability assessment and security testing, and interpret cyber laws, digital evidence, and ethical practices in cybersecurity.

Detailed Syllabus

UNIT 1:

1.1 Fundamentals of Cyber Security and Core Concepts

1.1. Definition of Cyber Security & Information Security

1.2. Difference between Data Security, Network Security, Application Security

1.3. Security Goals (CIA Triad): Confidentiality, Integrity, Availability

1.2 Risk & Threat Concepts: Asset, Threat, Vulnerability, Risk, Risk management process, Types of vulnerabilities (hardware, software, human)

1.3 Cyber Crime & Criminal

Definition of Cyber **Crime** & **Cyber Criminal**. Evolution of Cyber Crimes, Cybercriminals, Classifications of Cybercrimes and Cyber Criminals. Hackers: White Hat (Ethical hackers), Black Hat (Malicious hackers), Grey Hat, Script Kiddies, Hacktivists, Insider threats

Cyber Attacks & Threats

2.1 Malware Types: Virus (file infectors, macro virus), Worms, Trojan Horse, Spyware & Adware, Ransomware, Cyberstalking, Botnets: The Fuel for Cybercrime

2.2 Network Attacks: DoS (Denial of Service), DDoS (Distributed DoS), Man-in-the-Middle (MITM), Session Hijacking

2.3 Social Engineering: Phishing (Email fraud), Spear phishing, Vishing (Voice phishing), Smishing (SMS phishing), Baiting, Pretexting

2.4 Other Threats: Identity theft, Password attacks (Brute force, Dictionary attack), Zero-day attacks

2.5 Cyber Crime Planning Phases: 1) Reconnaissance-Active and Passive Attack. 2) Scanning and Scrutinizing Gathered Information- Port Scanning, Network Scanning and Vulnerability Scanning. 3) Attack/Exploit – Gaining and Maintaining System Access. 4) Post Attack Cleanup.

UNIT 3: Network Security

3.1 Network Basics: OSI Security architecture, Network vulnerabilities

3.1.1 Security Mechanisms: Firewalls: Packet filtering, Stateful firewall, Proxy firewall, IDS (Intrusion Detection System), IPS (Intrusion Prevention System)

3.1.2 Secure Communication: HTTPS, SSL/TLS, Secure FTP (SFTP)

3.1.3 Wireless Security: Wi-Fi attacks, WPA/WPA2/WPA3 security, Rogue access points

3.1.4 VPN: Types of VPN, Tunnelling protocols

3.2 Cryptography

3.2.1 Cryptography Basics: Plaintext, Ciphertext, Encryption & Decryption, Cryptanalysis

3.2.2 Types of Cryptography: Symmetric key cryptography (AES, DES), Asymmetric key cryptography (RSA)

3.2.3 Hash Functions: Definition, **Key Properties: Deterministic**-The same input always produces the exact same output. **One-Way (Non-reversible)-** It is computationally infeasible to reverse the process to find the original input, Avalanche **Effect-** A tiny change in input (even a single bit) produces a drastically different hash value, **Fast Computation-** Hashing operations are rapid, even for large data sets. E.g. MD5, SHA family.

Unit-4.

4.1 System & Application Security

4.1.1 Operating System Security: User authentication, Access control models: DAC (Discretionary Access Control), MAC (Mandatory Access Control), RBAC (Role-Based Access Control)

4.1.2 Web Application Security: Injection - SQL Injection, LDAP Injection, OS Command Injection, XPath Injection. Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF)

4.1.3 Vulnerability & Testing: Vulnerability assessment, Penetration testing basics, Security auditing

4.1.4 Tools: Vulnerability scanners, Password cracking tools, Web security testing tools

4.2 Cyber Laws & Ethics (India Focus)

4.2.1 Legal Framework: IT Act 2000 & Amendments, Cybercrime categories: Hacking, Data theft, Cyber terrorism

4.2.2 Digital Evidence: Types of digital evidence, Handling and preservation

4.2.3 Ethics: Ethical hacking principles, Privacy issues, Cyber ethics

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	3	1	2	1	2	1	1	1.67	2	3	1	2	2
CO-2	3	3	3	1	1	2	1	3	1	2	1	1	1.83	2	3	2	1	2
CO-3	3	3	3	1	1	3	1	3	2	2	1	1	2	2	3	2	2	2.25
CO-4	3	3	3	2	1	3	1	3	2	2	1	2	2.17	2	3	3	3	2.75
Avg	3	2.75	2.75	1.25	1	2.75	1	2.75	1.5	2	1	1.25	1.82	2	3	2	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)	• 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:

- Nina Godbole, Sunit Belapure, “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley
- The Basics of Web Hacking, “Tools and Techniques to attack the web, Josh Pauli, Syngress
- Mike Shema, “Anti-Hacker Tool Kit (Indian Edition)”, Publication Mc Graw Hill.
- Nina Godbole, Information Systems Security, Wiley India, New Delhi
- William Stallings, “Cryptography and network Security, Principles and Practices”, Sixth Edition, Pearson
- Kennetch J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
- Bruce Schneir, “Applied Cryptography: Protocols, Algorithms, and Source Code in C”, 20th Anniversary Edition, John Wiley & Sons
- William Stallings, “Network Security Essentials Applications and Standards (5th Edition)”, Pearson

- National Cyber Crime Reference Handbook - National Cyber safety and Security Standards.

Online Resources & Tools:

- Kali Linux: https://www.kali.org
- Windows OS: Window 10/7/XP
- Metasploit: https://www.metasploit.com
- Exploit DB: https://www.exploit-db.com/
- Network Intrusion Detection & Prevention System: https://www.snort.org
- THC Hydra: https://www.cyberpunk.rs/password-cracker-thc-hydra
- SqlMap: https://sqlmap.org/
- VirtualBox: https://www.virtualbox.org/
- Damn Vulnerable Web Application (DVWA): https://dvwa.co.uk/

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

Semester- 3

Course Code 266510244019	Name of Course Lab Based on Big Data Analytics	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: Implement distributed data storage and processing solutions using Hadoop ecosystem components such as HDFS, MapReduce, and Hive

CO-2: Develop batch data analytics applications using Apache Spark by performing data ingestion, transformation, querying, and analysis on large datasets.

CO-3: Build and test real-time data streaming applications using Apache Kafka and Spark Structured Streaming.

CO-4: Design, deploy, and evaluate end-to-end Big Data analytics pipelines by integrating storage, processing, streaming, monitoring, and visualization components for real-world use cases.

Mapping Matrix of POs, PSOs, and COs

	POs													PSOs				
COs	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	1	1	3	1	2	1	1	1.75	2	3	2	1	2
CO-2	3	3	3	1	1	1	1	3	2	2	1	1	1.83	2	3	2	1	2
CO-3	3	3	3	1	1	1	1	3	2	2	1	1	1.83	2	3	2	1	2
CO-4	3	3	3	2	1	1	1	3	2	2	3	2	2.17	2	3	3	2	2.5
Avg	3	3	3	1.25	1	1	1	3	1.75	2	1.5	1.25	1.9	2	3	2.25	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 • Guided lab exercises • Project-Based Learning, Reflective Practice

Assessment Method

	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
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- 3

Course Code 266510244020	Name of Course Lab Based on Cloud Architecture & DevOps	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: Configure and manage cloud infrastructure components

CO-2: Implement networking and security configurations in AWS.

CO-3: Monitor and optimize cloud resources

CO-4: Design and deploy scalable cloud infrastructure solutions

Mapping Matrix of POs, PSOs, and COs

	POs													PSOs				
COs	1	2	3	4	5	6	7	8	9	10	11	12	Avg	1	2	3	4	Avg
CO-1	3	2	3	2	-	-	-	3	-	2	-	-	1	3	3	-	-	1.5
CO-2	3	3	3	2	2	-	-	3	2	2	-	-	1.66	3	3	2	-	2
CO-3	2	3	3	-	3	3	-	2	2	2	-	2	1.83	3	3	3	2	2.75
CO-4	3	3	3	3	3	2	2	3	3	2	3	2	2.66	3	3	3	3	3
Avg	2.75	2.75	3	1.75	2	1.25	0.5	2.75	1.75	2	0.75	1	1.78	3	3	2	1.25	2.31

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)	• Guided + independent lab tasks, Exploration-based learning • Scenario-driven labs, Case-based exercises • Capstone mini project, Architecture-first approach, Team-based implementation

Assessment Method

	COs	Marks	Exam Component		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
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:

- Cloud Computing: Principles and Paradigms - Rajkumar Buyya, James Broberg, Andrzej Goscinski
- Architecting the Cloud - Michael J. Kavis
- AWS Certified Solutions Architect Official Study Guide - Joe Baron

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

Semester- 3

Course Code 266510244021	Name of Course Lab Based on Cyber Security	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: Perform basic cybersecurity experiments to identify system vulnerabilities, security threats, and cybercrime scenarios using security assessment tools.

CO-2: Demonstrate malware analysis, network attack simulation, and social engineering awareness techniques in a controlled laboratory environment.

CO-3: Configure and test network security mechanisms, secure communication protocols, VPNs, and cryptographic techniques for data protection.

CO-4: Conduct vulnerability assessment, penetration testing, and web application security testing while following ethical hacking principles, cyber laws, and digital evidence handling practices.

Mapping Matrix of POs, PSOs, and COs

	POs													PSOs				
COs	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	3	1	2	1	1	1.83	2	3	2	1	2
CO-2	3	3	3	1	1	2	1	3	1	2	1	1	1.83	2	3	2	1	2
CO-3	3	3	3	1	1	3	1	3	2	2	1	1	2	2	3	2	2	2.25
CO-4	3	3	3	2	1	3	1	3	2	2	1	2	2.17	2	3	3	3	2.75
Avg	3	3	3	1.25	1	2.5	1	3	1.5	2	1	1.25	1.9	2	3	2.25	1.75	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		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1	10	10	13	7
	CO-2	10			
	CO-3	10	10		
	CO-4	10			
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- 3

Course Code 266510444022	Name of Course Case Study / Internship	Compulsory
Credit: 04	Teaching Scheme: Theory (0) - Practical (120)	Hours: 120

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	1	1	1	1	1	2	1.83	3	3	2	2	2.5
CO-2	3	2	3	3	2	1	1	2	1	1	2	3	2	3	2	3	1	2.25
CO-3	2	2	2	3	2	3	1	2	2	1	2	3	2.08	2	3	3	2	2.5
CO-4	2	1	1	1	2	2	3	2	3	3	2	2	2	1	1	2	3	1.75
Avg	2.5	2	2.25	2.25	2	2	1.5	1.75	1.75	1.5	1.75	2.5	1.97	2.25	2.25	2.5	2	2.25

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

Assessment Method (As per the MCA Internship guideline)

Appendix-A

Program - MSCIT (Faculty of Information, Communication and Technology) Semester- 3		
Course Code **266520244018**	**Name of Course** **MOOC-Python for Data Science**	**MOOC**
Credit: 02 **NCrF Level: 4.5 – 8.0**	**Teaching Scheme: Theory (30) - Practical (0)**	**Teaching Hours:** **4 Weeks**

Course Outcomes (COs)

After completing this course, students will be able to

CO-1: To introduce students to the principles, scope, and significance of Data Science and its interdisciplinary nature.

CO-2: To familiarize students with statistical and machine learning methods for deriving insights from data.

CO-3: To understand the applications of Data Science in business, industry, and scientific domains for informed decision-making and research.

CO-4: To provide hands-on experience with programming environments and tools commonly used for Data Science applications.

Detailed Syllabus

Week 1: BASICS OF PYTHON SPYDER (TOOL)

1.1. Introduction Spyder
1.2. Setting working Directory
1.3. Creating and saving a script file
1.4. File execution, clearing console, removing variables from environment, clearing environment
1.5. Commenting script files
1.6. Variable creation
1.7. Arithmetic and logical operators
1.8. Data types and associated operations

Week 2: Sequence data types and associated operations

2.1 Strings
2.2 Lists
2.3 Arrays
2.4 Tuples
2.5 Dictionary
2.6 Sets
2.7 Range
2.8 NumPy
2.9 ndArray

Week 3: Pandas data frame and data frame related operations on Toyota Corolla dataset

3.1 Reading files
3.2 Exploratory data analysis
3.3 Data preparation and preprocessing
3.4 Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries
3.5 Scatter plot
3.6 Line plot

3.7 Bar plot
3.8 Histogram
3.9 Box plot
3.10 Pair plot
3.11 Control structures using Toyota Corolla dataset
3.12 if-else family
3.13 for loop
3.14 for loop with if break
3.15 while loop
3.16 Functions

Week 4: CASE STUDY

4.1 Regression
4.2 Predicting price of pre-owned cars
4.3 Classification
4.4 Classifying personal income

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	1	1	2	1	2	1	2	1	**1.50**	2	2	2	1	**1.75**
CO-2	3	3	3	1	1	1	3	1	2	1	2	2	**1.92**	3	3	2	1	**2.25**
CO-3	2	3	2	2	2	1	2	1	2	2	3	3	**2.08**	3	2	3	2	**2.50**
CO-4	3	2	3	1	1	1	3	2	2	2	2	1	**1.92**	3	3	2	1	**2.25**
Avg	**2.75**	**2.50**	**2.25**	**1.25**	**1.25**	**1**	**2.50**	**1.25**	**2**	**1.50**	**2.25**	**1.75**		**2.75**	**2.50**	**2.25**	**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)**	• As per MOOC Instructor

Assessment Method

Continuous Comprehensive Evaluation 40 Marks	**COs**	**Marks**	**Exam Component**			
			Class Test	**Assignment**	**Presentation**	**Involvement**
	CO-1		As per MOOC			
	CO-2					
	CO-3					
	CO-4					
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: • Introduction to linear algebra - by Gilbert Strang • Applied statistics and probability for engineers – by Douglas Montgomery • Mastering python for data science, Samir Madhavan **Online Resources & Tools:** • UGC Swayam Portal(Swayam Central), e-PGPathsala(e-PGPathshala (inflibnet.ac.in)) **Course Link: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs107** **Course Instructor:** Prof. Ragunathan Rengasamy, IIT Madras

Appendix-B

Program – MSC-IT (Faculty of Information, Communication and Technology)

Semester- 3

Course Code 266510244023	Name of Course MOOC-Lab based on Python for Data Science	MOOC
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: Collect, clean, transform, and organize datasets using appropriate Data Science tools and programming techniques.

CO-2: Apply statistical methods and basic machine learning algorithms to analyze data and extract useful patterns and knowledge.

CO-3: Create effective visualizations and interpret results for solving problems in business, industry, and scientific applications.

CO-4: Demonstrate proficiency in using modern Data Science platforms, libraries, and programming environments for real-world data analysis projects.

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	2	2.5
Avg	3	2.5	2.75	1.25	1.25	2	2	2	1.75	2	1	1.25		3	2.25	1.5	1.25	2.00

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		
			Practical Test	Journal	Viva
Continuous Comprehensive Evaluation 40 Marks	CO-1		10	13	7
	CO-2				
	CO-3		10		
	CO-4				
Term-End Evaluation 60 Marks	COs	Marks	Exam Component		
	CO-1	15	Term End Examination		
	CO-2	15			
	CO-3	15			
	CO-4	15			

Assessment Method (As per the MOOC guideline)