



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
II 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 OBJECTIVES (PEOs)

PEO1: Competitive Platform

To create a competitive platform for solving critical problems in a wide variety of fields 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 2018 &
Recognized by UGC u/s 2(f) of the UGC Act, 1956)

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FACULTY OF ENGINEERING & TECHNOLOGY
B.TECH. IN COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)
(REGULATION – R25 NEP)
SEMESTER – II

Sl. No.	Course Code	Course Title	Cate gory	Periods			Cre dits	Hrs.	Max. Marks								
				L	T	P			CAT Theory (Best of two)	ASS	MCQ	ATT	SEM	P	CAM	ESM	Total
1	U25CD07B	Web Application Development II	PC	3	0	2	4	75	20	5	5	5	5	10	50	50	100
2	U25CD08B	Data Structures and Algorithms	PC	3	0	2	4	75	20	5	5	5	5	-	40	60	100
3	U25CD09T	Numerical Ability	BS	2	1	0	3	45	20	5	5	5	5	-	40	60	100
4	U25CD10B	Introduction to DBMS	PC	3	0	2	4	75	20	5	5	5	5	10	50	50	100
5	U25CD11T	Communicative English Advanced	HS	3	0	0	3	45	20	5	5	5	5	-	40	60	100
6	U25CD12B	Building LLM Applications	PC	3	0	2	4	75	20	5	5	5	5	10	50	50	100
Total:							22	390							270	330	600
7	U25VA04T	Introduction to Indian Knowledge System	VAC	1	0	0	1	30	40	15	15	20	10	-	100	-	100
Total:							1	30							100		100
Semester Total:							23	420							370	330	700

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

U25CD07B	Web Application Development II	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

• To understand modern JavaScript concepts, ES6 features, and programming paradigms for developing interactive web applications
• To develop asynchronous JavaScript applications using callbacks, promises, async/await, and API integration techniques
• To design reusable and interactive user interfaces using React components, JSX, state management, and event handling
• To implement routing, context management, authentication, and secure client-server communication in React applications
• To apply modern frontend development practices and tools to build scalable, responsive, and maintainable web applications.

COURSE OUTCOMES:

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

CO1:	Describe modern JavaScript concepts including scope, hoisting, object manipulation, ES6 features, and error handling.
CO2:	Develop asynchronous JavaScript programs using callbacks, promises, async/await, and REST API integration techniques.
CO3:	Build interactive React applications using JSX, components, props, state, hooks, lifecycle methods, and event handling.
CO4:	Implement routing, context-based state management, reducer patterns, and custom hooks to develop scalable React applications.
CO5:	Develop secure React applications by integrating client-server communication, JWT authentication, protected routes, and industry best practices.

UNIT I: MODERN JAVASCRIPT	9 Hrs.
Scope: Global Scope, Function Scope, Block Scope. Hoisting: Variable Hoisting, Function Hoisting. 'this' Keyword and Context. Error Handling: try/catch/finally. Array Methods. String Methods. Object Methods (keys, values, entries).	

UNIT II: JAVASCRIPT ESSENTIALS	9 Hrs.
ES6 Features: JavaScript Classes, Arrow Functions, Lexical Scope, Template Literals, DE structuring Syntax, Spread Syntax.	

UNIT III: ASYNCHRONOUS JAVASCRIPT	9 Hrs.
Asynchronous Programming Basics. Callback Functions. Callback Hell and Management. Timer Functions (set Timeout, set Interval). Promises: Creating Promises, Consuming Promises, Promise Chaining, Promise. All. Async/Await Syntax. Async/Await Error Handling. Practical API Request Implementation.	

UNIT IV: REACT FUNDAMENTALS	9 Hrs.
Introduction to React. Virtual DOM Concepts. JSX Syntax and Usage. React Developer Tools. Types of Components: Functional Components, Class Components, Props Communication. Hooks Overview, State Management using State () hook. Component Lifecycle Overview: Mounting Phase, Updating Phase, Unmounting Phase. Side Effects Management using Effect Hook, Cleanup Functions. Handling User Interactions. Event Handling Techniques. Conditional Rendering. Form Handling (Controlled and Uncontrolled Components). Dynamic Lists. Keys for Dynamic Content.	

UNIT V: ROUTING, CONTEXT AND AUTHENTICATION	9 Hrs.
React Hooks: use Hook, use Reducer Hook usage and implementation. Creating Custom Hooks. Application Routing with React Router: Route Setup and Implementation, Navigation Components, Route Parameters, Nested Routes, USEPA rams () hook, Advanced State Management: Context API for Global State, Reducer Patterns in React. Client-Server Communication. Authentication Flow with JWT: Protected Routes, Token Management. Security Best Practices.	

Total Hours: 45

LIST OF EXPERIMENTS:
Build a Quick Commerce Application (Zepto Clone)
Login/Logout Page
Products Page
Product Details Page
Cart Page
Build a Task Management Application (Trello Clone)
Login/Signup Page

Task Dashboard
Task Details Page
Add/Edit Task Page
Build an Emoji Game using Lists and keys
Build a Blog List by using React Router
Build a Cowin Dashboard Page using Third Party Packages
Get the popular GitHub repos by using API Requests

Total Hours: 30

TEXT BOOKS:

1.	Duckett, J. (2011). HTML and CSS: Design and Build Websites. Wiley.
2.	Flanagan, D. (2020). JavaScript: The Definitive Guide (7th Ed.). O'Reilly.
3.	Banks, A., & Porcello, E. (2020). Learning React: Modern Patterns for Developing React

WEB REFERENCES:

1.	https://developer.mozilla.org/en-US/docs/Web/JavaScript
2.	https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide
3.	https://react.dev/
4.	https://javascript.info/
5.	https://www.freecodecamp.org/learn/

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	—	3	—	—	—	—	1	—	2	3	2	1
2	3	3	2	2	3	—	—	—	1	1	—	2	3	3	1
3	3	3	3	2	3	—	—	—	2	2	—	2	3	3	2
4	3	3	3	2	3	—	—	—	2	2	1	2	3	3	2
5	3	3	3	2	3	1	—	2	2	2	1	3	3	3	3

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


BoS Chairman

U25CD08B	Data Structures & Algorithms	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

• To understand the fundamental concepts of data structures, algorithms, recursion, and complexity analysis to develop efficient computational solutions
• To apply appropriate searching, sorting, and hashing techniques to organize, retrieve, and process data effectively
• To design and implement linear data structures such as arrays, linked lists, stacks, queues, and strings to solve programming problems
• To analyze and implement non-linear data structures including trees, heaps, and graphs using suitable traversal and optimization techniques
• To evaluate and select appropriate data structures and algorithms based on time and space complexity for real-world applications.

COURSE OUTCOMES:

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

CO1:	Describe the fundamentals of data structures, algorithm design techniques, recursion, and asymptotic complexity analysis.
CO2:	Implement and analyze searching, sorting, and hashing algorithms for efficient data organization and retrieval.
CO3:	Develop solutions using linear data structures such as arrays, linked lists, stacks, queues, and strings for computational problems.
CO4:	Apply non-linear data structures including binary trees, binary search trees, heaps, and graphs to solve complex algorithmic problems using appropriate traversal and search techniques.
CO5:	Compare and evaluate different data structures and algorithms based on their performance, scalability, and suitability for practical applications.

UNIT I: BASIC DATA STRUCTURES & ALGORITHMS AND COMPLEXITY ANALYSIS	9 Hrs.
Introduction, Basic Terminology, Data Structures & Algorithms, Algorithms, Asymptotic Notations, Time and Space Complexity Analysis, Linear Arrays, Representation of Linear Arrays in Memory, Traversing Linear Arrays, Searching, Advanced Array Applications: Prefix Sum, Sliding Window,	

Two-Pointer Techniques, Multidimensional Arrays, Pointers, Recursion Fundamentals, Recursive Algorithms and Applications, Towers of Hanoi.

UNIT II: SORTING AND SEARCHING TECHNIQUES

9 Hrs.

Basic Sorting: Selection Sort, Bubble Sort, Insertion Sort, Advanced Sorting: Merge Sort, Quick Sort, Binary Search and Applications, Searching and Data Modification, Hashing, Hash Tables and Hash Functions.

UNIT III: LINEAR DATA STRUCTURES & ALGORITHMS

9 Hrs.

Linked List, Representation of Linked List in Memory, traversing a Linked List, searching a Linked List, Memory Allocation, Insertion into a Linked List, Deletion from a Linked List, Header Linked Lists, Two-way Lists, Advanced Operations: Reversals, Merging, Flattening, Strings, String Manipulation Techniques.

UNIT IV: RATIOS, PROPORTIONS, AND ITS APPLICATIONS

9 Hrs.

Stacks, Array Representation of Stacks, Arithmetic Expressions: Infix, Prefix, Postfix, Applications of Stacks, Monotonic Stack and Next Greater Element, Implementation of Recursive Procedures by Stacks, Queues, Implementing Stack using Queue, Implementing Queue using Stack, Linked Representation of Queues, Dequeues, Priority Queues.

UNIT V: NON-LINEAR DATA STRUCTURES & ALGORITHMS

9 Hrs.

Binary Trees, Binary Tree Traversals, Applications: Path Sum Calculations, Lowest Common Ancestor, Binary Search Trees, Heaps: Min-Heap, Max-Heap, Priority Queue Implementation, Heap Sort, Huffman's Algorithm, Graph Theory Terminology, Graph Representation, Graph Traversals techniques, BFS, DFS, Cycle Detection, Topological Sorting, Bipartite Graph.

Total Hours: 45

List of Exercises:

Design & implement the following concepts:

1. Linked List
2. Stack ADT
3. Queue ADT
4. Priority Queue

5.	Sorting and Searching
6.	Tree Traversal
7.	Tree Structure - Binary Tree
8.	Binary Tree Structure
9.	Graph Traversals (BFS, DFS)
10.	Hash Table

Total Hours: 30

TEXT BOOKS:

1.	Horowitz, E., Sahni, S., & Mehta, D. (2008). Fundamentals of Data Structures & Algorithms in C. Universities Press.
2.	Weiss, M. A. (2012). Data Structures & Algorithms and Algorithm Analysis in C++ (4th Ed.). Pearson Education.
3.	Lafore, R. (2002). Data Structures & Algorithms and Algorithms in Java. Sams Publishing.

REFERENCE BOOKS:

1.	Introduction to Algorithms. (2022). (4th ed.). MIT Press.
2.	Algorithms. (2011). (4th ed.). Addison-Wesley.
3.	Data Structures and Algorithms Made Easy. (2017). (5th ed.). CareerMonk Publications.
4.	Problem Solving with Algorithms and Data Structures Using Python. (2019). Franklin, Beedle & Associates.
5.	The Algorithm Design Manual. (2020). (3rd ed.). Springer.

WEB REFERENCES:

1.	https://nptel.ac.in/courses/106106145
2.	https://www.geeksforgeeks.org/data-structures/
3.	https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-fall-2011/

4.	https://nptel.ac.in/courses/106102064
5.	https://visualgo.net/en

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	-	-	-	-	-	-	2	3	-	1
2	3	3	2	2	3	-	-	-	-	-	-	2	3	2	1
3	3	3	3	2	3	-	-	-	2	1	-	2	3	3	1
4	3	3	3	3	3	-	-	-	2	1	-	2	3	3	1
5	3	3	2	2	3	1	-	1	-	2	1	3	2	3	3

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


BoS Chairman

U25CD09T	Numerical Ability	L	T	P	C	Hrs
		2	1	0	3	45

COURSE OBJECTIVES:

• To develop quantitative aptitude skills to solve mathematical and logical reasoning problems efficiently
• To apply analytical techniques to solve problems involving time and work, permutations, combinations, probability, clocks, and calendars
• To interpret and analyze data presented in various graphical and tabular forms for effective decision-making
• To enhance logical thinking and problem-solving abilities through ranking, direction sense, and coding-decoding techniques
• To build speed, accuracy, and critical thinking skills required for competitive examinations, campus recruitment, and professional aptitude assessments.

COURSE OUTCOMES:

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

CO1:	Solve quantitative problems related to time and work, pipes and cisterns, wage distribution, and work efficiency.
CO2:	Apply permutation, combination, and probability concepts to solve analytical and real-world problem scenarios.
CO3:	Analyze and solve problems involving clocks, calendars, and time-based logical reasoning with accuracy.
CO4:	Interpret and evaluate data from tables, charts, and graphs to draw meaningful conclusions and perform quantitative analysis.
CO5:	Demonstrate logical reasoning skills by solving problems involving ranking, direction sense, coding-decoding, and pattern recognition.

UNIT I: TIME & WORK	9 Hrs.
Time and Work: Work efficiency concepts, pipes and cisterns, wage distribution, and the man-chain rule for determining work completion timelines.	

UNIT II: PERMUTATION, COMBINATION AND PROBABILITY	9 Hrs.
Permutations & Combinations: Fundamental counting principle, permutation and combination formulas, ranking-based questions, and circular permutations. Probability: Solving problems related to probability with coins, dice, playing cards, and miscellaneous probability-based scenarios.	

UNIT III: CLOCKS AND CALENDARS	9 Hrs.
Clocks: Angle between hands, gaining and losing time, problems on incorrect clocks, Calendars: Odd days concept, leap year calculations, Calendar Repetition.	

UNIT IV: DATA INTERPRETATION AND ITS APPLICATIONS	9 Hrs.
Tables and Graphs: Interpretation of data presented in tables, bar graphs, pie charts, and line graphs. Applications: Analyzing trends, calculating percentages, ratios, and averages, and comparing data across different categories.	

UNIT V: LOGICAL THINKING AND PATTERN ANALYSIS	9 Hrs.
Ranking: Problems with relative and absolute ranking, finding a position in a row or queue, and highest and lowest ranking scenarios. Directions: Cardinal directions (North, South, East, West), distance calculation, final direction and position determination, clockwise and counterclockwise movement. Coding-Decoding: Letter shifting, number coding, symbol coding, word-pattern coding, substitution, and deciphering logical sequences.	

Total Hours: 45

TEXT BOOKS:	
1.	Quantitative Aptitude for Competitive Examinations. (2024). Revised Edition. S. Chand Publishing.
2.	A Modern Approach to Verbal and Non-Verbal Reasoning. (2023). Revised Edition. S. Chand Publishing.
3.	How to Prepare for Quantitative Aptitude for CAT. (2024). 11th ed. McGraw Hill Education.

REFERENCE BOOKS:	
1.	R.S. Aggarwal. (2021). Quantitative Aptitude for Competitive Examinations. S. Chand Publishing.

2.	Abhijit Guha. (2023). Quantitative Aptitude for Competitive Examinations. McGraw Hill Education.
3.	Arun Sharma. (2022). How to Prepare for Quantitative Aptitude for the CAT. McGraw Hill Education.

WEB REFERENCES:

1.	https://nptel.ac.in/courses/109107121
2.	https://www.indiabix.com/
3.	https://www.geeksforgeeks.org/aptitude/
4.	https://www.freshersworld.com/online-test/aptitude-test
5.	https://www.tutorialspoint.com/quantitative_apptitude/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	2	3	2	1	2	–	–	–	–	1	–	2	2	1	2
2	2	3	2	2	2	–	–	–	–	1	–	2	2	2	2
3	2	3	2	1	2	–	–	–	–	1	–	2	2	1	2
4	2	3	3	2	3	–	–	–	1	2	–	2	3	2	2
5	2	3	2	2	2	1	–	1	2	2	1	3	2	2	3

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


BoS Chairman

U25CD10B	Introduction to DBMS	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

To understand the fundamental concepts of database systems, data models, database architecture, and relational database design
To develop proficiency in designing relational databases using Entity-Relationship (ER) modeling, normalization, and schema refinement techniques
To apply SQL for database creation, data manipulation, query processing, and advanced database operations
To analyze transaction management, concurrency control, and database optimization techniques to ensure reliable database systems
To explore NoSQL databases and MongoDB for designing and managing scalable, flexible, and data-intensive applications.

COURSE OUTCOMES:

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

CO1:	Describe the principles of database systems, data models, ER modeling, relational database design, and database architecture.
CO2:	Design and implement relational databases using SQL, constraints, schemas, and data manipulation operations.
CO3:	Construct advanced SQL queries using joins, subqueries, aggregate functions, views, and query optimization techniques.
CO4:	Apply normalization techniques, transaction management, and concurrency control mechanisms to design efficient and reliable database systems.
CO5:	Develop and manage NoSQL databases using MongoDB by performing CRUD operations, querying, aggregation, and comparing SQL and NoSQL approaches.

UNIT I: INTRODUCTION TO DATABASE SYSTEMS	9 Hrs.
Database Fundamentals, DBMS Types, Relational vs Non-Relational Databases, Database Approach Benefits, ACID Properties, Data Models, Schemas and Instances, DBMS Components, Database Environment, Entity Relationship Model, ER Diagram Notation, ER Design Refinement, ER to Relational Mapping, Relationship Types, Implementation Strategies.	

UNIT II: SQL FUNDAMENTALS	9 Hrs.
Constraints and Schemas, Unary Operations: SELECT, Set Theory Operations, SQL Basics, Table Creation and Modification, Data Manipulation, WHERE Clause, Primary and Foreign Keys, Multi- table Queries.	

UNIT III: ADVANCED SQL AND QUERY OPERATIONS	9 Hrs.
Comparison and Logical Operators, Pattern Matching with LIKE, Operator Precedence, IN and BETWEEN Operators, Result Ordering, LIMIT and OFFSET, Set Operations, SQL Functions, CASE Expressions, Expression Usage in Queries, Join Types, Aggregation Functions, Alias Usage, GROUP BY Implementation, HAVING Usage, View Creation and Management, Subqueries, Query Processing and Optimization.	

UNIT IV: DATABASE NORMALIZATION AND TRANSACTION PROCESSING	9 Hrs.
Schema Refinement, Functional Dependencies, Normalization: Normalization -1 NF - 2 NF - 3 NF- Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain Key Normal Form, Denormalization, Transaction Management, Concurrency Control.	

UNIT V: INTRODUCTION TO NOSQL DATABASES AND MONGODB	9 Hrs.
NoSQL Database Concepts, Collections vs Tables, Documents vs Records, Fields, Schema Flexibility, setting up MongoDB and Creating a Database, CRUD Operations in MongoDB, Querying: Projection, Conditional Operators, Ordering Results, Pagination, Logical Operators, Nested Documents, Array Fields, Basic Array Queries, Array Operators, \$Elem Match, Grouping & Aggregate functions, Comparison of SQL vs NoSQL.	

Total Hours: 45

List of Experiments:
1. Creating, altering and dropping tables with integrity constraints using DDL commands.
2. Retrieving and modifying data from a database using DML Statements.
3. Retrieving data from the database using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING clauses.

4.	Use of scalar and aggregate functions.
5.	Retrieving data from a database using Join operations (Inner and Outer Joins).
6.	Using subqueries for retrieving data.
7.	Use of triggers in data manipulation
8.	Design and Develop a NOSQL Database

Total Hours: 30

TEXT BOOKS:

1.	Database System Concepts. (2020). Database System Concepts (7th ed.). McGraw-Hill Education.
2.	Fundamentals of Database Systems. (2017). (7th ed.). Pearson.
3.	MongoDB: The Definitive Guide. (2019). (3rd ed.). O'Reilly Media.

REFERENCE BOOKS:

1.	Elmasri, R., & Navathe, S. B. (2016). Fundamentals of Database Systems (7th Ed.). Pearson Education.
2.	Silberschatz, A., Korth, H. F., & Sudarshan, S. (2019). Database System Concepts (7th Ed.). McGraw-Hill Education.
3.	Chodorow, K. (2013). MongoDB: The Definitive Guide (2nd Ed.). O'Reilly Media.

WEB REFERENCES:

1.	https://nptel.ac.in/courses/106105175
2.	https://docs.oracle.com/en/database/
3.	https://www.mongodb.com/docs/
4.	https://www.postgresql.org/docs/
5.	https://www.w3schools.com/sql/

COs/POs/PSOs Mapping:															
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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2	3	3	3	2	3	–	–	–	1	1	–	2	3	3	1
3	3	3	3	2	3	–	–	–	1	1	–	2	3	3	2
4	3	3	3	3	3	–	–	–	1	1	1	2	3	3	2
5	3	3	3	2	3	1	–	1	1	1	1	3	3	3	3

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


BoS Chairman

U25CD11T	Communicative English Advanced	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

To develop a strong understanding of English tense structures and their appropriate usage in spoken and written communication
To apply present, past, and future tenses accurately to describe actions, events, experiences, and plans
To construct grammatically correct and meaningful sentences by combining different time frames and using appropriate connectors
To use conditional sentences and hypothetical expressions effectively to communicate possibilities, assumptions, and consequences
To enhance overall grammatical accuracy and communication skills for academic, professional, and everyday contexts.

COURSE OUTCOMES:

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

CO1:	Identify and apply present tense forms accurately to express habits, ongoing actions, experiences, and general truths.
CO2:	Use past tense forms appropriately to describe completed actions, ongoing events, and sequences of past experiences.
CO3:	Construct sentences using future tense forms to express predictions, intentions, plans, and future events with grammatical accuracy.
CO4:	Integrate multiple tense forms and transitional expressions to communicate ideas clearly across different time frames in spoken and written English.
CO5:	Apply conditional sentence structures and hypothetical expressions effectively in problem-solving, decision-making, and real-life communication scenarios.

UNIT I: PRESENT TENSE CONSTRUCTION	9 Hrs.
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Present Simple: General Truths and Habits, Present Continuous: Actions Happening Now, Present Perfect vs. Present Perfect Continuous: Describing Ongoing Experiences, Forming Questions in the Present Tense, Making Negations in the Present Tense.

UNIT II: PAST TENSE CONSTRUCTION

9 Hrs.

Simple Past for Completed Actions, Past Continuous for Actions at a Specific Moment, Past Perfect for Actions Before Another Past Event, Past Perfect Continuous for Ongoing Actions in the Past, Using Past Tenses in Defining Experiences.

UNIT III: FUTURE TENSE CONSTRUCTION

9 Hrs.

Simple Future for Predictions, Plans, and Intentions, Future Continuous for Ongoing Actions at a Specific Time, Future Perfect for Actions Completed by a Certain Future Point, Future Perfect Continuous for Ongoing Actions Over Time.

UNIT IV: USING FUTURE TENSES & COMBINING TIME FRAMES

9 Hrs.

Using Future Tenses in Planning and Forecasting, Combining Tenses to Show Relationships Across Time, Using Conjunctions and Transitional Phrases to Connect Actions, Creating Complex Sentences with Multiple Time Frames, Practicing Mixed Tenses in Interviews, Discussions, or Timelines, Ensuring Clarity in Expressing Actions Across Past, Present, and Future.

UNIT V: CONDITIONAL SENTENCES AND HYPOTHETICALS

9 Hrs.

First Conditional for Real Future Possibilities, Second Conditional for Hypothetical Situations, Third Conditional for Past Situations That Didn't Happen, Mixed Conditionals for Past Events with Present Consequences, Conditional Sentences in Problem-Solving, Planning, and Expressing Regret.

Total Hours: 45

TEXT BOOKS:

1. Hewing's, M. (2013). Advanced Grammar in Use (3rd Ed.). Cambridge University Press.
2. Swan, M., & Smith, B. (2013). Learner English: A Teacher's Guide to Interference and Other Problems (2nd Ed.). Oxford University Press.
3. Leech, G., & Svartvik, J. (2002). A Communicative Grammar of English (3rd Ed.). Pearson Education.

REFERENCE BOOKS:

1.	English Grammar in Use. (2019). <i>English Grammar in Use</i> (5th ed.). Cambridge University Press.
2.	Practical English Usage. (2016). (4th ed.). Oxford University Press.
3.	A Practical English Grammar. (2019 reprint). Oxford University Press.
4.	Understanding and Using English Grammar. (2017). (5th ed.). Pearson.
5.	The Blue Book of Grammar and Punctuation. (2021). (12th ed.). Jossey-Bass.

WEB REFERENCES:

1.	https://learnenglish.britishcouncil.org/grammar
2.	https://nptel.ac.in/courses/109106094
3.	https://dictionary.cambridge.org/grammar/british-grammar
4.	https://www.bbc.co.uk/learningenglish/english/course/intermediate
5.	https://owl.purdue.edu/owl/general_writing/grammar/

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	1	2	–	–	1	–	–	–	–	3	–	2	–	–	2
2	1	2	–	–	1	–	–	–	–	3	–	2	–	–	2
3	1	2	1	–	1	–	–	–	–	3	–	2	–	–	2
4	1	2	2	–	1	–	–	–	1	3	–	3	–	–	3
5	1	3	2	1	1	1	–	2	2	3	1	3	1	1	3

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


BoS Chairman

U25CD12B	Building LLM Applications	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

To understand the concepts, architectures, and workflows of AI agents and multi-agent systems for intelligent task automation
To develop AI-powered applications using modern frameworks such as Lang Chain, Lang Graph, Crew AI, Flask, and Large Language Models (LLMs)
To apply Retrieval-Augmented Generation (RAG), vector databases, and embedding techniques to build knowledge-aware AI systems
To design and implement full-stack AI applications by integrating frontend, backend, REST APIs, and generative AI models
To develop user-centric AI applications by adopting UI/UX principles, AI-assisted development tools, and deployment best practices.

COURSE OUTCOMES:

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

CO1:	Develop autonomous AI agents using Lang Chain, Lang Graph, and agent-based workflows for task planning and execution.
CO2:	Build and deploy collaborative multi-agent systems using Crew AI and Model Context Protocol (MCP) for coordinated problem solving.
CO3:	Design full-stack AI applications using Flask, REST APIs, frontend-backend integration, and Large Language Models (LLMs).
CO4:	Implement Retrieval-Augmented Generation (RAG) pipelines using embedding models, vector databases, and retrieval techniques to enhance AI applications.
CO5:	Develop end-to-end generative AI applications by applying modern UI/UX principles, AI coding assistants, and deployment best practices.

UNIT I: BUILDING AI AGENTS	9 Hrs.
Building AI Agents using Lang chain/Langgraph, Agent Architecture and Tool Usage, Autonomous Agent Workflows, Task Planning and Execution.	

UNIT II: MULTI-AGENT SYSTEMS	9 Hrs.
Multi agents using Crew AI: Introduction to Collaborative AI, Crew AI Framework Fundamentals, Defining Agent Roles and Goals, Task Delegation, Agent Collaboration and Workflows, building own MCP servers and integrating.	

UNIT III: FULL-STACK DEVELOPMENT FOR AI APPLICATIONS	9 Hrs.
Client & Server Communication, Introduction to Flask, Flask Routing, Building REST APIs using Flask, Building Frontend and Backend, Integrating Claude LLM, AI-Powered Interview Assistant: Architecture, Integration and Deployment.	

UNIT IV: RAG ARCHITECTURE AND VECTOR DATABASES	9 Hrs.
Introduction to Retrieval Augmented Generation (RAG), RAG Architecture and Components, Retrieval Methodologies - Dense, Sparse, Hybrid, Indexing Essentials, Vector Databases: Introduction and Use Cases, Embedding Models, Creating and Managing Embeddings, Integration with LLM Workflows.	

UNIT V: GEN AI UI/UX DEVELOPMENT	9 Hrs.
UI Design Principles for AI Applications, Accessibility and Feedback Loops, Streaming Responses and Error Handling, AI-Assisted Coding Tools - GitHub Copilot, Cursor, Windsurf, Best Practices for GenAI-Driven Frontend Development, Building an End-to-End Website Using GenAI.	

Total Hours: 45

List of Experiments:
1. Develop a Role-based Multi-Agent System using Crew AI.
2. Design an Agent-Powered Travel Planner.
3. AI-Powered Interview Simulator.
4. Build a Resume Reviewer App.
5. Create a RAG-Powered Knowledge Base Assistant.
6. Build a Personalized Learning Assistant.
7. Create a GenAI-Powered Portfolio Builder.
8. Create an interactive application for personalized outfit recommendations with an elegant interface.

Total Hours: 30

TEXT BOOKS:

1.	Eisenstat, S., & Wilk, J. (2023). Lang Chain in Action: Build LLM-powered applications. Manning Publications.
2.	White, T. (2023). LLM Application Engineering Handbook. O'Reilly Media. (Also available as part of O'Reilly's Academic Learning platform)
3.	Grus, J. (2022). Data Science from Scratch: First Principles with Python (2nd Ed.). O'Reilly Media.

REFERENCE BOOKS:

1.	Building LLM Powered Applications. (2024). O'Reilly Media.
2.	Generative AI with Python and PyTorch. (2024). O'Reilly Media.
3.	Designing Machine Learning Systems. (2022). O'Reilly Media.

WEB REFERENCES:

1.	https://python.langchain.com/docs/
2.	https://langchain-ai.github.io/langgraph/
3.	https://docs.crewai.com/
4.	https://flask.palletsprojects.com/
5.	https://docs.anthropic.com/

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4	3	3	3	3	3	–	–	–	1	1	1	2	3	3	2
5	3	3	3	2	3	1	–	2	2	2	1	3	3	3	3

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


BoS Chairman

U25VA04T	Introduction to Indian Knowledge System	L	T	P	C	Total
		1	0	0	1	30

COURSE OBJECTIVES:

• Provide an overview of India's intellectual, cultural, and scientific heritage
• Develop understanding of Indian philosophical systems and their relevance today
• Introduce India's contributions to mathematics, science, medicine, arts, and governance
• Promote appreciation for holistic knowledge traditions and sustainability practices
• Connect ancient Indian knowledge with contemporary challenges and modern disciplines.

COURSE OUTCOMES:

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

CO1:	Explain the scope, sources, and foundational concepts of Indian Knowledge Systems.
CO2:	Compare major Indian philosophical traditions and epistemological frameworks.
CO3:	Discuss scientific and technological contributions of ancient India.
CO4:	Analyze Indian arts, literature, and aesthetic traditions.
CO5:	Evaluate socio-political systems, ecological wisdom, and contemporary applications of IKS.

UNIT I: FOUNDATIONS OF INDIAN KNOWLEDGE SYSTEMS	6 Hrs.
Definition, nature, and scope of IKS-Sources of IKS: Vedas, Upanishads, Puranas, Epics, Agamas-Guru-Shishya Parampara, oral & written traditions-Concepts of Rita, Dharma, Purusharthas, Samskaras-Indian worldview and holistic knowledge orientation.	

UNIT II: INDIAN PHILOSOPHICAL AND INTELLECTUAL TRADITIONS	6 Hrs.
Overview of Indian Darshanas: Nyaya, Vaisheshika, Sankhya, Yoga, Mimamsa, Vedanta-Heterodox traditions: Buddhism & Jainism-Theory of knowledge (Pramanas): perception, inference, verbal	

testimony, etc.-Concepts of self, consciousness, and mind - Ethical models from Upanishads, Gita, Buddhist and Jain texts.

UNIT III: INDIAN SCIENTIFIC KNOWLEDGE – MATHEMATICS, ASTRONOMY, HEALTH & TECHNOLOGY	6 Hrs.
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Mathematics & Astronomy:Zero, decimal system, algebra, geometry-Aryabhata, Brahmagupta, Bhaskaracharya, Kerala School of Mathematics-Timekeeping, Panchanga, cosmology.Ayurveda & Health Sciences:Tridosha theory, Panchamahabhutas-Contributions of Charaka and Sushruta-Yoga as a science of well-being Metallurgy, Chemistry & Technology:Iron pillar, metallurgy, Rasashastra-Architecture and engineering traditions.

UNIT IV: INDIAN ARTS, LITERATURE, CULTURE & AESTHETICS	6 Hrs.
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Classical literature: Sanskrit & regional texts-Performing arts: music, dance, drama traditions-Natyashastra and Rasa theory-Temple architecture, iconography, and symbolism-Aesthetic principles: Alankara Shastra, artistic consciousness.

UNIT V: SOCIETY, GOVERNANCE, ENVIRONMENT & CONTEMPORARY RELEVANCE	6 Hrs.
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Society & Governance:Ancient education systems: Nalanda, Takshashila, Gurukula-Concepts of Varna, Jati, Ashrama-Leadership and ethics from Arthashastra, Tirukkural, Panchatantra-Role of women in IKS, Ecology, Sustainability & Indigenous Practices:Environmental ethics in Vedic and tribal traditions-Traditional agriculture, water systems, biodiversity conservation-Vriksha Ayurveda, holistic living, Contemporary Applications:NEP 2020 and IKS integration-Yoga and mindfulness in modern life-Traditional knowledge and modern innovation-Relevance of IKS for global challenges.

Total Hours: 30

TEXT BOOKS:

- | | |
|----|---|
| 1. | Indian Knowledge Systems: Concepts and Applications – Kapil Kapoor (Ed.),1st Edition, 2023. |
| 2. | Indian Philosophy – S. Radhakrishnan,2nd Edition (Reprint), 2020. |
| 3. | Science and Technology in Ancient India – Debiprasad Chattopadhyaya, Reprint Edition, 2019. |
| 4. | Indian Aesthetics – Coomaraswamy & others,Reprint Edition, 2019. |
| 5. | Indian Knowledge Systems and Sustainable Development – N. Ganesan & M. Soundarapandian (Eds.),1st Edition, 2023 |
| 6. | Arthashastra – Kautilya (Trans. R. Shamasastri), Reprint Edition, 2019. |

REFERENCE BOOKS:

1.	Indian Philosophy: A Very Short Introduction – Sue Hamilton, 2nd Edition, 2020
2.	Classical Indian Philosophy – Peter Adamson & Jonardon Ganeri, 1st Edition, 2020.
3.	The Crest of the Peacock: Non-European Roots of Mathematics – George Gheverghese Joseph, 3rd Edition, 2020.
4.	An Introduction to Indian Art (Part I & II) – NCERT, Revised Edition, 2022.
5.	Tirukkural – Thiruvalluvar (Trans. G.U. Pope), Reprint Edition, 2018
6.	NEP 2020: Implementation and Indian Knowledge Systems – Ministry of Education, Govt. of India, 2021.

WEB REFERENCES:

1.	https://iks.aicte-india.org/
2.	https://www.education.gov.in/en/indian-knowledge-systems
3.	https://onlinecourses.nptel.ac.in/noc25_ge58/preview
4.	https://sanskritdocuments.org/

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4	2	2	1	–	–	2	2	1	2	–	2	1	1	2	2
5	2	3	1	1	–	3	3	2	2	–	3	2	2	3	3

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


BoS Chairman