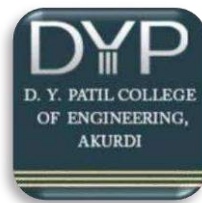




D Y Patil College of Engineering, Akurdi, Pune
An Autonomous Institute from AY 2024-25, Affiliated to Savitribai Phule Pune University, Pune
Department of Information Technology

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25 affiliated to
Savitribai Phule Pune University



Curriculum Structure **B.Tech Engineering from AY 2025-26**



National Education Policy (NEP) based Curriculum

R6: 28 March 2025



Preface

D Y Patil College of Engineering, Akurdi, Pune (DYPCOE) has been recognized for providing quality education in Maharashtra for the past 40 years. With a commitment to academic excellence and a vision for the future, DYPCOE is now boarding a new journey towards Autonomy, in line with the latest educational reforms. The Institute is dedicated to the effective implementation of the New Education Policy (NEP) 2020, as per the guidelines by the Government of Maharashtra. This initiative is aimed at fostering the holistic development of our students, ensuring they are well-equipped to meet the challenges of the 21st century.

The present syllabus details the first-year engineering (SY) syllabus, meticulously designed to align with the NEP 2020 and effective from the academic year 2024-25. The curriculum is structured to provide a robust foundation through Engineering Science Courses. It also integrates Vocational and Skill Enhancement Courses, Ability Enhancement Courses, the Indian Knowledge System, and co-curricular Liberal Learning courses. This comprehensive approach aims to cultivate well-rounded engineers who are adaptable to Internationalization.

One of the key highlights of this syllabus is its emphasis on Experiential Learning and hands-on experience. By integrating theoretical knowledge with practical laboratory sessions, we aim to enhance the learning process and foster a deeper understanding of core concepts. Additionally, the curriculum promotes research and innovation by encouraging students to engage in project-based learning.

The development of this curriculum has been a collaborative effort, and we owe a debt of gratitude to all those who have contributed to its creation. Our sincere thanks go to the Management, Steering Committee Members, Heads of Departments, and the Board of Studies chairpersons and members for their invaluable input and dedication. Their collective expertise and commitment have been instrumental in shaping this curriculum.

We are confident that this new curriculum will pave the way for our students to achieve academic excellence and holistic development, preparing them to thrive in an ever-evolving global landscape.

Dr Preeti Patil
BOS Chairman

Dr P Malathi
Principal



D Y Patil College of Engineering, Akurdi, Pune
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Programs Offered in Bachelor of Technology (B Tech)

1. Artificial Intelligence and Data Science
2. Civil Engineering
3. Computer Engineering
4. Electronics and Telecommunication Engineering
5. Information Technology
6. Instrumentation and Control Engineering
7. Mechanical Engineering
8. Robotics and Automation



Abbreviations and Definitions

NEP: National Education Policy

PEO: Program Educational Objectives

PO: Program Outcomes

PSO: Program Specific Outcomes

CO: Course Outcomes

BSC: Basic Science Courses

ESC: Engineering Science Courses

VSEC: Vocational and Skill Enhancement Courses

AEC: Ability Enhancement Courses

CC: Co-Curricular Courses

IKS: Indian Knowledge System

HSSM: Humanities Social Science and Management

PCC: Program Core Course

CCA: Continuous Comprehensive Assessment

ESE: End Sem Examination Cr: Credits

L: Lecture

T: Tutorial

P: Practical

FY: First Year

SY: Second Year

TY: Third Year

BY: Final Year

Group A: Computer, IT and AIDS

Group B: ETC, Instrumentation and Robotics and Automation,

Group C: Civil and Mechanical

Group I: Civil, Mech, Robotics and Automation, Instrumentation

Group II: Computer, IT, AIDS, ETC,

Cycle I: Computer, IT and AIDS

Cycle II: Civil, Mech, Robotics and Automation, ETC, Instrumentation



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4	Index	iv
5	Curriculum Structure Semester I	v
6	Curriculum Structure Semester II	vi

Detailed Syllabus

Sr No	Course Code	Course Title	Page No
1.	PCC2	Fundamentals of Data Structures	
2.	PCC2	Fundamentals of Data Structures Lab (C++/Java) (LeetCode)	
3.	PCC3	Advanced Discrete and Computational Mathematics	
4.	PCC4	Database Management System	
5.	MDM1	Foundations of Cybersecurity	
6.	OE1	Fundamentals of Java Programming	
7.	EEM1	Entrepreneurship/Economics and Management 1 - Project Management	
8.	VEC1	Value Education Course 1- Sustainable Development Goals I	
9.	FEP	DBMS Project	
10.	NC1	Non Credit Course- Design Thinking	
11.	NC2	Non Credit Course - Employability Skills	
12.	PCC5	Advance Data Structures & Analysis of Algorithms	
13.	PCC5	Advance Data Structures & Analysis of Algorithms Lab	
14.	PCC6	Computer Network	
15.	PCC6	Computer Network Lab	
16.	PCC7	Software Engineering & Project Management	
17.	MDM2	Cryptography and Network Security	
18.	OE2	Advanced Excel with AI	
19.	VSEC3	Web Application Development	
20.	AEC2	Ability Enhancement Course2-Soft Skills: Workplace and Life	
21.	EEM2	Entrepreneurship/Economics and Management 2-Project Management and Finance	
22.	VEC2	Value Education Course 2-Sustainable Development Goals II	
23.	NC3	Non Credit Course-Advance Java	
24.	NC4	Non Credit Course	

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D Y Patil College of Engineering, Akurdi, Pune												
Second Year Engineering SY B Tech Semester IV(2024 Course)												
Course Code	Course	Teaching Scheme				Evaluation Scheme						
		L	T	P	C r	Exa m	Theory % Marks			Practical % Marks		
							Ma x	Min for Pass		Ma x	Min for Pass	
IT124PC401	Advance Data Structures & Analysis of Algorithms	3	0	0	3	CCE	50	20	40			
						ESE	50	20				
IT124PC402	Advance Data Structures & Analysis of Algorithms Lab	0	0	2	1	CCE				50	20	40
						ESE				50	20	
IT124PC403	Computer Network	3	0	0	3	CCE	50	20	40			
						ESE	50	20				
IT124PC404	Computer Network Lab	0	0	2	1	CCE				50	20	40
						ESE				50	20	
IT124PC405	Software Engineering	2	0	0	2	CCE	50	20	40			
						ESE	50	20				
IT124MD406	Cryptography and Network Security	2	0	0	2	CCE	50	20	40			
						ESE	50	20				
IT124OE407	Healthcare Management System	2	0	0	2	CCE	50	20	40			
						ESE	50	20				
IT124VS408	Web Application Development	1	0	2	2	CCE	100	40				
IT124AE409	Ability Enhancement Course2-Soft Skills: Workplace and Life	1	0	2	2	CCE	100	40				
IT124EE410	Entrepreneurship, Management & Software Project Execution	2	0	0	2	CCE	50	20	40			
						ESE	50	20				
IT124VE411	Sustainable Development - 2	2	0	0	2	CCE	50	20				
IT124NC412	Advanced Java	0	0	2	0	CCE	50	20				
IT124NC413	Aptitude & Technical Mastery for Placements-II	0	0	2	0	CCE	50	20				
	Total	18	0	12	22							
				Hrs								
L	Lecture	Theo ry		18								
T	Tutorial	Pract /Lab		12								
P	Practical	Total		30								
Cr	Credits	Total		22								
NC	Non Credit Course (Pass/Fail)											
CCA	Continuous and Comprehensive Assessment											
ESE	End Semester Examination											
Rev 5	28th Nov 24											



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Department of Information Technology
Second Year Engineering SY B Tech Semester III (2024 Course)

Course Category		Program core course			Course Code		IT124PC301		
Course Title		Fundamentals of Data Structures							
Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
3	0	0	3	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
39	0	0	Total hrs: 39		100				
Prerequisites: Fundamental knowledge of programming language and basics of algorithms									
Course Objectives:									
1. To introduce fundamental concepts of data structures, their classifications, and real-world applications. 2. To analyse and implement searching and sorting techniques to improve algorithmic efficiency. 3. To understand and implement abstract data types (ADTs) such as stacks and queues using arrays and linked lists. 4. To explore tree data structures, including binary trees, binary search trees, Threaded Binary Trees and AVL trees, and their applications. 5. To study graph representations, traversal techniques, and graph-based algorithms for real-world problem-solving.									
Course Outcomes: Student will-									
CO1	Implement abstract data types (ADT) and various data structures to solve specific problems, demonstrating an understanding of how to apply different data structures to practical scenarios.							BT 5	
CO2	Perform operations such as searching, insertion, deletion, and traversal on various data structures, ensuring efficient data manipulation and retrieval.							BT 3	
CO3	Implement and apply stack and queue ADTs using array and linked list representations to solve practical problems like expression evaluation, recursion, and efficient data manipulation.							BT 4	
CO4	Construct and manipulate binary search trees (BST), Threaded Binary trees and AVL trees, including insertion, deletion, and searching.							BT 5	
CO5	Implement BFS and DFS traversals, apply Prim’s and Kruskal’s algorithms for Minimum Spanning Trees, use Dijkstra’s algorithm for shortest path computation, and perform topological sorting for directed acyclic graphs.							BT 5	



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Syllabus

Unit I	Introduction to Data Structures -Concept of Data, Data Objects, Data Structures-Primitive and Non-Primitive Data Structures Types of Data Structures -Linear vs. Non-Linear Data Structures, Static vs. Dynamic Data Structures Abstract Data Types (ADT) -Definition of ADT Sequential Organization: Arrays, Single and Multidimensional Arrays with address calculation Linked Organization -Concept of Linked Organization Types of Linked Lists and Operations- Singly Linked List: Implementation Operations: Create, Display, Search, Insert, Delete Circular Linked List: Operations: Create, Display, Insert, Delete Doubly Linked List: Implementation Operations: Insert, Delete, Search Applications of Linked Lists Real-world applications (e.g., memory management, dynamic data structures, file systems)	8 hrs
Unit II	Analysis of Algorithms -Frequency Count, Time Complexity: Big O, Omega (Ω), and Theta (Θ) Notations, Space Complexity Need for searching and sorting, internal and external sorting and sort stability. Searching methods: Linear search, binary search Sorting methods: Bubble, insertion, selection, Quick, Merge, Heap sort. Comparison and analysis of all searching and sorting methods.	7 hrs
Unit III	Stack ADT: Definition of Stack: Understanding the stack as an abstract data type (ADT), Operations on Stack: Push, pop, peek, and traversal. Applications of Stack: Infix to postfix conversion, Postfix expression evaluation, Recursion and backtracking. Queue ADT: Definition of Queue: Understanding the queue as an abstract data type (ADT). Operations on Queue: Enqueue (insertion), dequeue (deletion), front, and rear. Types of Queues: Circular Queue: Concept and implementation of circular queues. Double Ended Queue (Deque): Operations for inserting and deleting from both ends. (Note: Both stack and queue will be implemented using array and linked list representations as applicable.)	8 hrs
Unit IV	Tree: Trees and binary trees-concept and terminology, Expression tree, Binary tree as an ADT, Binary search tree, Recursive and Non recursive algorithms for binary tree traversals, Binary search tree as ADT (Insert Search Delete, level wise Display)	8 hrs



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	Threaded binary tree: Concept of threaded binary tree (inorder, preorder and postorder). Preorder and In-order traversals of in-order threaded binary tree, Applications of trees. AVL tree	
Unit V	Graph -Concept and terminologies, Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Breadth First Search traversal, Depth First Search traversal, Prim's and Kruskal's algorithms for minimum spanning tree, Shortest path using Dijkstra's algorithm, topological sorting.	8 hrs

References

TEXT BOOKS:

1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan AndersonFreed, Universities Press.
2. Y. Langsam, M. Augenstein, A. Tannenbaum, "Data Structures using C and C++", 2nd Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9.

REFERENCE BOOKS:

1. G. A.V, PAI, "Data Structures and Algorithms ", McGraw Hill, ISBN -13: 978-0-07-066726-6
2. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
3. Data Structures and Algorithms in C++" – Michael T. Goodrich, Roberto Tamassia, David M. Mount.
4. Data Structures and Algorithms in Java" (2nd Edition) – Robert Lafore

NPTEL:

1. <https://nptel.ac.in/courses/106/102/106102064/> (Introduction to Data Structures and Algorithms, IIT Delhi , Prof. Naveen Garg, 40 hrs)
2. <https://nptel.ac.in/courses/106/105/106105085> (Programming & Data structure ,IIT Kharagpur , Dr.P.P.Chakraborty ,40 hrs)
3. https://onlinecourses.nptel.ac.in/noc22_cs26/preview (Programming, Data Structures And Algorithms Using Python, Chennai Mathematical Institute,By Prof. Madhavan Mukund ,38 hrs)



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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-		-	-	2	3	2	2
CO2	3	3	2	2	1	-	1	1	-	-	2	3	3	2
CO3	3	3	3	2	1	-	-		-	1	2	3	3	2
CO4	3	3	3	2	1	-	1	1	1	1	2	2	3	2
CO5	3	3	3	2	1	1	-	1	1	-	2	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
ESE	Institute	10	10	10	10	10	50	20

Continuous Comprehensive Evaluation (CCE) Plan (50 Marks)

Component	Weightage (Marks)	Description
Assignments (2)	10	Assignments covering Arrays, Linked Lists, Stacks, Queues, Trees, and Graphs, including operations and applications.
Quiz Gate Pattern(2)	10	Multiple-choice and problem-solving questions on Sorting, Searching algorithms, ADTs, Tree and Graph Operations, Complexity Analysis.
Case Study Analysis (1)	10	Analyze real-world scenarios involving applications of Trees, Graphs, and Searching Techniques.
Seminar Presentation (1)	10	Individual presentation on advanced topics such as AVL Trees, Threaded Binary Trees, Graph Traversals, Dijkstra's Algorithm, or Topological Sorting.
Viva (Oral Exam)	5	Oral questions covering Algorithm Complexity (Big O, Ω , Θ), Recursive vs. Non-recursive traversals, and ADT Implementations.
Attendance & Participation	5	Marks based on attendance, participation, and engagement in class activities.



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CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination



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Department of Information Technology

Second Year Engineering SY B Tech Semester III (2024 Course)

Course Category		Program core course		Course Code		IT124PC302	
Course Title		Fundamentals of Data Structures Lab					
Teaching Scheme				Evaluation Scheme			
L (Hr)	T (Hr)	P (Hr)	Cr	Exam	Lab % Marks		
					Max %	Min marks for Passing	
0	0	2	1	CCE	50	20	40
0	0	0		ESE	50	20	

Prerequisites: Programming and Problem Solving ,OOP

Course Objective:

1. To introduce students to fundamental data structures, including arrays, linked lists, stacks, queues, trees, and graphs, and their applications in real-world problems.
2. To equip students with the skills to implement and analyze common sorting algorithms (Bubble Sort, Insertion Sort, Quick Sort) and searching algorithms (Binary Search, Linear Search), and to apply them to solve practical problems.
3. To enable students to design, implement, and manipulate various types of linked lists (singly, doubly, and circular), and to solve problems using linked list-based solutions.
4. To deepen students' understanding of trees and graphs, with an emphasis on binary search trees (BST), expression trees, and graph algorithms such as Dijkstra's and Minimum Spanning Tree (Kruskal's and Prim's).
5. To teach students how to apply data structures and algorithms effectively in various application domains, such as optimizing search queries, network routing, and data analysis.

Course Outcomes: Student will-

CO1	Implement and optimize basic sorting and searching algorithms such as Bubble Sort, Insertion Sort, Quick Sort, and Binary Search for various types of data.	BT 5
CO2	Create, manipulate, and traverse arrays, linked lists, stacks, and queues, demonstrating a solid understanding of their structure and behavior.	BT 5
CO3	Create and perform operations (insertion, deletion, traversal) on singly, doubly, and circular linked lists, and understand their applications in solving dynamic data storage problems.	BT 5
CO4	Construct and traverse binary search trees and expression trees, and implement tree algorithms like insertion, deletion, searching, and depth calculation.	BT 5
CO5	Implement graph algorithms like Dijkstra's, Kruskal's, and Prim's, and use them to solve practical problems such as finding shortest paths and minimum spanning trees.	BT 5

Guidelines

Course Design and Assessment:

- The assignments are divided into groups (A, B, C), with specific implementation requirements.
- Group A and B assignments are to be implemented using C++/Java, focusing on fundamental operations without using built-in methods for core functionalities.
- Group C assignments are to be implemented using C++/Java, emphasizing advanced



structures and real-world problem applications. All 7 assignments must be completed.

- Your performance on the LeetCode platform will be considered for CCE. Ensure that you actively participate, solve assigned problems, and maintain consistency in your submissions.

Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.

Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Syllabus	
	GROUP A
PR1	Consider a student database of SEIT class (at least 15 records). Database contains different fields of every student like Roll No, Name and SGPA. (array of structure) a) Sorting 1) Design a roll call list, arrange list of students according to roll numbers in ascending order (Use Bubble Sort) 2 Arrange list of students alphabetically. (Use Insertion sort) 3) Arrange list of students to find out first ten toppers from a class. (Use Quick sort) (Vlab) b) Searching 1) Search students according to SGPA. If more than one student having same SGPA, then print list of all students having same SGPA. 2) Search a particular student according to name using binary search without recursion. (all the student records having the presence of search key should be displayed)

PR2	a) Write a program that uses functions to perform the following operations on singly linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal b) Write a program that uses functions to perform the following operations on doubly linked list. i) Creation ii) Insertion iii) Deletion iv) Traversal c) Write a program that uses functions to perform the following operation on circular linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal
PR3	Implement stack as an abstract data type using array and use this ADT for conversion of infix expression to postfix, prefix and evaluation of postfix and prefix expression. (Vlab)
GROUP B	
PR4	Construct an Expression Tree from postfix and prefix expression. Perform a) Recursive In-order, pre-order and post-order traversals. b) Non-recursive In-order, pre-order and post-order traversals.
PR5	Implement binary search tree and perform following operations: a) Insert (Handle insertion of duplicate entry) b) Delete c) Search d) Display tree (Traversal) e) Display - Depth of tree f) Display - Mirror image g) Create a copy h) Display all parent nodes with their child nodes i) Display leaf nodes j) Display tree level wise (Note: Insertion, Deletion, Search and Traversal are compulsory, from rest of operations, perform Any three)
GROUP C	
PR 6	Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments/institutes and links should represent the distance between them. Find minimum spanning tree a) Using Kruskal's algorithm. b) Using Prim's algorithm.
PR 7	Represent a graph of city using adjacency matrix /adjacency list. Nodes should represent the various landmarks and links should represent the distance between them. Find the shortest path using Dijkstra's algorithm from single source to all destination.
Text Books:	
- Horowitz and Sahani, "Fundamentals of Data Structures in C++", University Press, ISBN 10:0716782928 /ISBN 13: 9780716782926. - Brassard & Bratley, "Fundamentals of Algorithms", Prentice Hall India/Pearson Education, ISBN 13-9788120311312.	



Reference Books:

1. Steven S S. Skiena, "The Algorithm Design Manual", Springer, 2nd ed. 2008 Edition, ISBN- 13: 978-1849967204, ISBN-10: 1849967202.
2. M. Weiss, "Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.

Journal Papers:

1. B. Park and D. T. Ahmed, "Abstracting Learning Methods for Stack and Queue Data Structures in Video Games," 2017 International Conference on Computational Science and Computational Intelligence (CSCI), Las Vegas, NV, USA, 2017, pp. 1051-1054, doi: 10.1109/CSCI.2017.183.

Vlab:

1. **Quick Sort Experiment**, <https://ds1-iiith.vlabs.ac.in/exp/quick-sort/index.html>
2. **Stacks and Queues**, <https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html>
3. **Linked List**, <https://ds1-iiith.vlabs.ac.in/exp/linked-list/index.html>
4. **Depth First Search** <https://ds1-iiith.vlabs.ac.in/exp/depth-first-search/index.html>

NPTEL:

1. <https://nptel.ac.in/courses/106/102/106102064/> (Introduction to Data Structures and Algorithms, IIT Delhi , Prof. Naveen Garg, 40 hrs)
2. <https://nptel.ac.in/courses/106/105/106105085> (Programming & Data structure ,IIT Kharagpur , Dr.P.P.Chakraborty ,40 hrs)
3. https://onlinecourses.nptel.ac.in/noc22_cs26/preview (Programming, Data Structures And Algorithms Using Python, Chennai Mathematical Institute,By Prof. Madhavan Mukund ,38 hrs)



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Scheme for Practical Examination

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Problem-Solving Assessment (LeetCode Challenges)	20	50	20
		Participation and Engagement in Geeks for Geeks	10		
		Quality of Code Submissions and Solutions	10		
		Regular Coding Practice Attendance	10		
End Semester Exam	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	2	3	2	2
CO2	3	3	2	2	1	-	-	-	-	-	2	3	3	2
CO3	3	3	3	2	1	-	-	-	-	-	2	3	3	2
CO4	3	3	3	2	1	-	-	1	-	-	2	2	3	2
CO5	3	3	3	2	1	1	1	-	1	1	2	2	3	2



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Department of Information Technology

Second Year Engineering SY B Tech Semester III (2024 Course)

Course Category	Program core course	Course Code	IT124PC303
Course Title	Advance Discrete and Computational Mathematics		

		Teaching Scheme			Evaluation Scheme		
L	T	P	Cr	Exam	Theory % Marks		
					Max	Min for Pass	
3	1	0	4	CCE	50	20	40
39	0	0		ESE	50	20	

Prerequisites: Differential and Integral Calculus, Basic Mathematics & Logic

Course Objective

1. To enable students to **analyze and apply** advanced probabilistic and logical reasoning techniques to solve complex problems in data science and artificial intelligence. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines
2. To provide a strong foundation in **designing and innovating** graph-based solutions for computational and network-based challenges using advanced graph theory concepts and algorithms
3. To equip students with the knowledge to **evaluate and implement** linear algebra methods, such as matrix factorization and eigenvalue computations, for dimensionality reduction, feature extraction, and optimization in machine learning.
4. To develop the skills required to **formulate and optimize** machine learning and deep learning models by utilizing modern optimization techniques, including convex programming and gradient-based approaches
5. To empower students to **model and critically evaluate** algorithms using mathematical tools like recurrence relations, probabilistic analysis, and game theory, fostering their ability to address challenges in artificial intelligence and computational domains.

Course Outcomes : Outcome is specification of course the student will

CO1	Solve real world engineering problems by applying set theory, Develop skill in expressing mathematical properties of relation	BT3
CO2	Apply graph-based solutions for real-world challenges in network science and AI.	BT 3
CO3	Apply Statistical methods like correlation and regression analysis for data analysis and predictions in machine learning	BT3
CO4	Apply probability theory and Probability Distribution for data analysis and predictions in machine learning	BT3
CO5	Apply optimize machine learning models using advanced optimization techniques.	BT3

Syllabus

Unit I	Mathematical Foundations for Data Science	8hrs
Set Theory and Logic: Advanced set operations, Venn diagrams, propositional and predicate logic, and logical equivalences Recurrence Relations: Formulation, solving techniques (substitution, iteration), and Master Theorem		
Unit II	Graph Theory and Network Science	8hrs



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Graph Basics: Graph terminology, representations (adjacency matrix, adjacency list), types of graphs (directed, weighted, etc.), **Graph Algorithms:** Shortest path (Dijkstra's, Bellman-Ford), Minimum Spanning Tree (Prim's, Kruskal's).

Network Science: PageRank algorithm, and graph clustering

Graph Embeddings: Introduction to graph neural networks, node embedding, and graph-based machine learning.

Unit III	Statistics for Data Analysis	8hrs
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Statistics: Measure of Central Tendency, Measure of Dispersion, Coefficient of Variation, Moments, Skewness and Kurtosis, Correlation and Regression, Curve Fitting

Matrix Factorizations: Principal Component Analysis (PCA). Singular Value Decomposition (SVD)

Unit IV	Probability and application in Machine Learning	8hrs
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Probability: Basics of Probability, Bayes theorem, Random Variable, Mathematical Expectation, Probability Density function Probability Distribution, Test of Hypothesis: Chi-Square test

Markov Chains: Introduction, state transition matrices, and applications in prediction and modeling

Unit V	Optimization Techniques	8hrs
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Optimization Basics: Convex sets, convex functions, and optimization problems.

Convex Programming: Linear Programming, duality, quadratic programming,

Non Linear Programming: Karush-Kuhn-Tucker (KKT) conditions.

Applications: Optimization in supervised learning, Gradient-Based Optimization: Gradient descent, stochastic gradient descent (SGD), Optimization in reinforcement learning and neural network training

Text Books:

Textbooks

1. **"Discrete Mathematics and Its Applications"** by Kenneth H. Rosen
 - o A foundational book covering discrete mathematics concepts, logic, graph theory, and combinatorics, with applications in computer science.
2. **"Graph Theory"** by Reinhard Diestel
 - o A comprehensive text on advanced graph theory, providing theoretical and practical insights into graph algorithms and their applications in networks and AI.
3. **"Introduction to Probability"** by Dimitri P. Bertsekas and John N. Tsitsiklis
 - o Covers probability theory in depth, including Markov chains and stochastic processes, which are critical for data science and AI.
4. **"Higher Engineering Mathematics"** by B. V. Ramana (Tata McGraw Hill)
5. **"Optimization for Machine Learning"** by Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright

Reference Books:

1. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)
2. Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
3. 3. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
4. Bernard Kolman, Robert Busby and Sharon Ross, "Discrete Mathematical Structures"
5. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill.
6. Norman L. Biggs, Discrete Mathematics, Oxford University Press.

Journal Papers:

1. Numerical Algebra, Control and Optimization, Scopus: from 2011 to 2024, Publisher: American Institute of Mathematical Sciences, ISSN:2155-3289E-ISSN:2155-3297

V Lab:



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1. **Numerical Representation**, <https://ps-iiith.vlabs.ac.in/exp/numerical-representation/>
2. **Permutation**, <https://ps-iiith.vlabs.ac.in/>
3. **Factorial**, <https://ps-iiith.vlabs.ac.in/exp/factorials/>

NPTEL:

1. https://onlinecourses.nptel.ac.in/noc22_cs123/preview
2. [Discrete Mathematics - NPTEL](#)
3. [Computational Mathematics with SageMath - NPTEL](#)
4. [Advanced Computational Techniques - NPTEL](#)

Scheme for Theory Examination

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Assessment (CCA)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit Test 1 (UT1)			Unit Test 2 (UT2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3						1			1		1	1	
CO2	3	3	2					1			1		1	1	
CO3	3	3						1			1		1	1	
CO4	3	3						1			1		1	1	
CO5	3	3	2					1			1		1	1	

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category		Program core course			Course Code		IT124PC304		
Course Title		Database Management System							
Teaching Scheme					Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
3	0	0	3	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
39	0	0	Total hrs: 39		100				
Prerequisites: Discrete Mathematics									
Course Objectives: Students will be able to									
1. Introduction to Databases and DBMS: To provide foundational knowledge of databases, their architecture, and models, while emphasizing their role in real-world applications. 2. Relational Database Design and Normalization: To teach relational database design through ER modeling, normalization techniques, and relational algebra to ensure efficient database structures. 3. SQL and Query Optimization: To develop proficiency in SQL for data manipulation and retrieval while introducing query optimization techniques for performance enhancement. 4. Transactions, Concurrency, and Recovery: To explain transaction management, concurrency control, and recovery mechanisms to maintain data consistency and reliability 5. Emerging Trends in Databases: To explore advanced database paradigms, including NoSQL, Big Data, and cloud databases, and their application in modern data-intensive environments.									
Course Outcomes: student will									
CO1	Analyze and evaluate the architecture, components, and types of database management systems to select the most suitable database model for a given application								BT5
CO2	Design efficient relational database schemas using ER modeling, relational algebra, and normalization techniques to eliminate redundancy and ensure consistency.								BT5
CO3	Develop complex SQL queries for data definition, manipulation, and retrieval, and optimize query performance using advanced techniques.								BT5
CO4	Evaluate transaction management protocols, concurrency control methods, and recovery mechanisms to ensure database reliability and consistency under various scenarios.								BT5



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CO5	Assess and apply modern database technologies, such as NoSQL, Big Data, and distributed databases, to solve contemporary data challenges in real-world applications.	BT3
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Syllabus		
Unit I	Introduction to Databases and DBMS	7 hrs
	1. Database Basics - o Definition, importance, and applications of databases. - o Data vs. Information, Database vs. File System. - o Characteristics of databases. 2. Database Management Systems - o DBMS architecture: Levels of abstraction (physical, logical, and view levels). - o Types of DBMS: Relational, NoSQL, Object-Oriented. - o Database models: Hierarchical, Network, and Relational models. 3. Database Environment - o Role of database administrators (DBAs) and database designers. - o Overview of database users and their roles.	
Unit II	Relational Database Design and Normalization	8 hrs
	1. Relational Model Concepts - o Attributes, tuples, relations, and schema. - o Keys: Primary, candidate, foreign, and superkeys. 2. Relational Algebra and Operations - o Basic operations: Selection, projection, union, intersection, difference, and Cartesian product. - o Advanced operations: Joins, division, aggregation, and grouping. 3. Database Design Process - o Entity-Relationship (ER) modeling: Entities, attributes, relationships, and ER diagrams. - o Conversion of ER diagrams to relational schema. 4. Normalization - o Functional dependencies. - o Normal forms: 1NF, 2NF, 3NF, and BCNF (with examples). - o Denormalization and its applications.	
Unit III	SQL and Query Optimization	8 hrs



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	1. Structured Query Language (SQL) - o Basics of SQL: Data definition (CREATE, ALTER, DROP) and data manipulation (INSERT, UPDATE, DELETE). - o Querying data: SELECT, WHERE, GROUP BY, HAVING, ORDER BY, LIMIT. - o Joins: Inner, outer, self-joins, and cross-joins. - o Subqueries and set operations. 2. Advanced SQL Features - o Views, Indexes, and Triggers. - o Stored Procedures and Functions. - o Role of constraints (NOT NULL, UNIQUE, CHECK, DEFAULT). 3. Query Optimization - o Query execution plans. - o Optimization strategies: Indexing and query rewriting.	
Unit IV	Transactions, Concurrency, and Recovery	8hrs
	1. Transaction Management - o ACID properties: Atomicity, Consistency, Isolation, Durability. - o Transaction states and lifecycle. 2. Concurrency Control - o Problems in concurrent transactions: Lost updates, uncommitted data, and inconsistent analysis. - o Lock-based protocols: Shared, exclusive locks, and two-phase locking. - o Deadlock handling in DBMS. 3. Database Recovery - o Types of failures: System crash, media failure. - o Recovery techniques: Log-based recovery, shadow paging. - o Checkpointing and its significance.	
Unit V	Emerging Trends in Databases	8 hrs
	1. NoSQL Databases - o Types of NoSQL databases: Key-value stores, document databases, column-family stores, graph databases. - o Use cases and advantages of NoSQL over relational databases. - o Introduction to popular NoSQL systems (MongoDB, Cassandra, Redis). 2. Big Data and Distributed Databases - o Basics of distributed databases and CAP theorem.	



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	- o Data partitioning, replication, and consistency. - o Introduction to Big Data frameworks (Hadoop, Spark). 3. Cloud Databases and Database as a Service (DBaaS) - o Overview of cloud-based databases (e.g., Amazon RDS, Google Cloud SQL). - o Benefits and challenges of cloud databases. 4. Introduction to Advanced Topics - o Time-series databases (e.g., InfluxDB). - o Graph databases (e.g., Neo4j). - o Basics of database security and privacy.	
Case Studies	Library Management System (LMS) Student Enrollment System	
Text Books:		
1.Silberschatz A., Korth H., Sudarshan S. “Database System Concepts”, 6th edition, Tata McGraw Hill Publishers 2.“Fundamentals of Database Systems” by Ramez Elmasri and Shamkant Navathe” 2.Ivan Bayross “SQL, PL/SQL the Programming Language of Oracle” , BPB Publications, 2014 ISBN: 9788176569644. 3. Connally T, Begg C., “Database Systems- A Practical Approach to Design, Implementation and Management”, Pearson Education, 5th Edition, 2010, ISBN 81-7808-861-4.		
Reference Books:		
1. “SQL Cookbook” by Anthony Molinaro” 2. “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence” by Pramod J. Sadalage and Martin Fowler” 3. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566. 4. .S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674.		
Journal Papers:		
Joseph M. Hellerstein, Michael Stonebraker, “The Architecture of Database Systems”, Foundations and Trends in Databases		
NPTEL:		



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1.Database Management System by Prof. Partha Pratim Das and Prof. Samiran Chattopadhyay (IIT Kharagpur)

[https://onlinecourses.nptel.ac.in/noc25_cs18/announcements?force=true\(Database management system, By Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay | IIT Kharagpur\)](https://onlinecourses.nptel.ac.in/noc25_cs18/announcements?force=true(Database%20management%20system,By%20Prof.%20Partha%20Pratim%20Das,%20Prof.%20Samiran%20Chattopadhyay%20%20IIT%20Kharagpur))

2.Database Management System by Prof. S. Sudarshan (IIT Bombay):

- **Course Overview:** This course delves into various topics such as relational database design, storage and file structures, query processing and optimization, transactions, concurrency control, and recovery systems. It is based on the textbook "Database System Concepts" by Silberschatz, Korth, and Sudarshan.
- **Link:** [Database Management System - NPTEL](#)

3.Introduction to Database Systems by Prof. D. Janakiram (IIT Madras):

- **Course Overview:** This course introduces students to the theoretical and practical principles involved in the design and use of database systems, emphasizing the SQL standard and various aspects of DBMS.
- **Link:** [Introduction to Database Systems - NPTEL](#)

CCA: Continuous Comprehensive Assessment (CCA), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	-	2	-	2	1	1	2	2	2	3
CO2	3	3	2	-	1	1	1	-	2	-	2	2	2	2
CO3	3	3	3	2	1	-	-	2	-	2	2	2	3	2
CO4	3	3	-	2	-	-	2	-	-	1	1	2	3	2
CO5	3	2	2	2	2	-	-	-	1	1	1	2	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
ESE	Institute	10	10	10	10	10	50	20

Continuous Comprehensive Evaluation (CCE) Plan (50 Marks)

Component	Weightage (Marks)	Description
Assignments (2)	10	Two assignments covering topics such as Normalization, SQL Queries, and Indexing.
Quiz Gate Pattern (2)	10	Multiple-choice and problem-solving questions on ER Modeling, Relational Algebra, and Transactions.
Case Study Analysis (1)	10	Analysis of real-world database applications such as Banking, E-commerce, or Hospital Management Systems.
Seminar Presentation (1)	10	Individual presentation on advanced topics like NoSQL Databases, Big Data, or Query Optimization.
Viva (Oral Exam)	5	Oral questions on database architecture, indexing strategies, and transaction management.
Attendance & Participation	5	Marks based on attendance, class participation, and engagement in discussions.



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Course Category		Multidisciplinary minor			Course Code		IT124PC305	
Course Title		Foundation of cyber security						
		Teaching Scheme			Evaluation Scheme			
L	T	P	Cr	Exam	Theory % Marks			
					Max	Min for Pass		
2	0	0	2	CCE	50	20	40	
26	0	0		ESE	50	20		
Prerequisites: Basic computer literacy								
Course Objective								
CO1: To introduce students to the fundamental concepts of cybersecurity and develop awareness about modern digital threats and vulnerabilities.								
CO2: To provide a basic understanding of cryptographic techniques and their application in ensuring data security.								
CO3: To explain networking basics and highlight essential tools and practices for securing networks.								
CO4: To emphasize cybersecurity practices in everyday life, including safeguarding personal data and avoiding social engineering attacks.								
CO5: To provide knowledge of emerging trends and technologies in cybersecurity to address future challenges.								
Course Outcomes: After successful completion of the course the student will								
CO1	Analyze and evaluate key cybersecurity terminologies, concepts, and the impact of cyber threats on individuals and organizations.						BT2	
CO2	Apply cryptographic methods like encryption, decryption, and hashing to secure digital communication.						BT3	
CO3	Implement basic network security techniques using firewalls, antivirus tools, and VPNs to mitigate network vulnerabilities.						BT3	
CO4	Assess and adopt effective cybersecurity practices in daily activities to safeguard personal devices, data, and online identities.						BT4	
CO5	Evaluate emerging cybersecurity trends and design solutions for future security challenges.						BT4	

Syllabus		
Unit I	Introduction to Cybersecurity	5 hrs
Understanding Cybersecurity - What is cybersecurity? - Importance of cybersecurity in today's digital world. - Key cybersecurity terminologies: threat, vulnerability, attack, and risk. Types of Cyber Threats - Malware (viruses, worms, ransomware). - Phishing and social engineering attacks. - Denial of Service (DoS) and Distributed DoS (DDoS) attacks.		



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Basic Cyber Hygiene

- Password management and two-factor authentication.
- Importance of software updates and patch management.
- Securing personal devices and networks.

Unit II	Basics of Cryptography	5 hrs
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Introduction to Cryptography

- Importance of cryptography in cybersecurity.
- Encryption and decryption: Basic concepts.
- Types of encryption: Symmetric vs. Asymmetric.

Common Cryptographic Techniques

- Caesar Cipher (hands-on exercise).
- Hashing: MD5, SHA basics.
- Public Key Infrastructure (PKI) fundamentals.

Applications of Cryptography

- Secure messaging (e.g., WhatsApp encryption).
- Digital signatures and certificates.

Unit III	Securing Networks	4 hrs
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Basics of Networking and Security

- Introduction to networks: LAN, WAN, Internet.
- Common network vulnerabilities and threats.

Firewalls and Antivirus

- Role of firewalls in securing networks.
- Types of firewalls: Hardware vs. Software.
- Importance of antivirus and anti-malware tools.

Virtual Private Networks (VPNs)

- Understanding VPNs and their role in privacy.
- Use cases for personal and professional use.

Unit IV	Cybersecurity in Daily Life	4 hrs
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Social Engineering and Online Fraud

- Types of social engineering attacks (phishing, pretexting).
- Identifying and avoiding fraudulent websites and scams.

Safe Internet Browsing Practices

- Importance of HTTPS.
- Recognizing and avoiding browser-based attacks (e.g., drive-by downloads).

Data Privacy

- Basics of data privacy laws (GDPR, IT Act in India).
- Securing personal information on social media.

Unit V	Emerging Trends in Cybersecurity	8 hrs
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Advanced Cyber Threats

- Zero-day attacks and Advanced Persistent Threats (APTs).
- Ransomware-as-a-Service (RaaS) and evolving malware threats.

Cloud Security

- Introduction to cloud computing and its risks.
- Security practices for cloud storage and applications.

Internet of Things (IoT) Security

- Challenges in securing IoT devices.
- Case studies of IoT vulnerabilities and attacks.

Artificial Intelligence in Cybersecurity

- Role of AI in threat detection and response.
- Potential risks and ethical considerations of AI in cybersecurity.

Text Books:

1. "Cybersecurity: Essentials" by Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short
 - Publisher: Jones & Bartlett Learning
 - This book provides a comprehensive overview of cybersecurity concepts, threats, and practical countermeasures, making it ideal for beginners.
2. "Cryptography and Network Security: Principles and Practice" by William Stallings
 - Publisher: Pearson
 - Covers the basics of cryptography, network security principles, and emerging threats with practical examples.
3. "Computer Security: Principles and Practice" by William Stallings and Lawrie Brown
 - Publisher: Pearson
 - Focuses on security technologies, tools, and methodologies, including cryptography, secure protocols, and secure system development.

Reference Books:

1. "Cybersecurity and Cyberwar: What Everyone Needs to Know" by P.W. Singer and Allan Friedman
 - Publisher: Oxford University Press
 - A concise book explaining key cybersecurity challenges, threats, and solutions, written in an accessible style for a broad audience.
2. "Network Security Essentials: Applications and Standards" by William Stallings
 - Publisher: Pearson
 - Focused specifically on network security techniques, standards, and applications.
3. "Practical Cryptography for Data Security" by Niels Ferguson and Bruce Schneier
 - Publisher: Wiley
 - A practical guide to cryptographic methods and their applications in securing information.
4. "The Art of Deception: Controlling the Human Element of Security" by Kevin D. Mitnick and William L. Simon
 - Publisher: Wiley
 - Provides insight into social engineering attacks and methods for improving human-centric cybersecurity defenses.
5. "Hacking Exposed 7: Network Security Secrets and Solutions" by Stuart McClure, Joel Scambray, and George Kurtz
 - Publisher: McGraw Hill Education
 - Offers hands-on approaches to understanding cybersecurity vulnerabilities and



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Scheme for Theory Examination

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit Test 1 (UT1)			Unit Test 2 (UT2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	2	-	-	1	-	-	-
CO2	3	3	3	2	2	-	-	1	-	-	-
CO3	3	3	2	3	1	1	-	1	-	-	-
CO4	3	2	3	3	1	-	-	2	-	-	-
CO5	3	3	3	2	2	3	3				

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category		Open Elective 1			Course Code		IT124OE306		
Course Title		Customer Relationship Management							
Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min
									for Pass
3	1	0	4	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
39	0	0	Total hrs: 39		100				
Prerequisites: Basic Business Knowledge, Fundamentals of Data Management, Communication Skills									
Course Objectives:									
1. To introduce the fundamental concepts, importance, and evolution of Customer Relationship Management (CRM) in engineering and business environments. 2. To develop an understanding of customer data management, CRM tools, and their role in data-driven decision-making. 3. To explore customer engagement strategies and service excellence through CRM-driven communication and feedback mechanisms. 4. To analyze the role of CRM analytics in business growth, including key performance indicators, predictive analytics, and customer segmentation. 5. To equip students with knowledge of CRM implementation strategies, challenges, legal considerations, and the future impact of AI and automation in CRM.									
Course Outcomes: Student will-									
CO1	Explain the significance of CRM and its various types in improving customer-centric business processes.								BT 2
CO2	Identify and utilize customer data effectively while leveraging CRM tools for business optimization.								BT 3
CO3	Apply CRM strategies to enhance customer engagement, communication, and service excellence.								BT 3
CO4	Analyze CRM analytics reports and dashboards to make informed business decisions and improve customer relationships.								BT 4
CO5	Develop a CRM implementation plan for an engineering business while addressing adoption challenges, ethical considerations, and future trends.								BT 5



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Syllabus

Unit I	Introduction to CRM & Business Relevance • What is CRM? – Definition, Importance, and Evolution • Why CRM Matters in Engineering? – Customer-Centric Approach • Types of CRM Systems: ◦ Operational CRM (Sales, Marketing, Service) ◦ Analytical CRM (Customer Insights & Reports) ◦ Collaborative CRM (Internal & External Communication) • Customer Lifecycle & Relationship Management	6 hrs
Unit II	Understanding Customer Data & CRM Tools • What is Customer Data? – Types of Data Used in CRM • How to Collect & Manage Customer Information? • Overview of Popular CRM Tools: ◦ Open-source CRMs (SuiteCRM, Odoo, VTiger) ◦ Commercial CRMs (Salesforce, HubSpot, Zoho CRM) • Data-Driven Decision-Making in CRM	9 hrs
Unit III	Customer Engagement & Service Excellence • What is Customer Engagement? – Importance in Engineering Businesses • CRM in Customer Service: ◦ Handling Customer Inquiries & Complaints ◦ Personalized Customer Interactions ◦ Service Level Agreements (SLAs) • Using CRM for Better Customer Communication (Emails, SMS, Chatbots) • Customer Feedback & Relationship Strengthening	9 hrs
Unit IV	CRM Analytics & Decision-Making • What is CRM Analytics? – Role in Business Growth • Key Performance Indicators (KPIs) in CRM • Using CRM Reports & Dashboards • Predictive Analytics for Customer Behavior • Customer Segmentation & Targeting	9 hrs
Unit V	CRM Strategy & Implementation • Steps to Implement CRM in an Engineering Business • Challenges & Best Practices in CRM Adoption • Legal & Ethical Considerations in CRM (Data Protection & GDPR)	6 hrs



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	• Future of CRM: AI & Automation in Customer Management	
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References

TEXT BOOKS:

1. "Customer Relationship Management: Concepts and Technologies" – Francis Buttle & Stan Maklan
2. "CRM at the Speed of Light: Social CRM Strategies, Tools, and Techniques" – Paul Greenberg

REFERENCE BOOKS:

1. Paul Greenberg – *CRM at the Speed of Light: Essential Customer Strategies for the 21st Century*, McGraw Hill, 4th Edition.
2. Ed Peelen & Rob Beltman – *Customer Relationship Management*, Pearson, 2nd Edition.
3. Francis Buttle & Stan Maklan – *Customer Relationship Management: Concepts and Technologies*, Routledge, 4th Edition.
4. Jagdish N. Sheth, Atul Parvatiyar & G. Shainesh – *Customer Relationship Management: Emerging Concepts, Tools, and Applications*, McGraw Hill.
5. V. Kumar & Werner Reinartz – *Customer Relationship Management: Concept, Strategy, and Tools*, Springer, 3rd Edition.
6. Kristin Anderson & Carol Kerr – *Customer Relationship Management*, McGraw Hill.
7. Adrian Payne – *Strategic Customer Management: Integrating Relationship Marketing and CRM*, Cambridge University Press.

NPTEL:

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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1									3	2	1
CO2	3	3	2	1								3	3	2
CO3	2	3	3	3	2	1						3	2	3
CO4	1	2	3	3	3	2	1					2	2	3
CO5	1	2	3	3	2							3	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

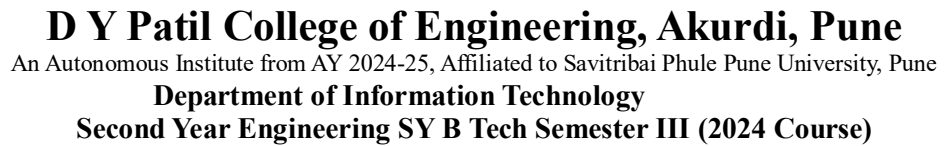
Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
ESE	Institute	10	10	10	10	10	50	20

Continuous Comprehensive Evaluation (CCE) Plan (50 Marks)

Component	Weightage (Marks)	Description
Quizzes & Case Studies	20	Multiple-choice questions and 1 case study
Group Presentations	10	Group presentation
Hands-on CRM Tool Exercises	10	Assignments
Final CRM Strategy Project	10	Project on some real time scenario.

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination



Course Category		Economics and Entrepreneur Management			Course Code		IT124EE307	
Course Title		Principles of Economics & Software Project Management						
Teaching Scheme					Evaluation Scheme			
L	T	P	Cr	Exam	Theory Marks		Practical Marks	
					Max	Min Marks for Pass	Max	Min for Pass
2	0	0	2	CCE	50	20	40	-
Total Hours				ESE	50	20		
26	0	0	Total hrs: 26		100			
Prerequisites: Basic understanding of software development concepts and project management principles.								
Course Objectives: - Understand economic principles and their relevance to IT and software industries. - Analyse financial decision-making in software project management. - Evaluate cost estimation, budgeting, and resource allocation for IT projects.								
Course Outcomes: After successful completion of the course the student will be able to								
CO1	Analyse economic principles and their applications in IT and software project management. (Analyse-Level 4)							BT 4
CO2	Assess cost estimation, budgeting, and investment strategies in software projects. (Evaluate- Level 5)							BT 5
CO3	Evaluate financial risks, software pricing models, and IT market structures. (Evaluate- Level 5)							BT 5
CO4	Utilize tools like JIRA, Trello, and MS Project to plan and manage software projects efficiently. (Apply – Level 3)							BT 3
CO5	Examine government policies, intellectual property rights, and sustainable software practices. (Evaluate- Level 5)							BT 5



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Syllabus

Unit I	Introduction to Economics for IT & Software Industry Basic economic principles: Demand, Supply, Opportunity Cost, Economic impact of IT industry and software development, Scarcity and resource allocation in software projects	5 hrs
Unit II	Market Structures and Cost Estimation in Software Development Market structures: Perfect competition, monopoly, oligopoly in IT, Cost analysis: Fixed vs. variable costs in software projects, Software project cost estimation techniques (COCOMO, Function Point Analysis)	5 hrs
Unit III	Financial Planning, Investment, and Risk in IT Projects Budgeting and funding strategies for software projects, Investment decision-making in IT companies, Risk management in software development and project planning	5 hrs
Unit IV	Software Project Management & Scheduling Introduction to Software Project Management (SPM) principles, Project planning, scheduling, and effort estimation, Software Development Life Cycle (SDLC) models and their economic impact, Introduction to JIRA, MS Project for Project Planning	6 hrs
Unit V	Government Policies, Intellectual Property, and Green IT Taxation policies, IT regulations, and government support for tech businesses, Intellectual Property Rights (IPR), patents, and copyright in software development, Sustainable development in IT: Green software engineering, energy-efficient computing	5 hrs



References

TEXT BOOKS:

1. Mankiw, N. Gregory – Principles of Economics, 9th Edition, Cengage Learning.
2. Pindyck, Robert S., and Daniel L. Rubinfeld – Microeconomics, 9th Edition, Pearson Education.(
E book Available)
3. Sommerville, Ian – Software Engineering, 10th Edition, Pearson.
4. Pressman, Roger S., and Maxim, Bruce R. – Software Engineering: A Practitioner's Approach, 9th Edition, McGraw-Hill.
5. Fenton, Norman & Pfleeger, Shari Lawrence – Software Metrics: A Rigorous and Practical Approach, 3rd Edition, CRC Press.

REFERENCE BOOKS:

1. Varian, Hal R. – Intermediate Microeconomics: A Modern Approach, 9th Edition, W.W. Norton & Co.
2. Krugman, Paul, and Robin Wells – Macroeconomics, 5th Edition, Worth Publishers.
3. Boehm, Barry W. – Software Engineering Economics, Prentice Hall.
4. Humphrey, Watts – Managing the Software Process, Addison-Wesley.
5. Jalote, Pankaj – Software Project Management in Practice, Pearson Education.

Project Management Tools

Sr No	Name of the Tools	Tasks in the Course
1	JIRA	Agile project management, sprint tracking
2	MS PROJECT	Gantt charts, scheduling, resource management



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Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	UT1		UT2			25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	2	3	2	2
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	3	2
CO3	3	3	3	2	1	-	-	-	-	-	-	2	3	3	2
CO4	3	3	3	2	1	-	-	-	-	-	-	2	2	3	2
CO5	3	3	3	2	1	-	-	-	-	-	-	2	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category		Value Education Course (VEC) I		Course Code				
Course Title		Sustainable Development Goals I						
Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks		Practical Marks	
					Max	Min Marks for Pass	Max	Min for Pass
2	0	0	2	CCE	100	40	-	-
Total Hours								
26	0	0	Total hrs: 26					
Prerequisites: None								
Course Objectives:								
1. Understand the Concept of SDGs – Introduce students to the importance of sustainable development and the role of SDGs in global and local contexts. 2. Explore SDG Interconnections – Analyze how various SDGs are linked and the challenges in achieving them collectively. 3. Develop SDG Project Planning Skills – Equip students with planning methodologies to design sustainability projects. 4. Examine Ethical s Policy Perspectives – Provide insights into governance, ethics, and regulatory frameworks that support SDG implementation.								
Course Outcomes: After successful completion of the course the student will be able to								
CO1	Understanding SDGs – DEFINE the key concepts of SDGs, LIST the 17 SDGs, and DISCUSS their significance globally and in India.							
CO2	SDG Framework s Interconnections – EXPLAIN how different SDGs are interconnected and their holistic impact.							
CO3	SDG Project Planning s Stakeholder Roles – IDENTIFY key sustainability challenges, ANALYZE stakeholder roles, and APPLY planning frameworks for SDG-based projects.							
CO4	Ethical s Policy Perspectives on SDGs – EXAMINE the ethical considerations, policies, and governance structures supporting SDGs.							

Syllabus

Unit I	Introduction to SDGs & Sustainability	7 hrs
	Importance of sustainable development in addressing global challenges. Evolution from Millennium Development Goals (MDGs) to SDGs. Overview of the 17 SDGs and their significance in the UN 2030 Agenda. India's contribution and policies towards SDGs.	
Unit II	SDG Targets & Interconnections	7 hrs
	Deep dive into SDG targets and indicators. Understanding interlinkages between various SDGs. The role of governments, businesses, NGOs, and individuals in SDG implementation. Global and Indian case studies showcasing successful SDG applications.	



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Unit III	Planning and Stakeholder analysis for SDG projects	6 hrs
	Key challenges in SDG implementation. Identifying relevant stakeholders and their roles in achieving SDGs. Project planning frameworks for SDG-related initiatives. SWOT analysis for effective SDG project design.	
Unit IV	Ethical and Policy perspectives on SDGs	6 hrs
	Ethical considerations in sustainable development. Policy frameworks governing SDG implementation at the global and national levels. The role of education, corporate social responsibility (CSR), and public-private partnerships in SDG success. Responsible decision-making and accountability in sustainability efforts.	

References

Website: <https://sdgs.un.org/goals#>

<https://unstats.un.org/sdgs/indicators/indicators-list/>

<https://sdgs.un.org/publications/sdg-good-practices-2020>

<https://unstats.un.org/sdgs/iaeg-sdgs/tier-classification/>

<https://unstats.un.org/UNSDWebsite/undatacommons/countries?p=country/IND>

<https://unstats.un.org/sdgs/report/2022/extended-report/>

Scheme for Examination (CCE)

Component	Parameters	Marks	Total	Pass
CCE	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Evaluation	Performance (Internal)	25	50	20
	Oral Examination (Internal)	25		

CCE: Continuous Comprehensive Evaluation (CCE)

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	3	3	3	3	3	3	3
CO2	-	-	-	-	-	3	3	3	3	3	3	3
CO3	-	-	-	-	-	3	3	3	3	3	3	3
CO4	-	-	-	-	-	3	3	3	3	3	3	3
CO5	-	-	-	-	-	3	3	3	3	3	3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category	Field project			Course Code	IT124FP309	
Course Title	Database Management system project lab					
Teaching Scheme				Evaluation Scheme		
L (Hr)	T (Hr)	P (Hr)	Cr	Exam	Lab % Marks	
					Max %	Min marks for Passing
0	0	4	2	CCE	100	40

Prerequisites: discrete mathematics, relational database concepts, SQL queries, ER modeling

Course Objective:

1. To develop a strong foundation in database management concepts
2. To enhance problem-solving skills through hands-on database implementation
3. **To apply database concepts in real-world applications**

Course Outcomes: By the end of the course, students should be able to

CO1	Construct the database schema using concepts of ER, EER diagrams.	BT 3
CO2	Populate and query a database using SQL DDL / DML / DCL commands.	BT 4
CO3	Develop a strong understanding of procedural SQL concepts, including cursors and triggers in relational databases.	BT 4
CO4	Develop a mini project using database management concepts.	BT 4

Guidelines

Course Design and Assessment:

- The assignments are divided into groups (A, B, C, and D), with specific implementation requirements.
- Student should submit term work in the form of handwritten journal based on specified list of assignments.
- Practical will be based on all the assignments in the lab manual
- Candidate is expected to know the theory involved in the experiment.
- The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.



Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.

Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Syllabus	
	GROUP A
PR1	Install and configure MySQL, PostgreSQL, or Oracle Database for practical implementation."
PR2	Design any database with at least 10 entities. Perform basic CRUD (Create, Read, Update, Delete) operations.
	GROUP B
PR3	Construct an ER diagram for a given case study and transform the ER model into relational database tables..
PR4	Create database tables with appropriate constraints, including Primary Key, Foreign Key, Unique, Not Null, and Check constraints. Insert data and validate constraint enforcement.
PR5	Perform following SQL queries on the database



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	a. Aggregate Functions and Grouping b. Subqueries and Set Operations c. SQL Queries with Joins
PR6	Design any database and Perform DDL operations on tables. Normalize a given dataset up to 3NF or BCNF
	GROUP C
PR 7	Develop PL/SQL blocks using BEGIN and END statements, incorporating loops and conditional constructs for procedural execution.
PR8	Design and implement triggers to handle insert, update, and delete operations in a database.
PR9	Develop and implement stored procedures to automate database operations and enhance efficiency.
	GROUP D
PR10	Using the database concepts covered, develop an application with following details: 1. Follow the same problem statement designed in Assignment 1 from Group B. 2. Develop any application such as Library management system, University database system using MYSQL. Students should develop applications in group of 2-4 students and submit the Project Report which will consist of documentation related to different phases of Software Development.
Text Books:	
1.Silberschatz A., Korth H., Sudarshan S. “Database System Concepts”, 6th edition, Tata McGraw Hill Publishers 2.Ivan Bayross “SQL, PL/SQL the Programming Language of Oracle” , BPB Publications, 2014 ISBN: 9788176569644. 3. Connally T, Begg C., “Database Systems- A Practical Approach to Design, Implementation and Management”, Pearson Education, 5th Edition, 2010,ISBN 81-7808-861-4.	
Reference Books:	
1.C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566. 2.S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education, 2009, ISBN 9788177585674. 3.Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O'Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.	



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Journal Papers:

1. Joseph M. Hellerstein, Michael Stonebraker, “The Architecture of Database Systems”, Foundations and Trends in Databases

NPTEL:

[https://onlinecourses.nptel.ac.in/noc25_cs18/announcements?force=true\(Database management system](https://onlinecourses.nptel.ac.in/noc25_cs18/announcements?force=true(Database%20management%20system)), By Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay | IIT Kharagpur)

CO-PO Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO 2	PS O3
CO1	3	3	2	2	-	2	-	2	1	1	2	2	2	3
CO2	3	3	2	-	1	1	2	-	2	-	2	2	2	2
CO3	3	3	3	2	1	-	-	2	-	2	2	2	3	2
CO4	3	3	-	2	-	-	2	-	-	1	1	2	3	2

Scheme for Practical Examination(Marks 100)

Component	Weightage (Marks)	Description
Lab Assignments (5)	20	Hands-on tasks covering SQL queries, Joins, Views, and Indexing.
ER Diagram & Relational Mapping	10	Design an ER diagram for a given case study and convert it into relational tables.
SQL Queries Implementation	10	Writing and executing queries using SELECT, INSERT, UPDATE, DELETE, GROUP BY, and HAVING.
Constraints Implementation	10	Define tables with Primary Key, Foreign Key, Unique, Not Null, and Check constraints and validate them with test data.
PL/SQL Programming	10	Develop PL/SQL blocks using BEGIN, END, loops, and conditional statements.
Stored Procedures & Functions	10	Create stored procedures for automating tasks and implement functions for calculations
Triggers Implementation	10	Write triggers to handle Insert, Update, and Delete operations.
Mini Project	15	Develop a small-scale database application integrating ER modeling, SQL queries, PL/SQL, and procedures.
Viva (Oral Exam)	5	Oral questions assessing understanding of DBMS concepts and practical work.
Attendance &	5	Marks based on attendance, class engagement, and active



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Participation		participation.
Total	100	Comprehensive assessment covering all key aspects of DBMS Lab.

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	UT1		UT2			25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3	PS O4
CO1	3	3	2	2	-	-	-	-	-	1	-	2	2	3	2
CO2	3	3	2	2	1	-	-	-	-	1	-	2	2	2	2
CO3	-	3	2	2	2	1	-	-	-	-	-	2	3	2	2
CO4	3	3	2		2	-	-	-	-	1	-	2	3	2	2
CO5	3	2	2	2	2	-	-	-	-	-	-	2	2	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category	Non credit course	Course Code	IT124NC310
Course Title	Design thinking		

Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks	
					Max	Min for Pass	Max	Min for Pass
1	0	2	0		50	20	50	20
Total Hours						20		
1		26	Total: 26		50	20		

Prerequisites: Digital Mindset.

Course Objective:

1. Study a problem from multiple perspectives
2. Learn how to frame the design challenge properly.
3. Learn how to ideate, prototype and Iterate solutions.
4. Learn from the overall design process how to create value as entrepreneurs
5. Learn how to design successful products or enterprises

Course Outcomes: After Successful completion of course units, students will

1. **Comprehend** & analyze an Opportunity from a Problem.
2. **Demonstrate** and frame a Product/Service Idea.
3. **Analyze** how to empathize with the customers.
4. **Create** design and develop a Prototype.
5. **Select** and pitch their idea.



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Syllabus

Unit I	Introduction to Design Thinking	14 Hrs.
LRI Assessment, Introduction to Design Thinking, Understanding the Mindsets-Empathy, Optimism, Embrace Ambiguity, make it, learn from Failure, Iterate, Create Confidence, Creativity Convergent & Divergent Thinking		
Unit II	Stages of the Design Thinking Process	03 Hrs.
Stages of the Design Thinking Process-Empathies, define (the problem), Ideate, Prototype, and Test		
Unit III	Ideation tools & exercises	06 Hrs.
Empathize-Understand customers, Empathy Maps, Empathies-Step into customer's shoes Customer Journey Maps, Define- Analysis & Drawing Inferences from Research.		
Unit IV	The Design Challenge	03 Hrs.
The Design Challenge: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing Documentation and the Pitching.		
Reference Books		
1. R. S. Aggarwal,. <i>Quantitative Aptitude for Competitive Examinations</i>, 3rd (Ed.). New Delhi: S. Chand Publishing 2. ETHNUS,. <i>Aptimithra</i>, 1st (Ed.). Bangalore: McGraw-Hill Education Pvt. Ltd. 3. Arun Sharma, (2016). <i>Quantitative Aptitude</i>, 7th (Ed.). Noida: McGraw Hill Education Pvt. Ltd. 4. Soft Skills & Interview Prep – Dale Carnegie, LinkedIn Learning		
TEXT BOOK: 1. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School - IdrisMootee. 2. Christoph Meinel and Larry Leifer, "Design Thinking", Springer, 2011		



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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO4
CO1	3	3	3	3	2	-	-	-	2	-	-	3	3	2	2
CO2	2	3	2	-	3	-	-	3	3	-	-	3	2	3	3
CO3	3	3	2	3	3	-	-	-	2	-	-	3	3	3	-
CO4	-	2	1	-	3	-	-	3	3	2	-	3	2	2	-

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category		Non credit course			Course Code		IT124NC311		
Course Title		Aptitude & Technical Mastery for Placements-I							
Teaching Scheme					Evaluation Scheme				
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0	0	0	0		50	20	20	50	20
Total Hours									
0		26	Total: 26		50	20			

Prerequisites: Basic Mathematics

Course Objective:

1. Strengthen **fundamental quantitative, verbal, and logical reasoning** skills for placement aptitude tests.
2. Develop **critical thinking and problem-solving** abilities through real-world aptitude challenges.
3. Enhance **soft skills, networking strategies, and LinkedIn profile building** for career readiness.
4. Improve **resume-writing techniques** to create an ATS-proof CV

Course Outcomes: After Successful completion of course units, students will

1. Solve basic to intermediate-level aptitude problems with accuracy and speed.
2. Demonstrate proficiency in verbal reasoning for placement exams and interviews.
3. Develop a strong professional network through LinkedIn and networking skills.
4. Build an optimized ATS resume tailored for placement success.

Syllabus

Unit I	Quantitative Aptitude	14 Hrs.
1.	Linear Equations	
2.	Quadratic Equations	
3.	Profit and Loss	
4.	Simple Interest and Compound Interest	
5.	Time, Speed, and Distance - Basic	
6.	Race & Game & Problem on Trains	
7.	Time and Work	



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Unit II	Verbal Ability	03 Hrs.
1. Sentence Correction - Intermediate and Advanced 2. Sentence Completion		
Unit III	Reasoning Ability	06 Hrs.
1. Analytical Reasoning - I 2. Clock & Calendars 3. Coding and Decoding & Odd Man Out		
Unit IV	Career Skills	03 Hrs.
Resume Building 1. ATS Resume Hard Copy 2. Video Resume 3. Cover Letter		
Reference Books		
1. R. S. Aggarwal,. <i>Quantitative Aptitude for Competitive Examinations</i> , 3rd (Ed.). New Delhi: S. Chand Publishing 2. ETHNUS,. <i>Aptimithra</i> , 1st (Ed.). Bangalore: McGraw-Hill Education Pvt. Ltd. 3. Arun Sharma, (2016). <i>Quantitative Aptitude</i> , 7th (Ed.). Noida: McGraw Hill Education Pvt. Ltd. 4. Soft Skills & Interview Prep – Dale Carnegie, LinkedIn Learning		



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Second Year Engineering SY B Tech Semester IV (2024 Course)

Course Category	Program core course	Course Code	IT124PC401
Course Title	Advance Data Structures & Analysis of Algorithms		

Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks		Practical Marks	
					Max	Min Marks for Pass	Max	Min for Pass
3	0	0	3	CCE	50	20	40	-
Total Hours				ESE	50	20		
39	0	0	Total hrs: 39		100			

Prerequisites: ☐ Data Structures Fundamentals ☐ Algorithm Design Techniques

Course Objectives:

1. Understand advanced data structures, including sparse matrices, hashing techniques, and file organization methods.
2. Analyze divide & conquer, greedy, dynamic programming, backtracking, and branch & bound paradigms.
3. Implement various algorithmic strategies and evaluate their efficiency through recurrence relations.
4. Apply graph-based algorithms for shortest paths, MSTs, and NP-completeness concepts.
5. Evaluate computational complexity; classify problems into P, NP, NP-complete, and NP-hard categories.

Course Outcomes: Student will -

CO1	Analyze and evaluate the properties, advantages, and applications of sparse matrices, hashing techniques, and file organization methods for efficient data storage and retrieval.	BT 4
CO2	Analyze and compare divide & conquer algorithms, recurrence relations. Implement and apply greedy algorithms for graph-based optimization	BT4



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	problems.	
CO3	Implement dynamic programming techniques for solving optimization problems.	BT 4
CO4	Apply backtracking and branch & bound techniques to complex problems.	BT 3
CO5	Evaluate NP-completeness, computational complexity, and reductions.	BT 5

Syllabus

Unit I	Sparse matrix Hashing: Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, Different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining with and without replacement. File: Concept of File, File types and file organization (sequential, index sequential and Direct Access), Comparison of different file organizations.	8 hrs
Unit II	Divide & Conquer: General method, Control abstraction, Quick Sort – Worst, Best and average case. Finding Max-Min, Large integer Multiplication (for all above algorithms analysis to be done with recurrence). Greedy Method: General method and characteristics, Optimal storage on tapes, Fractional Knapsack problem, Job Sequencing	7 hrs
Unit III	Dynamic Programming : General strategy, Principle of optimality, 0/1 knapsack Problem, Bellman-Ford Algorithm , Multistage Graph problem, Optimal Binary Search Trees, Travelling Salesman Problem.	7 hrs
Unit IV	Backtracking: General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Sum of subsets, Graph coloring, Hamiltonian Cycle, 0/1 Knapsack Problem Branch and bound: The method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling sales person problem	8 hrs
Unit V	Computational Complexity: Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover.	6 hrs



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References

Text Books:

- Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
- Fundamentals of Algorithms – E. Horowitz et al.
- Design and Analysis of Algorithms, M.R.Kabat, PHI Learning
- Algorithms—A Creative Approach, 3RD Edition, UdiManber, Algorithms—A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA

REFERENCE BOOKS:

- The Design and Analysis of Algorithms by Dexter C. Kozen
- Thomas H Cormen and Charles E.L Leiserson, Introduction to Algorithm, PHI, ISBN:81-203-2141-3.
- Gilles Brassard, Paul Bratle, Fundamentals of Algorithms, Pearson, ISBN 978-81-317-1244-3.

Vlab: <https://ds1-iiith.vlabs.ac.in/exp/hashtables/index.html>

Website: <https://nptel.ac.in/courses/106106131>

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	1	-	-	-	-	-	2	2	3	2
CO2	3	3	3	2	1	1	-	-	1	-	2	2	3	2
CO3	3	3	3	2	2	1	-	-	-	1	2	2	3	2
CO4	3	3	3	2	2	-	-	-	-	1	2	2	3	2
CO5	3	3	3	2	1	-	1	1	1	-	2	2	3	2



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3: High, 2: Moderate, 1: Low, 0: No Mapping

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
ESE	Institute	10	10	10	10	10	50	20

Continuous Comprehensive Evaluation (CCE) Plan (50 Marks)

Component	Weightage (Marks)	Description
Assignment (2)	10	Assignments covering topics like Hashing, File Organization, and Sparse matrix.
Quiz Gate Pattern(2)	10	MCQs and problem-solving questions on Dynamic Programming, Greedy Methods, and Complexity Classes.
Case Study Analysis (2)	10	Analyze problem scenarios based on Backtracking, Dynamic Programming, divide and conquer and Branch & Bound techniques.
Seminar Presentation (1)	10	Individual presentation on advanced topics like NP-Complete problems, Greedy Method applications.
Viva (Oral Exam)	5	Oral questions based on core concepts and problem-solving techniques covered in the syllabus.
Attendance & Participation	5	Marks based on attendance, participation, and engagement in class activities.

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination



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Course Category	Program core course	Course Code	IT124PC402
Course Title	Advance Data Structures & Analysis of Algorithms Lab		

Teaching Scheme				Evaluation Scheme			
L (Hr)	T (Hr)	P (Hr)	Cr	Exam	Lab % Marks		
					Max %	Min marks for Passing	
0	0	2	1	CCE	50	20	40
0	0	0		ESE	50	20	

Prerequisites: Programming and Problem Solving ,OOP

Course Objective:

1. To understand and implement various techniques for representing and manipulating sparse matrices.
2. To apply efficient hashing methods and compare their performance in resolving collisions.
3. To explore and implement well-known algorithms such as Dijkstra's, Bellman-Ford, and greedy methods to solve optimization problems.
4. To learn and apply backtracking, branch and bound, and approximation techniques in solving classic computational problems like N-Queens, Traveling Salesman, and Vertex Cover.

Course Outcomes: Student will-

CO1	Implement and optimize operations like addition, subtraction, multiplication, and transposition on sparse matrices.	BT 5
CO2	Demonstrate proficiency in applying different hashing techniques such as Linear Probing, Quadratic Probing, and Chaining to handle collision resolution.	BT 4
CO3	Implement and analyze the efficiency of Dijkstra's Algorithm, Bellman-Ford Algorithm, "Finding Maximum and Minimum" problem using the divide & conquer approach and Fractional Knapsack Problem using greedy methods.	BT 5
CO4	Compare algorithmic approaches such as backtracking, branch and bound, dynamic programming, and approximation algorithms based on time complexity, space complexity, and problem suitability.	BT 4
CO5	Assess and justify the selection of appropriate algorithmic strategies for solving combinatorial problems by analyzing their efficiency, scalability, and computational trade-offs.	BT5



Guidelines

Course Design and Assessment:

- Students must solve at least one problem from PR 3 or PR 4, one from PR 6 or PR 7, and one from PR 8 or PR 9 as part of their lab assignments.
- Your performance on the LeetCode platform will be considered for CCA. Ensure that you actively participate, solve assigned problems, and maintain consistency in your submissions.

Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.

Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Prerequisites: Programming and Problem Solving ,OOP

Course Objective:

5. To understand and implement various techniques for representing and manipulating sparse matrices.
6. To apply efficient hashing methods and compare their performance in resolving collisions.
7. To explore and implement well-known algorithms such as Dijkstra's, Bellman-Ford, and greedy methods to solve optimization problems.
8. To learn and apply backtracking, branch and bound, and approximation techniques in solving classic computational problems like N-Queens, Traveling Salesman, and Vertex Cover.

Course Outcomes: Student will-

CO1	Implement and optimize operations like addition, subtraction, multiplication, and transposition on sparse matrices.	BT 5
CO2	Demonstrate proficiency in applying different hashing techniques such as Linear Probing, Quadratic Probing, and Chaining to handle collision resolution.	BT 4



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CO3	Implement and analyze the efficiency of Dijkstra's Algorithm, Bellman-Ford Algorithm, "Finding Maximum and Minimum" problem using the divide & conquer approach and Fractional Knapsack Problem using greedy methods.	BT 5
CO4	Compare algorithmic approaches such as backtracking, branch and bound, dynamic programming, and approximation algorithms based on time complexity, space complexity, and problem suitability.	BT 4
CO5	Assess and justify the selection of appropriate algorithmic strategies for solving combinatorial problems by analyzing their efficiency, scalability, and computational trade-offs.	BT5

Guidelines

Course Design and Assessment:

- Students must solve at least one problem from PR 3 or PR 4, one from PR 6 or PR 7, and one from PR 8 or PR 9 as part of their lab assignments.
- Your performance on the LeetCode platform will be considered for CCA. Ensure that you actively participate, solve assigned problems, and maintain consistency in your submissions.

Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.

Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Syllabus



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PR1	Implement a program to represent a sparse matrix using an array. a) Perform operations like addition, subtraction, and multiplication of sparse matrices. b) Implement the Fast Transpose algorithm to efficiently compute the transpose of a sparse matrix.
PR2	Implement different hashing techniques: a) Linear Probing and Quadratic Probing b) Chaining (with and without replacement) and Compare and analyse collision resolution methods.
PR3	Implement Dijkstra's Algorithm for the shortest path using greedy method.(Vlab)
PR4	Solve the Fractional Knapsack problem using the greedy method.(Vlab)
PR5	Solve the "Finding Maximum and Minimum" problem using the divide & conquer approach.
PR 6	Bellman-Ford Algorithm for shortest paths using dynamic programming.
PR 7	Solve the Multistage Graph Problem using dynamic programming.
PR 8	Implement the N-Queens Problem using backtracking.
PR 9	Implement the 0/1 Knapsack Problem using backtracking.
PR 10	Implement the Traveling Salesman Problem using Branch and Bound.
PR 11	Solve the Vertex Cover problem using an approximate algorithm.
Text Books:	
1. Brassard & Bratley, "Fundamentals of Algorithms", Prentice Hall India/Pearson Education, ISBN 13-9788120311312. 2. Data Structures and Algorithms by Aho, Hopcroft, and Ullman Covers fundamental algorithms including sorting, graph algorithms, and dynamic programming.	
Reference Books:	



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1. Steven S S. Skiena, "The Algorithm Design Manual", Springer, 2nd ed. 2008 Edition, ISBN- 13: 978-1849967204, ISBN-10: 1849967202.
2. M. Weiss, "Data Structures and Algorithm Analysis in C++", 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
3. "Algorithm Design" by Jon Kleinberg and Éva Tardos Publisher: Pearson ISBN-13: 978-0321295354

Journal Papers:

1. **Journal of the ACM (JACM)**, "Efficient Algorithms for Sparse Matrix Multiplication," *Journal of the ACM*, vol. XX, no. YY, pp. ZZ-ZZ, Year, Link.

Vlab:

1. **Greedy Algorithm – Fractional Knapsack** <https://ds1-iiith.vlabs.ac.in/exp/fractional-knapsack/index.html>
2. **Dijkstra's Shortest Path Algorithm** <https://ds1-iiith.vlabs.ac.in/exp/dijkstra-algorithm/index.html>

NPTEL:

1. Design and Analysis of Algorithms (IIT Madras) by Prof. Madhavan Mukund <https://nptel.ac.in/courses/106/106/106106131/>
2. Data Structures and Algorithms (IIT Kharagpur) by Prof. S. G. Shantharam <https://nptel.ac.in/courses/106/106/106106130/>
3. Design and Analysis of Algorithms (IIT Delhi) by Prof. Naveen Garg <https://nptel.ac.in/courses/106/102/106102064/>

Scheme for Practical Examination

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Problem-Solving Assessment (LeetCode Challenges, Geeks for Geeks)	20	50	20



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		Mini Project	20		
		Quality of Code Submissions and Solutions	5		
		Regular Coding Practice Attendance	5		
End semester examination	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	1		-	-	-	-	2	3	2	2
CO2	3	3	2	2	2	-	-	-	-	-	2	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	2	3	3	2
CO4	3	3	3	2	2	-	-	1	-	-	2	2	3	2
CO5	3	3	3	2	2	1	1	-	1	1	2	2	3	2



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Course Category	Program core course	Course Code: IT124PC403
Course Title	Computer Network	

Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks		Practical Marks	
					Max	Min Marks for Pass	Max	Min for Pass
3	0	0	3	CCE	50	20	40	-
Total Hours				ESE	50	20		
39	0	0	Total hrs: 39		100			

Prerequisites: Basics of communication

Course Objectives: (Min 3)

1. To introduce the fundamental concepts of computer networks and familiarize students with the OSI and TCP/IP models.
2. To study IP addressing, routing mechanisms, and transport layer protocols, including TCP and UDP.
3. To explore application layer, wireless networks, standards, and Adhoc network protocols, including MAC layer and sensor network architectures.
4. To provide a foundational understanding of network security, cryptographic principles, and authentication mechanisms.
5. To explore secure transport protocols, network security mechanisms, and tools for intrusion detection and prevention.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Students will be able to explain network classifications, architectures, and the functionalities of physical and data link layers.
CO2	Students will be able to apply IP addressing, routing algorithms, and transport protocols (TCP/UDP) to design and optimize data transmission in networks.
CO3	Students will be able to understand application layer, wireless networks, various wireless standards, and recognize the MAC layer, routing protocols, and sensor network architecture
CO4	Students will be able to analyze network vulnerabilities and evaluate cryptographic techniques to ensure data security.
CO5	Students will be able to evaluate and implement secure communication protocols and configure security tools like firewalls and IDS/IPS systems for network protection.



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Syllabus

Unit I	Introduction to Computer Networks	8 hrs
	Overview of Networking: Definition, goals, and applications, Types of networks: LAN, MAN, WAN, PAN, OSI and TCP/IP models: Layers and functionalities Physical and Data Link Layers: Transmission media (wired and wireless) Switching techniques: Circuit, packet, and message switching Error detection and correction mechanisms	
Unit II	Network and Transport Layer Protocols	8 hrs
	Network Layer: IP addressing: IPv4, IPv6, Subnetting and supernetting, Introduction to NAT (Network Address Translation), Routing concepts: Static and dynamic routing Routing Algorithms and Protocols: Distance Vector, Link State, and Path Vector, Protocols: RIP, OSPF, BGP Transport Layer Protocols: TCP: Features (reliability, flow control, error control, connection establishment), UDP: Features and applications, Comparison: TCP vs UDP, Multiplexing, demultiplexing, and port addressing	
Unit III	Application Layer	7 hrs
	Client Server Paradigm: Communication using TCP and UDP, Peer to Peer Paradigm, Application Layer Protocols: DNS, FTP, TFTP, HTTP, SMTP, POP, IMAP, MIME, DHCP	
Unit IV	Wireless Standards & WSN	8 hrs
	Wireless LANs: Fundamentals of WLAN, Design goals, Characteristics, Network Architecture, IEEE 802.11: components in IEEE 802.11 network, Physical Layer, MAC Sub Layers: DCF, PCF, Hidden and exposed station problem, Frame format, Addressing Mechanism, IEEE 802.15.1, Bluetooth: Architecture, Layers, operational states, IEEE 802.16 WiMax: Services, Architecture, Layers, comparison between Bluetooth, IEEE 802.11 and IEEE 802.16. Wireless Sensor Network: Applications of Sensor Network, Comparison with Ad Hoc Wireless Network, Sensor node architecture Issues and Challenges in Designing a Sensor Network,	



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	Classification of sensor network protocols, SENSOR NETWORK ARCHITECTURE: Layered Architecture, Clustered Architecture	
Unit IV	Security Fundamentals	8 hrs
	Importance and Need for Security, Network Attacks- Passive, Active Network Security Threats: Unauthorized access, Distributed Denial of Service (DDoS) attacks, Man in the middle attacks Concept of Security Principles: Confidentiality and Privacy, Authentication, Authorization and Access Control, Integrity, Non-repudiation, Stream Ciphers: Substitution Cipher – Mono alphabetic Cipher, Polyalphabetic Substitution Cipher., Transposition Cipher: Rail-Fence Block Ciphers modes: Electronic Code Book (ECB) Mode., Cipher Block Chaining (CBC) Mode., Cipher Feedback Mode (CFB) , Output Feedback (OFB) Mode.	

References

Text Books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.
2. C. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols, Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition.
3. Atul Kahate Cryptography and Network Security, 3e, McGraw Hill Education,
4. B. A. Forouzan Cryptography and Network Security McGraw Hill Education
5. William Stallings Cryptography and Network Security: Principles and Practice, 4th Edition.
6. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley

References Books:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley India, ISBN: 9788126527304
2. Schneir, Bruce, "Applied Cryptography: Protocols and Algorithms"
3. Charles E. Perkins, Adhoc Networking, Pearson Education, 978-81-317-2096-7
4. Andrew S. Tanenbaum, David J. Wetherall, Computer Network, Pearson Education, ISBN: 978-0-13- 212695-3.
5. Kurose Ross, Computer Networking: A Top Down Approach Featuring the Internet, Pearson Education, ISBN: 978-81-7758-878-



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6. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978- 81-203-5082-3

Journal Papers:

S. S. Patil and S. S. Suryawanshi, "An Insight into IP Addressing," International Journal of Advanced Research in Computer and Communication Engineering, vol. 9, no. 5, pp. 123-127, May 2020.

El-Hoiydi, "**Performance Analysis of Wireless Network Using Bluetooth and IEEE 802.11 Devices**," in Proceedings of the 2001 International Zurich Seminar on Broadband Communications, Zurich, Switzerland, 2001, pp. 1-5.

You Tube:

<https://www.youtube.com/@NesoAcademy>

<https://www.youtube.com/@KnowledgeGate>

Website:

1. <https://nptel.ac.in/courses/106/105/106105160/>

2. <https://nptel.ac.in/courses/106/105/106105031/>

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	UT1		UT2			25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3	PS O4
CO1	3	3	2	2	-	-	-	-	-	1	-	2	2	3	2
CO2	3	3	2	2	1	-	-	-	-	1	-	2	2	2	2
CO3	-	3	2	2	2	1	-	-	-	-	-	2	3	2	2
CO4	3	3	2		2	-	-	-	-	1	-	2	3	2	2
CO5	3	2	2	2	2	-	-	-	-	-	-	2	2	2	2



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Course Category	Program core course			Course Code: IT124PC404			
Course Title	Computer Network						
Teaching Scheme				Evaluation Scheme			
L (Hr)	T (Hr)	P (Hr)	Cr	Exam	Lab % Marks		
					Max %	Min marks for Passing	
0	0	2	1	CCE	50	20	40
0	0	0		ESE	50	20	
Prerequisites: Object-Oriented Programming (OOP),Basics of Computer Networks and Protocols							
Course Objective:							
1. To introduce the fundamental concepts of computer networks and familiarize students with the OSI and TCP/IP models. 2. To study IP addressing, routing mechanisms, and transport layer protocols, including TCP and UDP. 3. To explore application layer, wireless networks, standards, and Adhoc network protocols, including MAC layer and sensor network architectures. 4. To provide a foundational understanding of network security, cryptographic principles, and authentication mechanisms. 5. To explore secure transport protocols, network security mechanisms, and tools for intrusion detection and prevention							
Course Outcomes: After successful completion of the course the student will							
CO1	Explain network classifications, architectures, and functionalities of physical and data link layers.						BT 2
CO2	Apply IP addressing, routing algorithms, and transport protocols (TCP/UDP) to design and optimize data transmission.						BT 3
CO3	Understand application layer, wireless networks, various wireless standards, and recognize MAC layer, routing protocols, and sensor network architectures.						BT 4
CO4	Analyze network vulnerabilities and evaluate cryptographic techniques to ensure data security						BT 4
Guidelines							
Course Design and Assessment:							
● The assignments are divided into four groups (A, B, C, and D), each covering different aspects of networking. ● Group A & B assignments focus on fundamental networking concepts and are to be implemented using Python, avoiding built-in networking methods where possible. ● Group C & D assignments emphasize C++ implementation for advanced networking scenarios and real-world problem-solving.							



- A minimum of 9 assignments must be completed, ensuring at least:
- 2 assignments from Group A
- 2 assignments from Group B
- 2 assignments from Group C
- 3 assignments from Group D

Laboratory Journal Submission:

Students must maintain a laboratory journal with a structured format:

- Title, Objective, Problem Statement, and Outcomes.
- Theory (Concepts and Algorithms), Flowchart, and Test Cases.
- Program Code, Sample Output, Conclusion, and Analysis.
- Journals must be handwritten for problem-solving write-ups but may include soft copies of code and outputs to reduce paper usage.

Evaluation and Assessment:

Continuous evaluation based on:

- Timely submission of assignments.
- Code efficiency and innovation.
- Problem-solving and debugging skills.
- Punctuality and active participation.

Practical examination must include problem-solving demonstrations, viva voce, and code walkthroughs to assess conceptual clarity.

Syllabus	
	GROUP A
PR1	Explore and Study of TCP/IP utilities and Network Commands on Linux. a) Ping g) Tracert/Traceroute/Tracepath b) ipconfig / ifconfig h) NSlookup c) Hostname i) Arp d) Whois j) Finger e) Netstat k) Port Scan / nmap f) Route
PR2	Write a program for error detection and correction for ASCII codes using CRC.
PR3	Write a program to simulate Go-back-N and Selective Repeat modes of sliding window protocol.



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	GROUP B
PR4	Using a Network Simulator (e.g. packet tracer) Configure Sub-netting of a given network Super-netting of a given networks
PR5	Using a Network Simulator (e.g. packet tracer) Configure Router for... Configure Access Control lists – Standard & Extended.
PR6	Using a Network Simulator (e.g. packet tracer) Configure Router for... Network Address Translation: Static, Dynamic & PAT (Port Address Translation)
	GROUP C
PR 7	Using a Network Simulator (e.g. packet tracer) Configure a router using router commands and Configure Routing Information Protocol (RIP).
PR8	Using a Network Simulator (e.g. packet tracer) Configure Routing Protocol EIGRP – Explore Neighbor-ship Requirements and Conditions, its K Values Metrics Assignment and Calculation
PR9	Using a Network Simulator (e.g. packet tracer) Configure Routing Protocol OSPF – Explore Neighbor-ship Condition and Requirement, Neighbor-ship states, OSPF Metric Cost Calculation.
	GROUP D
PR10	Write Socket Program in C++/JAVA a) TCP Client, TCP Server
PR11	Write Socket Program in C++/JAVA a) UDP Client, UDP Server
PR12	Using a Network Simulator (e.g. packet tracer) Configure- WLAN with static IP addressing and DHCP with MAC security and filters
PR13	Introduction to server administration (server administration commands and their applications) and configuration of below Server: (Study/Demonstration Only) a) FTP b) Web Server
Text Books:	



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1. Behrouz A. Forouzan, TCP/IP Protocol Suite, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.
2. C. Siva Ram Murthy, B. S. Manoj, Adhoc Wireless Networks: Architecture and Protocols, Pearson Education, ISBN: 978-81-317-0688-6, 1st Edition.

Reference Books:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley India, ISBN: 9788126527304.
2. Bruce Schneier, Applied Cryptography: Protocols and Algorithms.
3. Charles E. Perkins, Adhoc Networking, Pearson Education, ISBN: 978-81-317-2096-7.
4. Andrew S. Tanenbaum, David J. Wethrall, Computer Network, Pearson Education, ISBN: 978-0-13-212695-3.

Journal Papers:

1. S. S. Patil and S. S. Suryawanshi, "An Insight into IP Addressing," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 9, no. 5, pp. 123-127, May 2020.
2. El-Hoiydi, "Performance Analysis of Wireless Network Using Bluetooth and IEEE 802.11 Devices," in *Proceedings of the 2001 International Zurich Seminar on Broadband Communications*, Zurich, Switzerland, 2001, pp. 1-5.

Vlab:

1. **Breaking the Shift Cipher**, <https://cse29-iiith.vlabs.ac.in/exp/shift-cipher/>
2. **Cryptographic Hash Functions and Applications** <https://cse29-iiith.vlabs.ac.in/exp/hash-functions/>
3. **Digital Signatures Scheme** <https://cse29-iiith.vlabs.ac.in/exp/digital-signatures/>

MOOCs:

1. <https://archive.nptel.ac.in/courses/106/105/106105183/> (Computer Network & Internet Protocol, Prof. Soumya Kanto Gosh & Prof. Sandeep Chakraborty)
2. <https://nptel.ac.in/courses/106105160> (Wireless Ad Hoc and Sensor Networks, IIT Kharagpur, Prof. S. Misra)



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Scheme for Practical Examination

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Assessment (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Attendance	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	1	-	-	-	-	-	2	3	2	2	2
CO2	3	3	2	2	2	-	-	-	-	-	2	3	3	3	2
CO3	3	3	3	2	2	-	-	-	-	-	2	3	3	3	3
CO4	3	3	3	2	2	1	-	-	-	-	1	2	3	3	3



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Course Category		Program Core Course			Course Code		IT124PC405		
Course Title		Software Engineering							
Teaching Scheme					Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
26	0	0	Total hrs: 26		100				
Prerequisites: Fundamentals of Programming Languages									
Course Objectives: (Min 3)									
1. To introduce students to fundamental principles of software engineering. 2. To develop the ability to analyze and design software requirements. 3. To apply design principles to real-world software development projects. 4. To impart an understanding of software testing and quality assurance frameworks. 5.To expose students to emerging trends and innovative practices in software engineering									
Course Outcomes: Student will									
CO1	Apply and analyze Software Engineering Principle like SDLC,Software process Models(Waterfall ,Agile, Spiral)								BT4
CO2	Evaluation of Software Requirements Specification (SRS) and Design Models is to ensuring the quality, feasibility, and correctness of a software								BT6



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CO3	Transform the requirement models into detailed design models by refining and structuring system specifications into architectural and component-level designs.	BT3
CO4	Assess Testing and maintenance practices using testing strategies like manual and automated testing.	BT4
CO5	Innovate Solutions Using Emerging Trends in Software Development and analyzing case study in software engineering.	BT5

Unit I	Introduction to Software Engineering and Software Process Models	6 hrs
	Concepts of Software Engineering: Definition and significance of software engineering Software engineering vs. traditional engineering disciplines Characteristics of good software, Software Development Life Cycle (SDLC) Overview Phases of SDLC: Requirements gathering, design, development, testing, deployment, and maintenance Waterfall, Agile, Spiral, and V-Model methodologies, Software Process Models Comparison of Waterfall, Agile (Scrum & Kanban), and Spiral models Advantages and limitations of each model, Introduction to Agile Principles : Agile manifesto, agility principles, Agile methods, Key principles of Agile development, Introduction to Extreme programming and Scrum	
Research Paper	https://www.researchgate.net/publication/325699454_Software_process_models_A_review_and_analysis	
Case Study	A Comparative Case Study of Waterfall and Agile Management	
Unit II	Software Requirements Engineering and Analysis	5 hrs



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	Requirement Engineering: Types of requirements: Functional vs. non-functional, Requirement gathering techniques (interviews, brainstorming, prototyping) Requirement Analysis and Specifications: Techniques for analyzing requirements, writing Software Requirement Specifications (SRS) Use cases and user stories Software Design Principles: Modular design and cohesion/coupling, Introduction to UML diagrams (Class, Use Case, Sequence Diagrams), Hands-on: Drawing simple UML diagrams for a small application	
Case Study	Prepare SRS on Online Learning Platform	
Unit III	Design Engineering	4 hrs
	Design Engineering: Design Process & quality, Design Concepts, design Model, Pattern-based Software Design. Architectural Design :Design Decisions, Views, Patterns, Application Architectures, Component level Design: component, Designing class based components, conducting component-level design, User Interface Design: The golden rules, Interface Design steps& Analysis,	
Case Study	Web App Design / Library Management System	
Unit IV	Software Testing and Maintenance	5 hrs
	Introduction to Software Testing: Importance of software testing, Types of testing: Unit testing, Integration testing, System testing, Acceptance testing. Testing Strategies: Black-box and White-box testing: Manual vs. Automated testing. Debugging and Maintenance: Debugging techniques and tools, Types of software maintenance: Corrective, Adaptive, Perfective, Preventive. Using tools like Selenium or Junit.	



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Case Study	Mobile banking application, Hands-on Session: Writing and executing simple test cases	
Unit V	Emerging Trends in Software Engineering and Case Study	6 hrs
	Introduction to DevOps: Continuous Integration/Continuous Deployment (CI/CD), DevOps tools overview (e.g., Jenkins, Docker, Kubernetes) Software Ethics and Legal Considerations: Intellectual property rights and software licensing, Ethical issues in software engineering. Industry Trends and Technologies: Artificial Intelligence in Software Engineering, Cloud-based software development, Low-code and no-code platforms. Case Study in Software Engineering: Analyzing successful and failed software projects, Discussion on lessons learned and best practices	
VLab	http://vlabs.iitkgp.ac.in/se/ Designing Test Suites	

References

Text Books:

1. Roger Pressman, —Software Engineering: A Practitioner's Approach, McGraw Hill, ISBN 0–07–337597–7
2. Pankaj Jalote, —An Integrated Approach to Software Engineering, Springer, ISBN 13: 9788173192715.

References Books:

1. Andrew Stellman and Jennifer Greene-"Applied Software Project Management"
2. Ian Sommerville-"Software Engineering" Prentice Hall India, ISBN-10: 0133056996
3. Frank Tsui, Orlando Karam, and Barbara Bernal —Fundamentals of Software Engineering, Prentice Hall India, ISBN-13: 978- 8120348981
4. S K Chang, —Handbook of Software Engineering and Knowledge Engineering, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1



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Journal Papers:

Senay Tuna Demirel, Resul Das , “Software Requirement Analysis: Research Challenges and Technical Approaches”, IEEE <https://doi.org/10.1109/ISDFS.2018.8355322>, 2018

NPTEL:

1) NPTEL Course: Software Project Management

2) NPTEL Course: Software Engineering

Scheme for Examination

Component	Level	UNIT I	UNIT II	UNIT III	UNIT IV	UNIT V	Total	Pass
ESE	Institute	10	10	10	10	10	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination,

Component	Weightage (Marks)	Description
Assignments (2)	10	Two individual assignments on any 2 units.
Quiz	10	MCQs on SRS, Software Models, Software Design.
Case Study	10	Any two case studies mentioned above.
Vlab	10	Vlab Assignment
Seminar Presentation (1)	5	Group presentation on software requirement, planning and cost estimation with example.
Attendance & Participation	5	Marks based on attendance, participation, and engagement in class activities.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	1	1	-	-	-	1	-	3	2	2
CO2	3	2	2	2	2	1	1	-	-	-	-	3	3	2
CO3	3	3	3	3	1	-	-	1	1	1	1	3	3	2
CO4	3	3	3	3	1	-	-	1	1	-	1	2	3	2
CO5	3	3	3	2	1	-	1	-	-	-	1	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category	Program Core Course	Course Code	IT124PC406
Course Title	Cryptography and Network Security		

		Teaching Scheme			Evaluation Scheme		
L	T	P	Cr	Exam	Theory % Marks		
					Max	Min for Pass	
2	1	0	2	CCE	50	20	40
24	0	0		ESE	50	20	

Prerequisites: Foundation of cyber security and basics of networking

Course Objective

By the end of the course, students will be able to:

1. Understand the basic principles of cryptography and its significance in digital communication.
2. Explain symmetric and asymmetric cryptographic techniques and their applications.
3. Analyze fundamental network security threats and tools to mitigate them.
4. Evaluate the role of cryptography and secure communication protocols in modern systems
5. Explore emerging trends in cryptography and network security along with ethical practices.

Course Outcomes : Outcome is specification of course the student will

CO1	Critically analyze the fundamental principles of cryptography, including encryption, decryption, and key management, to evaluate their effectiveness in securing digital communication.	BT3
CO2	Design secure solutions by applying symmetric algorithms (e.g., AES) and asymmetric algorithms (e.g., RSA) to address real-world data protection challenges.	BT 6
CO3	Evaluate the effectiveness of network security mechanisms, such as firewalls, VPNs, and intrusion detection systems, in mitigating emerging threats like sniffing and man-in-the-middle attacks.	BT5
CO4	Assess the role and impact of secure communication protocols like HTTPS, SSL/TLS, and SSH in ensuring data confidentiality and integrity over networks.	BT5
CO5	Assess the role and impact of secure communication protocols like HTTPS, SSL/TLS, and SSH in ensuring data confidentiality and integrity over networks.	BT6

Syllabus		
Unit I	Basics of Cryptography	5hrs
Introduction to Cryptography: • Definition, importance, and historical background of cryptography. • Cryptography's role in ensuring confidentiality, integrity, and authenticity. Types of Cryptography: • Symmetric vs. Asymmetric cryptography. • Key concepts: encryption, decryption, keys (public and private). Applications of Cryptography: • Real-world examples: secure messaging, digital signatures, and certificates. • o Overview of cryptographic protocols (SSL/TLS, HTTPS).		



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Unit II	Symmetric Key Cryptography	5hrs
Introduction to Symmetric Encryption: • Key concepts and importance in secure communication. • Examples of symmetric encryption algorithms (DES, AES). Strengths and Limitations of Symmetric Cryptography: • Challenges of key distribution. • Role of symmetric encryption in modern systems. Use Cases: • Applications in file encryption and secure storage.		
Unit III	Asymmetric Key Cryptography	5hrs
Introduction to Asymmetric Encryption: • Public and private key mechanisms. • Importance of asymmetric encryption in secure communication. Key Algorithms and Applications: • RSA and Diffie-Hellman key exchange. • Role in digital signatures and certificates. Comparison with Symmetric Cryptography: • Trade-offs: speed, security, and use cases.		
Unit IV	Fundamentals of Network Security	5hrs
Introduction to Network Security: • Overview of LAN, WAN, and Internet vulnerabilities. • Common network attacks: sniffing, spoofing, man-in-the-middle attacks. Network Security Tools and Techniques: • Role of firewalls, IDS/IPS (Intrusion Detection/Prevention Systems). • Virtual Private Networks (VPNs) and their applications. Importance of Secure Communication Protocols: • HTTPS, SSH, and their relevance in data transmission.		
Unit V	Emerging Trends and Ethical Practices in Cryptography and Network Security	4hrs
Advanced Cryptographic Techniques: • Blockchain cryptography basics. • Quantum cryptography overview. Current Network Security Challenges: • Zero-day vulnerabilities, ransomware, and APTs (Advanced Persistent Threats). Ethical and Legal Aspects: • Importance of ethical hacking. • Overview of data protection laws (e.g., GDPR, IT Act in India).		
Text Books:		



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Textbooks:

1. "Cryptography and Network Security: Principles and Practice" by William Stallings
2. "Introduction to Modern Cryptography" by Jonathan Katz and Yehuda Lindell

Reference Books:

Reference Books:

1. Network Security Essentials: Applications and Standards" by William Stallings
2. Applied Cryptography: Protocols, Algorithms, and Source Code in C" by Bruce Schneier

Scheme for Theory Examination

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Assessment (CCA)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit Test 1 (UT1)			Unit Test 2 (UT2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3						1			1		1	1	
CO2	3	3	2					1			1		1	1	
CO3	3	3						1			1		1	1	
CO4	3	3						1			1		1	1	
CO5	3	3	2					1			1		1	1	

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category		Open Elective			Course Code		IT124OE407		
Course Title		Healthcare Management System							
Teaching Scheme					Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
26	0	0	Total hrs: 26		100				
Prerequisites:									
Course Objectives:									
- To provide an understanding of healthcare systems, their structures, policies, and challenges. - To explore healthcare technologies such as medical instrumentation, wearable devices, and healthcare management systems. - To educate students on data security, privacy, and ethical considerations in healthcare - To analyze the role of AI, analytics, and engineering in healthcare decision-making and diagnostics. - To discuss future trends and innovations in healthcare technology, including IoMT, personalized medicine, nanotechnology, and telemedicine.									
Course Outcomes: Student will-									
CO1	Demonstrate knowledge of healthcare policies, regulations, and ethical considerations in patient data management.								BT 4
CO2	Analyze the contributions of engineering disciplines to healthcare technologies and hospital infrastructure.								BT 3
CO3	Assess the importance of cybersecurity, blockchain, and AI in ensuring data security and privacy in healthcare.								BT 4
CO4	Apply data analytics and AI-based tools for disease prediction, diagnostics, and healthcare logistics.								BT 3
CO5	Develop an interdisciplinary approach to problem-solving in healthcare technology and engineering.								BT 6



Syllabus

Unit I	Fundamentals of Healthcare Systems Overview of Healthcare Systems – Global healthcare models and digital transformation. Types of Healthcare Organizations – Hospitals, clinics, research institutions, and telehealth. Healthcare Policies and Regulations – HIPAA, NABH, WHO guidelines, medical ethics. Role of Engineering in Healthcare – Biomedical devices, hospital infrastructure, and automation. Challenges in Modern Healthcare – Sustainability, cost management, accessibility, and efficiency.	5 hrs
Unit II	Healthcare Technologies and Engineering Applications Medical Equipment and Instrumentation – MRI, CT scans, robotic surgery, prosthetics. Hospital Information and Management Systems – Patient data handling, scheduling, automation. Wearable Health Technologies – Smartwatches, fitness bands, biosensors for monitoring health. Role of Mechanical and Electrical Engineering – Ventilators, imaging systems, sterilization tools. Role of Civil and Environmental Engineering – Smart hospital design, HVAC systems, infection control.	5 hrs
Unit III	Data Security and Ethics in Healthcare Basics of Data Privacy in Healthcare – Patient confidentiality and data security measures. Cybersecurity in Healthcare – Risks, malware, and prevention strategies. Role of Blockchain in Medical Records – Securing patient data, decentralized information storage. Artificial Intelligence in Healthcare Security – Fraud detection, anomaly detection. Ethical Considerations – AI biases, patient data ownership, informed consent.	5 hrs
Unit IV	Healthcare Analytics and Decision-Making Introduction to Healthcare Analytics – Importance of data-driven solutions. Predictive Analytics in Disease Detection – Identifying early symptoms through machine learning. Imaging and AI-based Diagnostics – AI in radiology, pathology, and cancer detection. Healthcare Logistics and Supply Chain – Optimizing medical supply distribution. Application of Engineering in Prosthetics and Implants – 3D printing and bio-materials. Case Study: Smart Hospitals and Their Impact on Patient Care.	6 hrs



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Unit V	Future Trends and Innovations in Healthcare Technology Internet of Medical Things (IoMT) – Connected devices, real-time monitoring. Personalized Medicine and Bioinformatics – Genetic testing and AI-driven treatment planning. Role of Nanotechnology in Medicine – Drug delivery systems, nanosensors. Emerging Trends in Telemedicine – Remote consultations, AI-powered diagnosis. Case Study: The Role of Engineers in Pandemic Management – Lessons from COVID-19.	5 hrs
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References

TEXT BOOKS:

1. "Healthcare Operations Management" – Daniel B. McLaughlin, Julie M. Hays
2. "Cybersecurity in Healthcare: A Practical Guide" – Terrance J. O'Malley
3. "Telemedicine Technologies: Big Data, AI, and Cloud Computing" – Hemanth D. Jude

REFERENCE BOOKS:

1. "Health Care Information Systems: A Practical Approach for Health Care Management" – Karen A. Wager, Frances W. Lee, John P. Glaser
2. "Delivering Quality Healthcare for People With Disability" – Suzanne C. Smeltzer
3. "Cybersecurity for Hospitals and Healthcare Facilities" – Luis Ayala
4. "Essentials of Health Information Management: Principles and Practices" – Mary Jo Bowie
5. "Nanomedicine: Design and Applications of Magnetic Nanomaterials, Nanosensors, and Nanosystems" – Vijay K. Varadan



CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1									3	2	1
CO2	3	3	2	1								3	3	2
CO3	2	3	3	3	2	1						3	2	3
CO4	1	2	3	3	3	2	1					2	2	3
CO5	1	2	3	3	2							3	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

Scheme for Examination

Component	Level	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Faculty	5	5	5	5	5	25	20
	Department	5	5	5	5	5	25	
		Unit Test 1 (UT1)			Unit Test 2 (UT2)			
End Semester Examination (ESE)	Institute	10	10	10	10	10	50	20

Continuous Comprehensive Evaluation (CCE) Plan (50 Marks)

Component	Weightage (Marks)	Description
Assignments (2)	10	Two individual assignments covering topics such as Arrays, Linked Lists, and Tree Operations.
Quiz Gate Pattern(2)	10	Multiple-choice and problem-solving questions on Sorting Algorithms, ADTs, and Tree Traversals.
Case Study Analysis (1)	10	Analyze real-world scenarios involving applications of Trees, Graphs, and Searching Techniques.
Seminar Presentation (1)	10	Individual presentation on advanced topics like AVL Trees or Graph Traversals.
Attendance & Participation	10	Marks based on attendance, participation, and engagement in class activities.

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination



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Course Category		Value Education course			Course Code	IT124OE408	
Course Title		Web Application Development					
		Teaching Scheme			Evaluation Scheme		
L	T	P	Cr	Exam	Theory % Marks		
					Max	Min for Pass	
1	0	2	2	CCE	100	40	40
13	0	0					

Prerequisites: Programming and Problem Solving

Course Objective

1. Explore Bootstrap's mobile-first approach and responsive design principles.
2. Demonstrate the use of scripting language and event driven approach.
3. To explore the Front end web programming skills.
4. Learn the core concepts, built-in modules, and asynchronous nature of Node.js.
5. To understand and learn Web application deployment.

Course Outcomes: Student will

CO1	Design and develop responsive web applications using HTML, CSS, and Bootstrap, ensuring an optimized user experience by utilizing the Bootstrap components, utilities, and responsive design principles.	BT 6
CO2	Design and implement dynamic and interactive web client applications using a JavaScript framework including event-driven programming and DOM manipulation to enhance user experience.	BT 6
CO3	Compare the Virtual DOM with the traditional DOM and evaluate its efficiency.	BT 5
CO4	Develop and build server-side applications with Node.js like httpserver, socket server.	BT 6
CO5	Deploy a fully functional web application on the cloud using AWS by leveraging scalable compute resources.	BT 6

Syllabus

Unit I	Bootstrap	3 hrs
Introduction to Bootstrap: Overview of Bootstrap, Advantages of using Bootstrap, Setting up Bootstrap (CDN vs. Local Installation). Bootstrap Layout & Containers : Containers (.container, .container-fluid, .container-{breakpoint}) Bootstrap Grid System (Rows, Columns, and Breakpoints), Flexbox Utilities		



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Bootstrap Components : Buttons (.btn, .btn-primary, .btn-outline-*), Forms and Inputs (Validation, Input Groups, Checkboxes, Radio Buttons), Cards (Headers, Footers, Images, and Content)

Media Queries and Breakpoints.

Unit II	JavaScript and Event Handling	3 hrs
JavaScript: Introduction to JavaScript, basic syntax, variables and data types, statements, operators, literals, functions, objects, arrays, built in objects, DOM: Introduction to Document Object Model, DOM history and levels, intrinsic event handling, modifying element style, the document tree, DOM event handling, Event Handling: - onClick(), onSubmit(), onMouseOver() and onMouseOut(), java script cookies , create cookies.		
Unit III	React js	2 hrs
ReactJS: Introduction to ReactJS, React Components, Inter Components Communication, Components Styling, Routing, Redux- Architecture, Hooks- Basic hooks, useState() hook, useEffect() hook, useContext() hook.		
Case Study	Comparative analysis of various Front-End Technologies	
Unit IV	Node js	3 hrs
Introduction to Node.js (Basics & Setup) : Overview of Node.js, Installation of Node.js & NPM, Running a simple Node.js script (console.log("Hello, Node.js!")), Understanding the Node.js runtime environment Core Modules & File System: Introduction to CommonJS modules (require & module.exports) , built-in modules (fs - File System , path , os) , creating a basic file-handling application Building a Simple HTTP Server: understanding the http module, creating a basic web server with Node.js, Create HTTP Server, Create Socket Server		
Unit IV	Express js	2 hrs
Introduction to Node.js (Basics & Setup) : Overview of Node.js, Installation of Node.js & NPM, Running a simple Node.js script (console.log("Hello, Node.js!")), Understanding the Node.js runtime environment Core Modules & File System: Introduction to CommonJS modules (require & module.exports) , built-in modules (fs - File System , path , os) , creating a basic file-handling application Building a Simple HTTP Server: understanding the http module, creating a basic web server with Node.js, Create HTTP Server, Create Socket Server		
Case Study	Comparative analysis of various Front-End Technologies	
Unit V	Web Application Deployment	4 hrs



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Cloud: AWS Cloud, AWS Elastic Compute, AWS Elastic Load Balancer and its types, AWS VPC and Component of VPC, AWS storage, Deploy Website or Web Application on AWS, Launch an Application with AWS Elastic Beanstalk.

Text Books:

1. Jacob Lett "Bootstrap 4 Quick Start: A Beginner's Guide to Building Responsive Layouts with Bootstrap 4" ISBN-13 : 978-1732205819
2. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035.
3. Robert W. Sebesta, "Programming the World Wide Web", 4th Edition, Pearson education, 2008. ISBN 978-8131764589

Reference Books:

1. Marty Hall, Larry Brown, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.
2. H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429.

Journal Papers:

1. Journal paper for comparative analysis for web development technologies
https://link.springer.com/chapter/10.1007/978-981-99-1909-3_2

V Lab:

1. <https://vlead.vlabs.ac.in/development/#development-process>
2. <https://vlead.vlabs.ac.in/development/#hosting-process>

NPTEL :

1. https://onlinecourses.swayam2.ac.in/nou24_cs09/preview

CO-PO Mapping

	P O1	PO 2	PO 3	PO 4	P O5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	3	-	1	-	-	-	-	2	2	2
CO2	3	2	2	3	3	-	-	-	-	1	-	2	2	2
CO3	2	2	3	2	3	1	-	1	1	1	1	2	2	2
CO4	3	3	3	3	3	-	1	-	-	-	-	2	2	2
CO5	3	3	3	2	2	1	1	1	1	1	1	2	2	2

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Syllabus	
	GROUP A
PR1	https://vlead.vlabs.ac.in/development/#authoring-environment Vlab VS code environment
PR2	Create admin dashboard layout using sidebar with menu links, navbar at the top, grid layout to display analytics (like cards for Users, Sales, Orders, etc.), a Dark/Light mode switch using Bootstrap classes.
PR3	Create an interactive Rock-Paper-Scissors game against the computer. The user selects Rock, Paper, or Scissors . The computer randomly chooses an option. The game determines the winner and displays the result. Keep track of score .
	GROUP B
PR4	Implement an application in Java Script using following: a) Design UI of application using HTML, CSS, Bootstrap etc. b) Include Java script validation c) Use of prompt and alert window using Java Script e.g., Design and implement a simple calculator using Java Script for operations like addition, multiplication, subtraction, division, square of number etc.
PR5	Implement product listing page where users can filter products based on category, price range, and ratings using javascript.
PR6	Validate a registration form before submission. • Ensure the name is not empty. • Ensure email has a valid format. • Ensure the password is at least 6 characters long. • Show error messages dynamically using jQuery.
	GROUP C
PR 7	Implement a mobile-friendly photo gallery with jQuery Mobile.
PR8	Building a Mobile Form with Validation • Create a registration form with fields for name, email, password, and a submit button. • Use jQuery Mobile to style the form and make it responsive on different screen sizes. • Implement basic form validation (e.g., ensure the email is in the correct format, password is at least 6 characters long) using jQuery.



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PR9	https://vlead.vlabs.ac.in/development/#introduction0 Vlab on Development process
	GROUP D
PR10	Creating a Simple Node.js Script that prints "Hello, Node.js!" to the console.
PR11	Create a custom module (math.js) that exports functions for addition, subtraction, multiplication, and division. Import the module into app.js and perform calculations.
PR12	Create basic HTTP server using the http module. The server should respond with "Welcome to My Node.js Server!" on port 3000 .
PR13	Develop a web application using full stack development technologies in any of the following domains: 1. Social Media 2. ecommerce 3. Restaurant 4. Medical 5. Finance 6. Education 7. Any other
Text Books:	
1. Raymond Camden, Andy Matthews, jQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891 2. David Flanagan "JavaScript: The Definitive Guide" by– A deep dive into JavaScript for all levels.	
Reference Books:	
1. Kris Hadlock , "jQuery Mobile: Develop and Design" , Pearson India Education ISBN 978-8131775189 2. Raymond Camden, Andy Matthews, JQuery Mobile Web Development Essentials, Packt Publishing, Second Edition, 9781782167891.	
Journal Papers:	
Modern JavaScript frameworks: A Survey Study DOI: 10.1109/ZINC.2018.8448444 https://ieeexplore.ieee.org/document/8448444	
Vlab:	
1. https://vlead.vlabs.ac.in/development	



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NPTEL :

1. <https://nptel.ac.in/courses/106106156> Introduction to Modern Application Development, IIT Madras
2. <https://www.my-mooc.com/en/mooc/javascript-jquery-and-json> Javascript, JQuery & JSON



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Course Category	Ability Enhancement course	Course Code	IT124AE409
Course Title	Soft Skills		

Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks	
					Max	Min for Pass	Max	Min for Pass
0	1	2	2	ISE	--	--	100	40
Total Hours								
0	13	26	Total: 26		---	--	-	

Prerequisites: Basic English Grammar Skills	
Course Objective: Purposes of Course are:	
1. This course is designed to equip students with essential professional and technical communication skills necessary for success in the modern workplace. 2. Emphasizing both written and verbal communication 3. The course covers a wide range of topics, including effective written communication, active listening and public speaking.	
Course Outcomes: After Successful completion of course units, students will	
CO1	Express effectively through verbal or oral communication and Write precise briefs, essays, summaries or reports and technical documents for official communication.
CO2	Students will understands ethics and values for being a good professional
CO3	Learn to work in a team and handle conflicting situations in corporate world
CO4	Students will develop their leadership qualities for being a successful professional
CO5	Students will be able to create and deliver effective presentations

Syllabus

Unit I	Self-Introduction & SWOC Analysis	02 Hrs.
Difference between hard skills and Soft skills, Introduction of SWOC Analysis, Importance of Soft Skills in corporate setting, Formal / Informal self-introduction, goal setting, and how to maintain your attitude towards various circumstances.		
Unit II	Writing Skills	02Hrs.



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Practicing and understanding various formats of writing skills. Discussion on types of reports, various formats of report writing. Understanding Email etiquette and types of email. Writing emails on different topics. Practicing resume writing and its various formats. Types of application and how to write them.		
Unit III	Professionalism & Ethics	03 Hrs.
Understanding ethics and morals, Importance of Professional Ethics, hindrances due to absence of Work ethics, Professional etiquette – Introductions, with colleagues, attire, events, dinning, telephone, travelling, netiquette, social media, writing. Stress as integral part of life, Identifying signs and sources of stress, Steps to cope with stress – open communication, positive thinking, Belief in oneself, ability to handle failure, Retrospective thinking for future learning, Organizing skills to enhance time management, Focusing on goals, smart work vs hard work, Prioritizing activities, Perils of procrastination, Daily evaluation of “to-do” list.		
Unit IV	Group Discussion & Personal Interview	03 Hrs.
Introduction to Group Discussion, Difference between Group Discussion and debate, Etiquettes while conducting Group Discussion, Professional Phases to be used in Group Discussion, Understanding types of Interview, Grooming and etiquette while giving an Interview, Understanding Job Description and Studying Company Profile, Strategies and techniques to ace the interview		
Unit V	Interpersonal & Intrapersonal Skills	03 Hrs.
Differences of interpersonal and intrapersonal skills, Introduction of team building, Introduction to leadership and types of Leadership, Identifying your weakness and focussing on your strength to become a good leader, Introduction to Presentation Skills, 5P’s of Presentation, Types of Presentation		
	Practical/ Lab Sessions	
Lab Session	Activities	Duration (Hrs.)
1	Speaking Skills- Self Introduction: Introduce your friend	2
2	Team Building Activity	2
3	How to study job description and company profile : "Job Detective"	2
4	Grooming and image management	2
5	Speaking Skills- JAM Session	2
6	Speaking Skills- Debate session	2
7	Group Discussion	2
8	Group Discussion	2
9	Case study analysis : Problem solving and critical thinking : "The Problem-Solvers' Challenge"	2



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10	Presentation Skills	2
11	Presentation Skills	2
12	Personal Interview – Conducting of mock interview	2
13	Personal Interview – Conducting of mock interview	2

Reference Books

1. Indrajit Bhattacharya, “An Approach to Communication Skills”, Dhanpat Rai.
2. Simon Sweeney, “English for Business Communication”, Cambridge University Press.
3. Sanjay Kumar and Pushpa Lata, “Communication Skills”, Oxford University Press.
4. Atkinson and Hilgard's, “Introduction to Psychology”, 14th Edition.
5. Kenneth G. Mcgee, “Heads Up: How to Anticipate Business Surprises & Seize Opportunities First”, Harvard Business School Press, Boston, Massachusetts.
6. R. Gajendra Singh Chauhan and Sangeeta Sharma, “Soft Skills-An integrated approach to maximize personality”, Wiley Publication, ISBN: 987-81-265-5639-7

MOOC / NPTEL Courses:

1. NPTEL Course “Developing Soft skills & Personality”
<https://nptel.ac.in/courses/109/104/109104107/>
2. NPTEL Course “Communication Skills”
<https://nptel.ac.in/courses/109/104/109104030/>
3. NPTEL Course “Effective Writing” <https://nptel.ac.in/courses/109/107/109107172/>
4. NPTEL Course “Interpersonal Skills” <https://nptel.ac.in/courses/109/107/109107155/>

Rubrics for Continuous Evaluation

Rubrics for ISE (100)		
No	Component	Marks
1	Assignment 6 Assignments*5 Marks each = 30Marks	30
2	Quiz - Pre & Post Diagnostic Test-15 Marks Quiz on Unit 1 & 2 -15 Marks	30
3	Micro Project: Content creation- 15 Marks Presentation of the Report-15 Marks	30
4	Attendance	10
	Total Marks:	100



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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	0	0	0	0	0	0	0	1	3	0	2
CO2	0	0	0	0	0	0	3	1	0	0	2
CO3	0	0	0	0	0	1	3	3	1	3	2
CO4	0	0	0	0	0	0	3	1	0	2	2
CO5	0	0	0	0	0	0	2	2	1	1	3

3: High, 2: Moderate, 1: Low, 0: No Mapping



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Course Category		Entrepreneurship, /Economics and Management			Course Code		IT124AE410		
Course Title		Entrepreneurship, Management & Software Project Execution							
Teaching Scheme					Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min
						for Pass			
2	0	0	2	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
26	0	0	Total hrs: 26		100				
Prerequisites: Software Development & Engineering Concepts									
Course Objectives:									
1. Develop entrepreneurial skills for IT startups and software businesses. 2. Understand business planning, marketing, and financial models in software ventures. 3. Gain insights into software project execution, Agile methodologies, and leadership. 4. Learn to apply project management tools for efficient software development.									
Course Outcomes: Student will-									
CO1	Analyze entrepreneurship principles and software startup ecosystems.								BT 4
CO2	Design viable business and financial models for IT and software ventures.								BT 6
CO3	Evaluate software project management methodologies (Agile, Scrum, DevOps).								BT 5
CO4	Formulate leadership, team management, and conflict resolution strategies in IT projects.								BT 6
CO5	Apply project management tools like JIRA, GitHub Projects, and Monday.com for Agile software execution.								BT 3



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Syllabus

Unit I	IT Entrepreneurship and Software Start-up Ecosystem: Introduction to Entrepreneurship and Innovation in IT, Characteristics of Successful IT Entrepreneurs. Lean Start-up Methodology and Minimum Viable Product (MVP) Development, Role of Technology Incubators and Venture Capital in IT Start-ups. Case Studies on Successful IT Start-ups, Eg: Uber – Revolutionizing Transportation with a Ride-Sharing Model, Netflix – Transforming from DVD Rentals to a Streaming Giant etc.	5 hrs
Unit II	Business Models, Financial Management & Software Contracts :Understanding Business Model Canvas for IT Start-ups, Revenue Models and Pricing Strategies in Software Businesses, Software Licensing and Intellectual Property Considerations, Financial Planning, Funding, and Bootstrapping for IT Start-ups, Contract Management in IT: Service-Level Agreements (SLAs) and Legal Aspects. Case Studies on Building Business Models, Eg: Amazon – The Evolution from E-Commerce to Cloud Computing Giant, Tesla – Direct-to-Consumer Sales and Vertical Integration, etc.	5 hrs
Unit III	Software Project Execution, Agile Methodologies & Tools: Overview of Agile Project Management, Scrum, and Kanban, Software Development Lifecycle (SDLC) and Project Execution Strategies, Hands-on Training in JIRA, GitHub Projects for Agile Execution, DevOps and CI/CD (Continuous Integration & Continuous Deployment), Sprint Planning, Backlogs, and Iterative Development Eg: Microsoft – Shifting Windows Development to Agile & DevOps, Spotify – Scaling Agile with the Spotify Model etc.	6 hrs
Unit IV	Leadership, Team Management, and Conflict Resolution in IT Projects: Leadership Styles and Their Impact on Software Teams, Team Building, Motivation, and Communication in IT Companies, Conflict Resolution and Decision-Making in IT Project Teams, Delegation, Task Assignment, and Performance Evaluation	5 hrs
Unit V	Risk, Quality Assurance, and Scaling IT Start-ups: Identifying and Mitigating Risks in IT Projects, Software Quality Assurance (SQA) and Testing Strategies, Scaling Strategies for IT Start-ups and Product Growth, Managing Technical Debt and Business Expansion Challenges.	5 hrs



References

TEXT BOOKS:

1. **Hisrich, Robert, Peters, Michael, and Shepherd, Dean** – Entrepreneurship, 11th Edition, McGraw-Hill.
2. **Osterwalder, Alexander, and Pigneur, Yves** – Business Model Generation, Wiley.
3. **Schwalbe, Kathy** – Information Technology Project Management, 9th Edition, Cengage Learning.
4. **Kerzner, Harold** – Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 12th Edition, Wiley.
5. **Bass, Len, Weber, Ingo, and Zhu, Liming** – DevOps: A Software Architect's Perspective, Addison-Wesley.

REFERENCE BOOKS:

1. **Ries, Eric** – The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business.
2. **Blank, Steve, and Dorf, Bob** – The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, Wiley.
3. **Sutherland, Jeff** – Scrum: The Art of Doing Twice the Work in Half the Time, Random House.
4. **McConnell, Steve** – Rapid Development: Taming Wild Software Schedules, Microsoft Press.
5. **Bass, Barry, and Roy, Thomas** – Agile Software Development: Principles, Patterns, and Practices, Pearson.



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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-		-	-	2	3	2	2
CO2	3	3	2	2	1	-	1	1	-	-	2	3	3	2
CO3	3	3	3	2	1	-	-		-	1	2	3	3	2
CO4	3	3	3	2	1	-	1	1	1	1	2	2	3	2
CO5	3	3	3	2	1	1	-	1	1	-	2	2	3	2

3: High, 2: Moderate, 1: Low, 0: No Mapping

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
ESE	Institute	10	10	10	10	10	50	20

Continuous Comprehensive Evaluation (CCE) Plan (50 Marks)

Component	Weightage (Marks)	Description
Assignments (2)	10	Two individual assignments covering topics such as Arrays, Linked Lists, and Tree Operations.
Quiz Gate Pattern(2)	10	Multiple-choice and problem-solving questions on Sorting Algorithms, ADTs, and Tree Traversals.
Case Study Analysis (1)	10	Analyze real-world scenarios involving applications of Trees, Graphs, and Searching Techniques.
Seminar Presentation (1)	10	Individual presentation on advanced topics like AVL Trees or Graph Traversals.
Viva (Oral Exam)	5	Oral questions on algorithm complexity analysis and data structure applications.
Attendance & Participation	5	Marks based on attendance, participation, and engagement in class activities.

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination



Course Category		Value Education Course 2		Course Code		IT124AE411		
Course Title		Sustainable Development - 2						
Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory Marks		Practical Marks	
					Max	Min Marks for Pass	Max	Min for Pass
2	0	0	2	CCE	100	40	-	-
Total Hours								
26	0	0	Total hrs: 26					
Prerequisites:								
None								
Subjects Included:								
Universal Human Values (UHV) 3 units								
Constitution of India 1 unit								
Corporate Laws 1 unit								
Course Objectives: (Min 3)								
Understand Universal Human Values (UHV) – Develop ethical, moral, and professional values in students.								
Apply UHV in Personal and Professional Life – Explore human relationships, harmony, and responsible behavior.								
Develop Ethical Decision-Making Skills – Analyze real-life scenarios and case studies to build decision-making abilities.								
Study Constitutional Rights and Duties – Understand fundamental rights, directive principles, and governance structure.								
Understand Corporate Laws – Explore the regulatory framework governing businesses and corporate ethics.								
Course Outcomes: After successful completion of the course the student will be able to								
CO1	DEFINE the fundamental concepts of Universal Human Values (UHV).							
CO2	EXPLAIN the significance of ethical values and human relationships in society.							
CO3	ANALYZE ethical dilemmas and decision-making frameworks in professional contexts.							
CO4	DESCRIBE the fundamental rights, duties, and governance structure of India.							
CO5	UNDERSTAND key aspects of corporate laws and ethical business practices.							



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B Tech in-----Engineering | S Y B Tech Semester II (2024 COURSE)

Syllabus

Unit I	Introduction to Universal Human Values (UHV)	6 hrs
	Meaning and importance of UHV, ethical values, role in personal and professional life, self-exploration.	
Unit II	Human Relationships & Harmony	6 hrs
	Role of relationships in family, society, and workplace; conflict resolution; social responsibility; sustainability in human interactions.	
Unit III	Ethical Decision-Making	6 hrs
	Case studies on ethical dilemmas, corporate ethics, moral reasoning, frameworks for ethical decision-making.	
Unit IV	Constitution of India	4 hrs
	Fundamental rights and duties, directive principles, governance structure, significance of constitutional amendments, case laws.	
Unit V	Corporate Laws & Business Ethics	4 hrs
	Overview of business laws, corporate governance, ethical leadership, corporate social responsibility (CSR), impact of regulations on industries.	

Scheme for Examination

Component	Parameters	Marks	Total	Pass
CCE	Viva Voce for assessment of Understanding	20	50	20
	Involvement, Participation, and Engagement	10		
	Quality of Submission of Report	10		
	Attendance	10		
End Evaluation	Performance (Internal)	25	50	20
	Oral Examination (Internal)	25		

CCE: Continuous Comprehensive Evaluation (CCE)

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3									3	3
CO2	3	3	3	3									3	3
CO3	3	3	3	3									3	3
CO4	3	3	3	3									3	3
CO5	3	3	3	3									3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping*****



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Course Category	Non credit course	Course Code	IT124NC412
Course Title	Advanced Java		

Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks	
					Max	Min for Pass	Max	Min for Pass
0		2			--	--	50	20
Total Hours								
0		26	Total: 26		---	--	-	

Prerequisites: Knowledge of Core Java and Object-Oriented Programming

Course Objective:

1. To understand **JDBC, Servlets, JSP, Hibernate, and Spring Framework**
2. To develop **dynamic web applications** using Java EE technologies
3. To implement **real-world projects** using advanced Java concepts

Course Outcomes: After Successful completion of course units, students will

1. Demonstrate **logical reasoning and data interpretation** skills for real-world scenarios.
2. Write, debug, and optimize **Python/Java programs** to solve industry-standard coding problems.
3. Successfully attempt **company-specific technical assessments** using hands-on coding practice.

Syllabus

Unit I	JDBC – Java Database Connectivity	4Hrs.
Introduction to JDBC – Need for JDBC, Types of Drivers, JDBC Architecture & Connection Process , CRUD Operations in JDBC – Insert, Update, Delete, Select, Advanced JDBC – PreparedStatement, CallableStatement, ResultSet, Transaction Management & Connection Pooling		
Unit II	Servlets – Web Development	3Hrs.



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Introduction to Servlets – Features & Advantage,Servlet Life Cycle – init(), service(), destroy(),Handling HTTP Requests – GET vs POST,Session Management Techniques – Cookies, HttpSession, URL Rewriting,Servlet Communication – RequestDispatcher & ServletConfig,File Uploading & Downloading using Servlet		
Unit III	JSP (Java Server Pages)	06 Hrs.
Introduction to JSP – Need for JSP, Advantages over Servlets,JSP Life Cycle & Implicit Objects,JSP Scripting Elements – Directives, Scriptlets, Expressions,JSP Tag Libraries (JSTL) & Custom Tags,JSP with JDBC – Building Dynamic Web Applications		
Unit IV	Hibernate & ORM	03 r s .
Introduction to ORM & Hibernate Framework,Hibernate Architecture & Configuration,Hibernate CRUD Operations (Save, Update, Delete, Fetch),Hibernate Query Language (HQL) & Criteria API,Hibernate Relationships (One-to-One, One-to-Many, Many-to-Many)		
Unit IV	Spring Framework & REST APIs	10 r s .
Introduction to Spring Framework & Core Concept,Spring Dependency Injection (DI) & Inversion of Control (IoC),Introduction to RESTful Web Services – REST API Basics,Building REST APIs using Spring Boot, Mini Project – Web Application using Spring Boot & Hibernate		
Reference Books		
1. JDBC™ API Tutorial and Reference" by Seth White, Maydene Fisher, Jonathan BruceETHNUS,. <i>Aptimithra</i> , 1st (Ed.). Bangalore: McGraw-Hill Education Pvt. Ltd. 2 Head First Servlets and JSP" by Bryan Basham, Kathy Sierra, Bert Bates (Best for beginners) 1. "Hibernate in Action" by Christian Bauer, Gavin King 2. Spring in Action" by Craig Walls		
NPTEL: https://onlinecourses.nptel.ac.in/noc22_cs47/preview?		



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Assignments:

- 1. Develop a console-based Student Database System using JDBC**
- 2. Implement Stored Procedures with CallableStatement**
- 3. Implement User Login System using Servlets**
- 4. Develop a Session Tracking Example (Shopping Cart)**
- 5. Develop a JSP-based Employee Management System**
- 6. Implement a JSP-based Online Registration Form**



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Course Category	Non-credit course				Course Code		IT124NC413		
Course Title	Aptitude & Technical Mastery for Placements-II								
Teaching Scheme					Evaluation Scheme				
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0		2			--	--	--	50	20
Total Hours							-		
0		26	Total: 26		---	--			

Prerequisites: Basic Mathematics & Fundamentals of Programming		
Course Objective:		
Unit I	Quantitative Aptitude	4 Hrs.
1. Time, Speed, and Distance - Intermediate and Advanced 2. Areas and Volumes - Intermediate and Advanced		
Unit II	Verbal Ability	03 Hrs.
1. Critical Reasoning & Analogies 2. Sentence Completion- Advance		
Unit III	Reasoning Ability	06 Hrs.
1. Data Interpretation - Advanced 2. Cubes & Dices 3. Data Sufficiency		
Unit IV	Career Skills	03 Hrs.
1. Networking Skills 2. LinkedIn Profile Building & Internship Outreach		
Unit IV	Tech Essentials	10 Hrs.
1. Python for Non-Circuit, 2. Java for Circuit Branches 3. Programming fundamentals & applications 4. Hands-on Coding on LeetCode & HackerRank 5. Solving industry-standard problems		
Reference Books		
1. R. S. Aggarwal,. <i>Quantitative Aptitude for Competitive Examinations</i> , 3rd (Ed.). New Delhi: S. Chand Publishing		



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2. ETHNUS, *Aptimithra*, 1st (Ed.). Bangalore: McGraw-Hill Education Pvt. Ltd.
3. Arun Sharma, (2016). *Quantitative Aptitude*, 7th (Ed.). Noida: McGraw Hill Education Pvt. Ltd.
4. Soft Skills & Interview Prep – Dale Carnegie, LinkedIn Learning
5. **Python & Java Programming** – CodeWithHarry, GeeksforGeeks, HackerRank, LeetCode

1. Strengthen **advanced aptitude and reasoning skills** for competitive placement tests.
2. Introduce **industry-relevant programming concepts** for technical rounds.
3. Provide **hands-on coding practice** on **LeetCode & HackerRank** for problem-solving.
4. Improve **data interpretation, decision-making, and coding efficiency** for placement exams.

Course Outcomes: After Successful completion of course units, students will

1. Solve **complex aptitude problems** with confidence and efficiency.
2. Demonstrate **logical reasoning and data interpretation** skills for real-world scenarios.
3. Write, debug, and optimize **Python/Java programs** to solve industry-standard coding problems.
4. Successfully attempt **company-specific technical assessments** using hands-on coding practice.