



TAKSHASHILA UNIVERSITY

(Tamil Nadu State Private University)
ONGUR, TINDIVANAM TK, VILLUPURAM DT

FACULTY OF ENGINEERING AND TECHNOLOGY SCHOOL OF COMPUTATIONAL ENGINEERING

Department of Computer Science and Engineering
(Data Science)

REGULATION – R25 NEP CURRICULUM & SYLLABI III Semester



VISION AND MISSION OF UNIVERSITY

VISION:

To create change makers and world leaders similar to the ancient Takshashila University.

MISSION:

The brightest minds and the best resources are used to nurture and develop the leaders of tomorrow, where they are encouraged to be eternally curious and ethically sound.

DEPARTMENT VISION AND MISSION

VISION:

To be a center of excellence in Artificial Intelligence and Data Science by fostering transformative education, interdisciplinary research and innovation to develop intelligent, ethical, and sustainable solutions that address global challenges and contribute to societal progress.

MISSION:

M1: Academic Excellence	Deliver a contemporary, outcome-based curriculum that equips students with strong foundations in Artificial Intelligence, Data Science and computational thinking to solve complex real-world problems.
M2: Research and Innovation	Promote interdisciplinary research, innovation, and the adoption of emerging AI and data-driven technologies to develop impactful solutions for industrial and societal needs.
M3: Industry Readiness and Entrepreneurship	Strengthen employability and entrepreneurial capabilities through industry collaborations, experiential learning, internships, professional certifications and start-up incubation.
M4: Ethics and Lifelong Learning	In still ethical values, responsible AI practices, professional integrity, and a commitment to lifelong learning to develop socially responsible leaders capable of driving sustainable technological advancement.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis

Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8: Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning

Recognize the need for, and have the preparation and ability to engage in continuous learning in the face of technological change.

PROGRAMME EDUCATIONAL OUTCOMES (PEOs)

PEO1: Competitive Platform

To create a competitive platform for solving critical problems in a wide variety of fields.

PEO2: Exploration

Enthusiastic participation in learning, understanding, designing and applying new innovative research ideas as the field evolves.

PEO3: Career

Applying cutting-edge technology that improves knowledge and to commit students for life-long learning to reach the leading positions in the career.

PEO4: Professional Values

Simulate the graduates to hold the responsibilities in the context of technology, ethics, society and humanity.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: AI and Data Analytics Competency

Apply the principles of Artificial Intelligence and Data Science to develop intelligent, data-driven solutions for complex real-world problems.

PSO2: Research and Innovation

Design and implement AI-based and data-centric solutions using modern tools, emerging technologies and research methodologies to address industrial and societal challenges.

PSO3: Professional Competence

Demonstrate professional ethics, entrepreneurial mind-set and lifelong learning to excel in careers, higher education, research, and innovation in Artificial Intelligence and Data Science.



**TAKSHASHILA
UNIVERSITY**

(Established Under Tamil Nadu State Private Universities Act 2019 &
Recognized by UGC vide 2(f) of the UGC Act, 1956)

Ongur (PO), Tindivanam Taluk, Villupuram District,
Tamil Nadu - 604 305, India.
04147-234567 | +91 9297623456 | +91 99401 86843
contactus@takshashilauniv.ac.in | www.takshashilauniv.ac.in

FACULTY OF COMPUTATIONAL ENGINEERING
B.TECH. IN COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
(REGULATION – R25 NEP)
SEMESTER – III

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Hrs.	Max. Marks								
				L	T	P			CAT Theory (Best of two)	ASS	MCQ	ATT	SEM	PRAC	CAM	ESM	Total
1	U25CD13T	Probability and Statistics	BS	3	1	0	4	60	20	5	5	5	5	-	40	60	100
2	U25CD14T	Data Structures and its Applications	PC	3	0	0	3	45	20	5	5	5	5	-	40	60	100
3	U25CD15B	Backend Development	PC	3	0	2	4	75	20	5	5	5	5	10	50	50	100
4	U25CD16P	Data Structures and its Applications Laboratory	PC	0	0	4	2	60	20	-	-	10	-	20	50	50	100
5	U25CD17T	Introduction to Finance	ES	2	1	0	3	45	20	5	5	5	5	-	40	60	100
6	U25CD18T	Applied Communicative English	HS	3	0	0	3	45	20	5	5	5	5	-	40	60	100
7	U25CD19T	Logical Reasoning	HS	2	0	0	2	30	20	5	5	5	5	-	40	60	100
Total:							21	330									
8	U25VA06T	Constitution of India	VAC	2	0	0	0	30	20	20	20	20	20	-	100	-	100
Total:							0	45									
Semester Total:							21	375									
															400	400	800

Note:

L – Lecture

T – Tutorial

P – Practical

CAT – Continuous Assessment Test

ESM – End Semester Exam Marks

ASS – Assignment

ATT – Attendance

CAM – Continuous Assessment Marks

SEM – Seminar

PW – Project Work

BoS Chairman

U25CD13T	Probability and Statistics	L	T	P	C	Total
		3	1	0	4	60

COURSE OBJECTIVES:

To help students understand descriptive statistics including measures of central tendency, dispersion, skewness, and kurtosis for summarizing and visualizing data effectively
To guide students in analyzing relationships between variables using correlation, covariance, and building predictive models using simple, multiple, and nonlinear regression techniques
To familiarize students with probability fundamentals including addition and multiplication rules, conditional probability, Bayes' theorem, and counting principles
To teach students discrete and continuous probability distributions including Bernoulli, Binomial, Poisson with their properties and applications
To enable students to perform inferential statistics using sampling techniques, confidence intervals, hypothesis testing.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Interpret and analyze descriptive statistical measures including central tendency, dispersion, skewness, and kurtosis, and evaluate their applications in quality control and risk assessment using appropriate data visualization techniques.
CO2:	Evaluate and apply fundamental probability concepts, including conditional probability, Bayes' theorem, and combinatorial methods, to model and solve real-world uncertainty and decision-making problems.
CO3:	Analyze and differentiate discrete and continuous probability distributions, and apply appropriate distribution models (Bernoulli, Binomial, Poisson, Normal, etc.) to interpret stochastic behavior in practical scenarios.
CO4:	Perform and evaluate inferential statistical methods including sampling techniques, hypothesis testing, and confidence interval estimation, and critically analyze results using statistical tests such as z-test, t-test, Chi-square, and ANOVA.
CO5:	Develop and analyze correlation and regression models, and interpret relationships between variables using simple, multiple, and nonlinear regression techniques for predictive and decision-making applications.

UNIT I: DESCRIPTIVE STATISTICS	12 Hrs.
Introduction to Statistics - Importance of Statistics - Data Visualization Using tables and plots - Measures of Central Tendency (Mean, Median, Mode) - Measures of Dispersion (Range, IQR, Variance, Standard Deviation) - Applications in Quality Control and Risk Assessment - Skewness - Kurtosis - Types of Skewness and Kurtosis.	
UNIT II: FUNDAMENTALS OF PROBABILITY	12 Hrs.
Basics of Probability - Classical - Empirical - and Subjective Probability - Sample Space and Events - Mutually Exclusive - Exhaustive - and Independent Events - Addition and Multiplication Rules - Conditional Probability - Law of Total Probability - Bayes' Theorem - Permutations and Combinations.	
UNIT III: PROBABILITY DISTRIBUTIONS	12 Hrs.
Introduction to Random Variables - Discrete & Continuous Random Variables - Discrete Probability Distributions - Probability Mass Function (PMF) - Bernoulli - Binomial - Poisson distributions - Continuous Probability Distributions - Probability Density Function (PDF) - Cumulative Distribution Function (CDF) - Normal Distribution & its types - Uniform - Beta - Gamma - Exponential Distributions.	
UNIT IV: INFERENCE STATISTICS	12 Hrs.
Introduction to Sampling - Sampling Techniques - Sampling Distribution - Central Limit Theorem - T - Chi-Square - F Distributions - Confidence intervals & levels - Level of significance - Hypothesis Testing (Null and Alternative Hypotheses, Type I and Type II Errors, p-value, Significance Level) - z-test - t-test (One-sample, Two-sample, Paired) - Chi-square Tests (Independence, Goodness-of-fit) - One-way ANOVA - Post-hoc Analysis.	
UNIT V: CORRELATION AND REGRESSION	12 Hrs.
Correlation - Covariance - Types of Correlation - Coefficient of Correlation - Simple Linear Regression - Multiple Linear Regression - Nonlinear Regression.	

Total Hours: 60

TEXT BOOKS:	
1.	S. E. Rigdon, Introduction to Probability and Statistics for Data Science with R, 1st ed., Cambridge, UK: Cambridge University Press, 2024, ISBN: 978-1107113046.
2.	Fundamentals of Mathematical Statistics, S. C. Gupta & V. K. Kapoor. (2020). Fundamentals of Mathematical Statistics (12th ed.). Sultan Chand & Sons.

REFERENCE BOOKS:

1.	C. C. Aggarwal, Probability and Statistics for Machine Learning, 1st ed., Cham, Switzerland: Springer Nature, 2024, ISBN-13: 978-3031532818.
2.	F. Pesarin and L. Salmaso, Permutation Tests for Complex Data: Theory, Applications and Software, 2nd ed., Hoboken, NJ, USA: John Wiley & Sons, 2025, ISBN-13: 978-1119438236.
3.	D. Speegle and B. Clair, Probability, Statistics, and Data: A Fresh Approach Using R, 1st ed., Boca Raton, FL, USA: CRC Press, 2024, ISBN: 978-0367749453.
4.	A. G. Bluman, Elementary Statistics: A Brief Version, 9th ed., New York, NY, USA: McGraw-Hill Education, 2024, ISBN: 978-1264417926.
5.	G. G. Roussas, An Introduction to Probability and Statistical Inference, 3rd ed., Amsterdam, Netherlands: Elsevier, 2024, ISBN: 978-0443187209.

WEB REFERENCES:

1.	https://www.khanacademy.org/math/statistics-probability
2.	https://nptel.ac.in/courses/111105041
3.	https://online.stat.psu.edu/stat500/
4.	https://seeing-theory.brown.edu/
5.	https://stattrek.com/

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	3	2	1	1	-	-	1	1	2	3	2	1
2	3	3	2	3	2	2	2	-	-	1	2	2	3	2	2
3	3	3	2	3	3	1	1	-	-	1	1	2	3	2	2
4	3	3	3	3	3	2	2	-	1	2	2	3	3	3	2
5	3	3	3	3	3	2	2	-	1	2	2	3	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25CD14T	Data Structures and its Applications	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

• To understand string processing techniques and bit manipulation methods for computational problem solving
• To apply linked list operations and dynamic memory structures in linear data organization
• To implement stack and queue-based approaches for expression evaluation and problem solving
• To analyze hierarchical data structures using binary trees and binary search trees
• To develop efficient priority-based solutions using heaps and advanced sorting techniques.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Explain conversion methods, logical operators, and low-level computational techniques.
CO2:	Perform insertion, deletion, traversal, and cycle identification in connected data structures.
CO3:	Construct expression handling and order-maintenance solutions using abstract data management techniques.
CO4:	Examine traversal strategies, balancing methods, and search-oriented hierarchical models.
CO5:	Implement optimized retrieval and arrangement algorithms for ranking and aggregation problems.

UNIT I: HASHING, SLIDING WINDOW & TWO-POINTER	9 Hrs.
Hashing: Hash Tables - Hash Functions - Collisions - Collision Resolution (Separate Chaining, Open Addressing) Prefix Sum - Sliding Window - Two-Pointer Technique - Classic Problems: Longest Subarray with Sum K - Maximum Subarray (Kadane's Algorithm) - Two Sum.	

UNIT II: LINKED LISTS	9 Hrs.
Singly Linked List: Traversal - Insertion - Deletion - Doubly Linked List: Traversal - Insertion -	

Deletion - Circular Linked List - Reversals - Floyd's Cycle-Finding Algorithm - Cycle Detection & Length - Problems: Adding Two Numbers - Merge Two Lists - Intersection of Linked Lists - Flatten List.

UNIT III: STACKS & QUEUES

9 Hrs.

Stack: Implementation (Array & Linked List) - Expression Conversions & Evaluations (Infix/Prefix/Postfix) - Monotonic Stack - Advanced Problems: Balanced Parenthesis - Min Stack - Next Greater/Smaller Element - Asteroid Collision - Histogram - Queue: Implementation (Array & Linked List) - Stack Using Queue - Queue Using Stack.

UNIT IV: TREES & BINARY SEARCH TREES

9 Hrs.

Binary Tree: Introduction - Traversals (Inorder, Preorder, Postorder, Level Order) - Height - Diameter - Balanced Tree - Top View - Right View - LCA - Maximum Path Sum
BST: Insertion - Deletion - Validation - Kth Smallest - Predecessor & Successor - Merge Two BSTs

UNIT V: HEAPS

9 Hrs.

Heaps: Min-Heap - Max-Heap - Heap Sort - Heap Conversions - Priority Queue Applications - Kth Largest Element - Merge K Sorted Arrays - Top K Frequent Elements

Total Hours: 45

TEXT BOOKS:

1.	A. Bhargava, Grokking Algorithms, Second Edition: An Illustrated Guide for Programmers and Other Curious People, 2nd ed., Shelter Island, NY, USA: Manning Publications, 2024, ISBN-13: 978-1633438538.
2.	Mark Allen Weiss, Data Structures and Algorithm Analysis in C++ (5th ed.), Pearson, (2023).
3.	Narasimha Karumanchi, Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles (5th ed.). CareerMonk Publications, 2020.

REFERENCE BOOKS:

1.	J. Wengrow, A Common-Sense Guide to Data Structures and Algorithms, Volume 2: Level Up Your Core Programming Skills, 1st ed., Raleigh, NC, USA: Pragmatic Bookshelf, 2024, ISBN-13: 979-8888650783.
2.	R. Sedgewick and K. Wayne, Algorithms, Updated 5th ed., Boston, MA, USA: Addison-Wesley Professional, 2024, ISBN-13: 978-0138279837.
3.	S. Sridharan, Mastering Data Structures and Algorithms Using C and C++, 2nd ed.,

	Birmingham, UK: Packt Publishing, 2023, ISBN-13: 978-1804614178.
4.	H. Jain, Problem Solving in Data Structures and Algorithms Using C++: A Practical Approach to Competitive Programming, 1st ed., New Delhi, India: BPB Publications, 2024, ISBN-13: 978-9365890389.
5.	T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, 4th ed., Cambridge, MA, USA: MIT Press, 2022, ISBN-13: 978-0262046305.

WEB REFERENCES:

1.	https://www.geeksforgeeks.org/data-structures/
2.	https://visualgo.net/en
3.	https://nptel.ac.in/courses/106102064
4.	https://www.programiz.com/dsa
5.	https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	2	-	-	-	-	-	-	1	3	-	1
2	3	3	2	-	2	-	-	-	-	-	-	1	3	-	2
3	3	3	3	1	2	-	-	-	-	-	-	1	3	1	2
4	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
5	3	3	3	2	3	-	-	-	-	-	-	2	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25CD15B	Backend Development	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

• To understand server-side application development using Node.js and Express.js
• To design and develop data-driven web services with database integration and RESTful API development
• To implement secure user authentication, authorization, and middleware for backend applications
• To apply file handling, asynchronous programming, and stream processing techniques in server-side applications
• To build scalable backend applications with database connectivity, cloud integration, and role-based access control.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Explain backend runtime environment, routing mechanisms, and package management concepts.
CO2:	Construct service endpoints with database transactions, validation, and response handling.
CO3:	Develop secure access mechanisms using token generation, encryption, and custom interceptors.
CO4:	Utilize asynchronous storage operations and stream pipelines for efficient information processing.
CO5:	Analyze document-oriented database applications with schema mapping, filtering, and access permissions.

UNIT I: NODE JS AND EXPRESS FUNDAMENTALS	9 Hrs.
Introduction to Backend Development - Node.js Basics - Express.js Introduction - HTTP Server Setup - Handling HTTP Requests - Development Environment Setup - NPM Package Management - Routing Basics - Request and Response Objects - Error Handling - Introduction to Server-side Frameworks - Spring Boot Fundamentals - Express.js vs Spring Boot.	

UNIT II: DATABASE INTEGRATION AND RESTFUL API DEVELOPMENT	9 Hrs.
SQLite Data Creation and Integration - Database Schema - CRUD Operations - Query Writing - REST Principles - RESTful API Development - Query Handling - Request Validation - Response Formatting - Testing APIs - Debugging Techniques.	

UNIT III: AUTHENTICATION AND MIDDLEWARE	9 Hrs.
JWT Token Authentication - Authentication Strategies - Multi-Factor Authentication (MFA) - User Management - Middleware Functions and Implementation - Custom Middleware Development - Password Hashing - Security Best Practices - Error Logging.	

UNIT IV: FILE HANDLING AND STREAMS	9 Hrs.
File Handling using the fs Module - File System Operations - Working with File Streams - Data Transformation Streams - Error Handling with Streams - Stream Piping - Buffer Management - Asynchronous File Operations.	

UNIT V: MONGODB, CLOUD AND NODE JS INTEGRATION	9 Hrs.
Introduction to Cloud Computing - Cloud Service Models (IaaS, PaaS, SaaS) - MongoDB Installation and Setup - MongoDB Atlas Integration - Native Driver vs Mongoose - Schema Design - Defining Models - Filtering and Sorting - CRUD APIs with MongoDB - Role-Based Authorization - Testing MongoDB-Backed APIs – Debugging	

Total Hours: 45

LIST OF EXERCISES:	
1.	Set up a Node.js project, initialize NPM, and create an Express server to handle HTTP GET and POST requests.
2.	Implement modular routing with Express.js to create route handlers for multiple API endpoints with request and response handling.
3.	Integrate SQLite with a Node.js application and perform CRUD operations using parameterized SQL queries.
4.	Build a complete RESTful API with request validation, structured JSON response formatting, and error handling.
5.	Implement JWT-based user authentication including registration, login, and token verification in an Express application.
6.	Create custom middleware functions for authorization controls, error logging, and security enforcement.

7.	Implement file upload and download functionality using the fs module and multipart form handling.
8.	Use Node.js Readable and Writable streams to handle large file operations and data transformation.
9.	Connect a Node.js application to MongoDB Atlas and perform CRUD operations using Mongoose models.
10.	Implement password hashing, JWT authentication, and role-based authorization for a MongoDB-backed API.

Total Hours: 30

TEXT BOOKS:

1.	A. Banks and E. Porcello, Learning Node.js: A Hands-On Guide to Building Web Applications with JavaScript, 3rd ed., Sebastopol, CA, USA: O'Reilly Media, 2024, ISBN-13: 978-1098143991.
----	---

REFERENCE BOOKS:

1.	E. Hahn, Express in Action: Writing, Building, and Testing Node.js Applications, Updated ed., Shelter Island, NY, USA: Manning Publications, 2023, ISBN-13: 978-1633439962.
2.	A. Rauschmayer, Exploring JavaScript (ES2025 Edition): JavaScript and Modern Web Development, 1st ed., 2025, ISBN-13: 978-1091210097.
3.	K. Chodorow, MongoDB: The Definitive Guide, 4th ed., Sebastopol, CA, USA: O'Reilly Media, 2024, ISBN-13: 978-1098102004.
4.	M. Haverbeke, Eloquent JavaScript, 4th ed., San Francisco, CA, USA: No Starch Press, 2024, ISBN-13: 978-1593279509.
5.	M. Simon, JavaScript for Web Developers: Modern Backend and Full-Stack Development, 1st ed., Berkeley, CA, USA: Apress, 2023, ISBN-13: 978-1484297735.

WEB REFERENCES:

1.	https://nodejs.org/en/docs
2.	https://expressjs.com/
3.	https://developer.mozilla.org/en-US/docs/Learn/Server-side
4.	https://jwt.io/introduction

5. <https://www.mongodb.com/docs/manual/>

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	2	-	-	-	-	-	-	1	3	-	1
2	3	2	3	-	3	-	-	-	-	1	-	1	3	2	2
3	3	2	3	-	3	-	-	2	-	-	-	1	3	2	2
4	2	2	2	2	3	-	-	-	-	-	-	1	3	2	2
5	3	3	2	2	3	-	-	1	-	-	-	2	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25CD16P	Data Structures and its Applications Laboratory	L	T	P	C	Total
		0	0	4	2	60

COURSE OBJECTIVES:

• To apply computational techniques for string and bit-level operations
• To develop linear data structures for dynamic data management
• To explain stack- and queue-based approaches for processing applications
• To analyze tree structures for hierarchical data operations
• To implement heap-based methods for priority-driven problem solving.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Apply string manipulation, number conversion, and bitwise computation techniques in programs.
CO2:	Develop linked list solutions for traversal, insertion, deletion, and cycle analysis.
CO3:	Construct stack- and queue-oriented applications for expression processing and task handling.
CO4:	Build tree- and BST-based models for hierarchical traversal and search operations.
CO5:	Execute heap-driven algorithms for scheduling and priority management tasks.

LIST OF EXERCISES:

1.	Implement programs to perform string-processing operations such as reversing messages, detecting anagrams, validating simple username or text patterns, and applying basic string manipulation techniques.
2.	Implement programs to convert numbers between decimal, binary, octal, and hexadecimal systems and perform bitwise operations including AND, OR, XOR, NOT, left shift, and right shift operations.
3.	Implement bit-manipulation programs to check, set, clear, toggle, and count bits in integers, along with operations such as swapping numbers and removing the rightmost set bit.
4.	Implement a singly linked list to store and manage a list of integers, supporting operations

	such as insertion, deletion, search, and traversal, simulating basic numeric data handling.
5.	Implement linked list programs to detect cycles, find cycle length, and identify the intersection point of two linked lists, simulating data consistency checks in system logs.
6.	Build a stack-based calculator that converts infix expressions to postfix and evaluates them, simulating expression evaluation in compilers.
7.	Develop a queue-based system to simulate customer service request processing, including implementation of queue using stack or stack using queue.
8.	Create a program to construct a binary tree and compute its height, diameter, top view, and right view, simulating hierarchical data visualization.
9.	Create a BST-based program to insert, delete, validate, and find the Kth smallest element, simulating ordered data storage like student roll numbers.
10.	Implement min-heap and max-heap to schedule jobs based on priority and find the Kth largest task duration, simulating CPU scheduling.

Total Hours: 60

TEXT BOOKS:

1.	A. Bhargava, Grokking Algorithms, Second Edition: An Illustrated Guide for Programmers and Other Curious People, 2nd ed., Shelter Island, NY, USA: Manning Publications, 2024, ISBN-13: 978-1633438538.
----	---

REFERENCE BOOKS:

1.	J. Wengrow, A Common-Sense Guide to Data Structures and Algorithms, Volume 2: Level Up Your Core Programming Skills, 1st ed., Raleigh, NC, USA: Pragmatic Bookshelf, 2024, ISBN-13: 979-8888650783.
2.	R. Sedgewick and K. Wayne, Algorithms, Updated 5th ed., Boston, MA, USA: Addison-Wesley Professional, 2024, ISBN-13: 978-0138279837.
3.	S. Sridharan, Mastering Data Structures and Algorithms Using C and C++, 2nd ed., Birmingham, UK: Packt Publishing, 2023, ISBN-13: 978-1804614178.
4.	H. Jain, Problem Solving in Data Structures and Algorithms Using C++: A Practical Approach to Competitive Programming, 1st ed., New Delhi, India: BPB Publications, 2024, ISBN-13: 978-9365890389.
5.	T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, 4th ed., Cambridge, MA, USA: MIT Press, 2022, ISBN-13: 978-0262046305.

WEB REFERENCES:

1.	https://www.hackerrank.com/domains/data-structures
2.	https://leetcode.com/problemset/
3.	https://www.w3schools.com/dsa/
4.	https://www.geeksforgeeks.org/bitwise-algorithms/
5.	https://www.tutorialspoint.com/data_structures_algorithms/index.htm

COs/POs/PSOs Mapping:

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	2	-	-	-	-	-	-	1	3	-	2
2	3	3	2	1	2	-	-	-	-	-	-	1	3	1	2
3	3	3	3	1	2	-	-	-	-	-	-	1	3	1	2
4	3	3	3	2	2	-	-	-	-	-	-	1	3	2	2
5	3	3	2	2	3	-	-	-	-	-	-	1	3	2	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25CD17T	Introduction to Finance	L	T	P	C	Total
		1	0	2	3	45

COURSE OBJECTIVES:

• To Understand the fundamentals of financial systems, markets, institutions, and the transformative role of Generative AI in financial services and workflows
• To Design and develop AI-powered financial applications and intelligent agents using Retrieval-Augmented Generation (RAG), APIs, and real-time financial data sources
• To Apply evaluation, observability, and hallucination detection techniques to assess the reliability and performance of financial AI systems
• To Implement fine-tuning, deployment, monitoring, and optimization strategies for domain-specific financial AI models using modern frameworks and techniques
• To Analyze ethical, governance, transparency, privacy, and risk management aspects to build responsible and trustworthy AI solutions in finance.

COURSE OUTCOMES:

After successful completion of the course, learners will be able to:

CO1:	Explain the structure of financial systems, institutions, and the role of AI technologies in modern financial services.
CO2:	Develop AI-based financial applications and intelligent agents integrating RAG pipelines, APIs, and external financial data sources.
CO3:	Evaluate the accuracy, reliability, and effectiveness of financial AI systems using RAGAS metrics, observability tools, and automated evaluation frameworks.
CO4:	Fine-tune, deploy, and monitor domain-specific AI models for financial tasks such as fraud detection, risk analysis, and document intelligence.
CO5:	Apply ethical AI principles, governance frameworks, fairness measures, and risk management strategies in financial AI system design and deployment.

UNIT I: FINANCE FUNDAMENTALS AND AI FOR FINANCE	9 Hrs.
Finance fundamentals - markets - instruments - institutions - Key verticals: banking - insurance - capital markets - wealth management - Why Gen AI is transforming financial services - Real-world examples. Applications: document intelligence - fraud detection - trading - advisory - compliance.	

UNIT II: APPLICATIONS OF AI IN FINANCE	9 Hrs.
Building personal finance advisor agent using Retrieval-Augmented Generation (RAG) - Tool integration with financial APIs - web search (market data, filings, news) - Designing simple financial agents for real-world workflows - Tools for enhancing productivity with AI in financial use cases.	

UNIT III: EVALUATION AND OBSERVABILITY FOR FINANCIAL AI SYSTEMS	9 Hrs.
Implementing Retrieval-Augmented Generation (RAG) evaluations for Financial AI Agents RAGAS metrics: Faithfulness - Context Precision - Answer Relevancy - Context Recall for financial use cases (trading signals, fraud detection) LLM-as-judge evaluation for financial decision-making quality. Detecting and reducing hallucinations in financial AI systems. Building automated evaluation pipelines and regression test suites for financial workflows Task success rate evaluation for financial processes (e.g., trading, fraud detection)	

UNIT IV: ADVANCED FINE-TUNING AND DEPLOYING AI MODELS	9 Hrs.
Production monitoring of financial LLM systems - LangSmith tracing and evaluation workflows for finance agents - Evaluation frameworks for RAG-based financial document systems - RAGAS evaluation framework - Core RAG metrics - Prompting vs RAG vs fine-tuning decision strategies for financial use cases - Fundamentals of LoRA and adapter-based fine-tuning on financial datasets - QLoRA and 4-bit quantization techniques for cost-efficient financial AI systems - Preparing domain-specific financial training datasets (transactions, contracts, reports) - Instruction-tuning dataset creation for financial tasks - Training pipelines using HuggingFace PEFT libraries - Evaluating fine-tuned models against base models for fraud detection and risk scoring - Deployment of financial AI models with APIs - monitoring - and versioning.	

UNIT V: AI ETHICS AND RESPONSIBLE AI IN FINANCIAL SYSTEMS	9 Hrs.
Ethical risks in financial AI systems (bias in credit scoring, algorithmic trading risks) - Bias in financial training data and machine learning models - Data privacy and security considerations for sensitive financial data - Responsible AI frameworks in financial services - Fairness and transparency in AI-driven financial decision-making - AI governance frameworks for financial institutions - Risk management strategies for AI-powered financial products - Human-in-the-loop AI systems for fraud review and compliance - Building trustworthy - explainable - and accountable AI systems in finance.	

Total Hours: 45

TEXT BOOKS:	
1.	K. Ashok and A. Gupte, Generative AI for Finance: Building Intelligent Financial Systems, 1st ed., Birmingham, UK: Packt Publishing, 2025, ISBN-13: 978-1836205054.

2.	A Python-Based Guide, Yves Hilpisch, Artificial Intelligence in Finance, O'Reilly Media, 2020.
3.	Tom Taulli, Generative AI for Finance: Building AI Agents, RAG Systems, and Intelligent Financial Applications, Apress, 2025.

REFERENCE BOOKS:

1.	C. C. Aggarwal, Neural Networks and Deep Learning: A Textbook, 2nd ed., Cham, Switzerland: Springer Nature, 2023, ISBN-13: 978-3031296697.
2.	L. Tunstall, L. von Werra, and T. Wolf, Natural Language Processing with Transformers, Revised ed., Sebastopol, CA, USA: O'Reilly Media, 2022, ISBN-13: 978-1098103247.
3.	H. Face and PEFT Contributors, Efficient Fine-Tuning with PEFT and LoRA, 1st ed., Sebastopol, CA, USA: HuggingFace Publications, 2024, ISBN-13: 978-1098190018.
4.	B. Marr, Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, 2nd ed., Hoboken, NJ, USA: Wiley, 2023, ISBN-13: 978-1119795575.
5.	Y. Hilpisch, Artificial Intelligence in Finance: A Python-Based Guide, 2nd ed., Sebastopol, CA, USA: O'Reilly Media, 2024, ISBN-13: 978-1098147647.
6.	T. Taulli, Generative AI: How ChatGPT and Other AI Tools Will Revolutionize Business, 1st ed., New York, NY, USA: Apress, 2023, ISBN-13: 978-1484297926.
7.	M. Lewis and M. McKinnon, AI and Machine Learning in Finance, 1st ed., London, UK: Wiley Finance, 2024, ISBN-13: 978-1119907022.

WEB REFERENCES:

1.	https://www.investopedia.com/
2.	https://docs.smith.langchain.com/
3.	https://docs.ragas.io/
4.	https://huggingface.co/docs/peft
5.	https://www.nist.gov/itl/ai-risk-management-framework

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	1	1	1	1	-	-	-	2	2	1	1
2	3	3	3	2	3	1	1	-	1	1	1	2	3	3	3
3	3	3	2	3	3	1	1	-	-	1	-	2	3	3	2
4	3	3	3	3	3	2	2	1	1	1	1	2	3	3	3
5	2	3	2	2	2	3	3	3	1	1	1	3	2	2	2

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25CD18T	Applied Communicative English	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

• To explain language structures for effective group communication.
• To describe questioning methods for academic interactions.
• To discuss persuasive expression techniques for structured communication.
• To illustrate presentation strategies for confident public speaking.
• To summarize verbal and non-verbal communication practices.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Apply grammatical and organizational techniques in discussion-based interactions.
CO2:	Develop context-oriented questions and responses for academic communication scenarios.
CO3:	Construct persuasive arguments using appropriate expressions and stylistic elements.
CO4:	Deliver structured presentations with effective voice modulation and audience engagement.
CO5:	Demonstrate professional speaking abilities through verbal and non-verbal communication skills.

UNIT I: COLLABORATIVE COMMUNICATION FOR GROUP DISCUSSIONS (PART 1)	9 Hrs.
Grammatical Accuracy and Fluency in Group Interaction - Structuring Sentences for Coherence and Variety.	

UNIT II: COLLABORATIVE COMMUNICATION FOR GROUP DISCUSSIONS (PART 2)	9 Hrs.
Organizing Ideas through Clauses - Phrases - and Transitions - Using Linking Devices for Logical Flow - Maintaining Clarity - Tone - and Appropriateness in Discussions.	

UNIT III: STRATEGIC QUESTIONING AND RESPONSE TECHNIQUES	9 Hrs.
Purpose and Types of Questions in Academic Settings - Framing Clear and Context-Based Questions - Using Modals for Permission - Obligation - and Possibility - Responding with Precision and Confidence - Paraphrasing and Reporting Responses Accurately.	

UNIT IV: PERSUASION AND INFLUENCING OTHERS	9 Hrs.
Structuring Persuasive Discourse Effectively - Using Idioms - Collocations - and Fixed Phrases - Ensuring Fluency and Contextual Suitability - Building Credibility and Stylistic Coherence - Crafting Arguments and Counterarguments.	

UNIT V: PUBLIC SPEAKING AND PRESENTATION SKILLS	9 Hrs.
Stress - Rhythm - and Intonation for Effective Delivery - Organizing and Structuring Presentations - Ensuring Tense and Grammatical Consistency - Engaging Audiences through Verbal and Non-Verbal Cues - Developing Confidence and Stage Presence.	

Total Hours: 45

TEXT BOOKS:	
1.	A. Clare and J. Wilson, Speakout Advanced, 3rd ed., London, UK: Pearson Education, 2024, ISBN: 978-1-292-45556-8.
2.	Building Critical Skills, Kitty O. Locker & Stephen Kaczmarek, Business Communication, McGraw-Hill Education, 2022.
3.	Sunita Mishra & C. Muralikrishna, Communication Skills for Engineers, Pearson India, 2018.

REFERENCE BOOKS:	
1.	M. Hewings, Advanced Grammar in Use, 4th ed., Cambridge, UK: Cambridge University Press, 2023, ISBN: 978-1-108-45773-6.
2.	D. Carnegie, The Art of Public Speaking, Revised ed., New York, NY, USA: Simon & Schuster, 2022, ISBN: 978-1-4391-6764-5.
3.	J. Gilbert, Clear Speech, 4th ed., Cambridge, UK: Cambridge University Press, 2022, ISBN: 978-1-108-40022-0.
4.	R. Murphy, English Grammar in Use, 5th ed., Cambridge, UK: Cambridge University Press, 2023, ISBN: 978-1-108-45765-1.
5.	M. Swan, Practical English Usage, 4th ed., Oxford, UK: Oxford University Press, 2023, ISBN: 978-0-19-420246-6.

WEB REFERENCES:

1.	https://learnenglish.britishcouncil.org/
2.	https://www.bbc.co.uk/learningenglish
3.	https://dictionary.cambridge.org/grammar/british-grammar/
4.	https://owl.purdue.edu/owl/purdue_owl.html
5.	https://www.toastmasters.org/resources/public-speaking-tips

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	-	-	-	2	3	-	2	-	-	2
2	-	1	-	-	-	-	-	-	2	3	-	2	-	1	2
3	-	2	1	-	-	-	-	1	2	3	-	2	-	1	2
4	-	-	1	-	1	-	-	-	3	3	1	2	-	-	3
5	-	-	-	-	-	-	-	1	3	3	2	2	-	-	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25CD19T	Logical Reasoning	L	T	P	C	Total
		2	0	0	2	30

COURSE OBJECTIVES:

• To explain analytical approaches for arrangements and reasoning scenarios
• To describe set-based interpretation and deductive logic concepts
• To discuss validation techniques for logical and puzzle-oriented problems
• To illustrate visual interpretation and pattern recognition approaches
• To summarize analytical strategies for spatial reasoning problems.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Apply arrangement, sufficiency, and blood relation methods in reasoning problems.
CO2:	Develop Venn diagrams and syllogistic solutions for logical deduction tasks.
CO3:	Construct reasoning frameworks for validity assessment and puzzle analysis.
CO4:	Solve visual reasoning and figure identification problems using analytical techniques.
CO5:	Implement structured approaches for spatial and logical interpretation tasks.

UNIT I: DATA ARRANGEMENTS	6 Hrs.
Data Arrangements: Linear and circular arrangements - seating arrangements (row and column-based) - grouping and sequencing - and conditional arrangements.	

UNIT II: DATA SUFFICIENCY AND BLOOD RELATIONS	6 Hrs.
Data Sufficiency: Assessing whether given statements are sufficient to answer a question - covering topics like numbers - arrangements - ages - and logical reasoning. Blood Relations: Family tree-based problems - paternal and maternal relationships - coded blood relations - and generation-based questions.	

UNIT III: SET THEORY & BASIC SYLLOGISMS	6 Hrs.
Venn Diagrams: Set-based representation - logical categorization - solving problems involving union - intersection - and complements of sets. Syllogisms: Statements and conclusions - logical deduction using Venn diagrams.	

UNIT IV: VALIDITY & LOGICAL REASONING PUZZLES	6 Hrs.
Syllogisms: Evaluating the validity of conclusions - and solving categorical syllogism problems. Puzzles: Logical reasoning-based puzzles such as floor-based - box arrangement - scheduling - classification - and grid-based puzzles.	

UNIT V: SHAPES AND PATTERN DEDUCTION	6 Hrs.
Counting Figures: Identifying and counting geometric shapes like triangles - squares - rectangles - and other patterns within a complex figure. Visual Reasoning: Mirror and water images - paper folding and cutting - pattern completion - figure analogy - and odd-one-out identification.	

Total Hours: 30

TEXT BOOKS:	
1.	M. K. Pandey, Analytical Reasoning, 2nd ed., New Delhi, India: BSC Publishing Co. Pvt. Ltd., 2023, ISBN: 978-81-7009-191-4.
2.	S. Chand Publishing, A Modern Approach to Logical Reasoning, R. S. Aggarwal. 2022.

REFERENCE BOOKS:	
1.	S. Gupta, Verbal and Non-Verbal Reasoning, 2nd ed., New Delhi, India: Pearson Education India, 2023, ISBN: 978-93-325-8184-0.
2.	R. K. Jain, Reasoning Ability for Competitive Examinations, 1st ed., New Delhi, India: McGraw Hill Education, 2022, ISBN: 978-93-392-1734-2.
3.	E. R. Barrett, How to Solve Logic Puzzles, 1st ed., New York, NY, USA: Sterling Publishing, 2021, ISBN: 978-1-4027-8463-3.
4.	A. K. Gupta and A. Gupta, Logical Reasoning, 3rd ed., Noida, India: Arihant Publications, 2023, ISBN: 978-93-87045-88-6.
5.	R. S. Aggarwal, A Modern Approach to Verbal and Non-Verbal Reasoning, Revised ed., New Delhi, India: S. Chand Publishing, 2022, ISBN: 978-93-5253-402-5.

WEB REFERENCES:

1.	https://www.indiabix.com/logical-reasoning/questions-and-answers/
2.	https://www.geeksforgeeks.org/aptitude/logical-reasoning/
3.	https://www.hitbullseye.com/reasoning.php
4.	https://www.sawaal.com/logical-reasoning-questions-and-answers.html
5.	https://testbook.com/reasoning

COs/POs/PSOs Mapping:

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	1	-	-	-	-	-	-	-	-	2	2	-	2
2	2	3	2	1	-	-	-	-	-	-	-	2	2	-	2
3	2	3	2	2	-	-	-	-	-	-	-	2	2	1	2
4	2	3	1	2	-	-	-	-	-	-	-	2	2	-	2
5	2	3	2	1	-	-	-	-	-	-	-	3	2	1	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25VA06T	Constitution of India	L	T	P	C	Total
		1	0	0	1	15

COURSE OBJECTIVES:

• To study the Constituent Assembly debates and philosophical foundations of the Indian Constitution
• To examine the Preamble, Fundamental Rights, Directive Principles, and Duties as guiding values
• To understand the structure, powers, and functions of the Union Government including President, Prime Minister, and Parliament
• To study the organization and functioning of State Governments including Governor, Chief Minister, and Legislature
• To assess the role of the Supreme Court, High Courts, and judicial review in safe guarding constitutional values.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Describe the historical and philosophical foundations of the Indian Constitution.
CO2:	Interpret the Fundamental Rights, Duties, Directive Principles, and Constitutional Remedies of India.
CO3:	Summarize the powers and functions of the Union Executive and Parliament.
CO4:	Evaluate the roles and responsibilities of the State Executive and Legislature.
CO5:	Analyze the structure and role of the Indian Judiciary in upholding constitutional governance.

UNIT I: HISTORICAL BACKGROUND AND MAKING OF THE CONSTITUTION	3 Hrs.
Historical background of the Indian Constitution – Constituent Assembly – Framing of the Constitution – Preamble – Salient Features of the Constitution – Citizenship – Union and its Territory – Constitutional Amendments – Basic Structure Doctrine.	

UNIT II: FUNDAMENTAL RIGHTS AND DIRECTIVE PRINCIPLES	3 Hrs.
Fundamental Rights – Right to Equality – Right to Freedom – Right against Exploitation – Right to Freedom of Religion – Cultural and Educational Rights – Right to Constitutional Remedies – Directive Principles of State Policy – Fundamental Duties – Relationship between Fundamental Rights and Directive Principles.	

UNIT III: UNION GOVERNMENT	3 Hrs.
President – Vice President – Prime Minister – Council of Ministers – Parliament – Lok Sabha – Rajya Sabha – Legislative Procedure – Money Bills – Constitutional Authorities – Election Commission – Comptroller and Auditor General (CAG).	

UNIT IV: STATE GOVERNMENT AND LOCAL SELF-GOVERNMENT	3 Hrs.
Governor – Chief Minister – Council of Ministers – State Legislature – High Courts – Centre–State Relations – Panchayati Raj Institutions – Municipal Administration – Constitutional Provisions relating to Local Self-Government.	

UNIT V: JUDICIARY AND CONSTITUTIONAL GOVERNANCE	3 Hrs.
Supreme Court of India – Judicial Review – Judicial Activism – Public Interest Litigation (PIL) – Independence of Judiciary – Emergency Provisions – Constitutional Amendment Procedure – Constitutional Values – Rule of Law – Good Governance – Rights and Responsibilities of Citizens.	

Total Hours: 15

TEXT BOOKS:	
1.	Basu, D. D. (2022). Introduction to the Constitution of India (26th ed.). LexisNexis.
2.	Laxmikanth, M. (2024). Indian Polity (7th ed.). McGraw Hill Education.

REFERENCE BOOKS:	
1.	Pandey, J. N. (2024). Constitutional law of India (61st ed.). Central Law Agency.
2.	Bakshi, P. M. (2023). The Constitution of India (18th ed.). Universal Law Publishing.
3.	Shukla, V. N. (2023). Constitution of India (14th ed., revised by Mahendra Pal Singh). Eastern Book Company.
4.	Jain, M. P. (2021). Constitutional government in India (8th ed.). LexisNexis.
5.	Kashyap, S. C. (2020). Our constitution. National Book Trust.

WEB REFERENCES:

1.	https://nptel.ac.in/courses/129106003
2.	https://nptel.ac.in/courses/129106411
3.	https://nptel.ac.in/courses/129105608

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	–	–	–	–	–	2	1	2	–	1	–	2	–	–	–
2	–	–	–	–	–	3	2	3	1	2	–	2	–	–	1
3	–	1	–	–	–	3	–	2	1	2	2	1	–	–	1
4	–	2	–	–	–	3	2	2	2	2	2	1	–	1	1
5	–	2	–	1	–	3	2	3	1	2	1	2	–	2	1

Correlation Level: 1-Low, 2-Medium, 3- High, '–' - no correlation


BoS Chairman