D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25 affiliated to

Savitribai Phule Pune University

Second Year (SY) B. Tech Autonomy Curriculum

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

CCE: Continuous Comprehensive Evaluation

ESE: End Semester Examination Cr: Credits

L: Lecture **T:** Tutorial **P**: Practical

FY: First Year **SY**: Second Year **TY**: Third Year **BY**: Final Year

List of Program Outcomes:

PO1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2 **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3 **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WKS)

PO4 **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5 **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6 **The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7 **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9 **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11 **Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Third Year B. Tech Syllabus
(With effect from Academic Year 2026-2027)

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D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Computer Engineering |S Y B Tech Semester III /IV(2024COURSE)

D Y Patil College of Engineering, Akurdi, Pune														
Second Year Computer Engineering SY B Tech Semester III (2024 Course)														
Course Code	**Course**	**Teaching Scheme**				**Evaluation Scheme**								
							Theory Marks			**Practical Marks**				
		L	**T**	**P**	**Cr**	**Exam**	**Max**	**Min for Pass**		**Max**	**Min for Pass**			
CE124PC301	**Fundamentals of Data Structures**	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
CE124PC302	**Data Structures Lab**	0	0	2	1	CCE				50	20	40		
						ESE				50	20			
CE124PC303	**Mathematical Foundations of Computer Engineering**	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
CE124PC304	**Computer Organization & Architecture**	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
CE124MD305	Multidisciplinary Minor 1 **Introduction to Data Handling with MS-Excel**	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
CE124OE306	Open Elective 1 **Digital Marketing and Advertising Management**	4	0	0	4	CCE	50	20	40					
						ESE	50	20						
CE124EE307	Entrepreneurship/Economics and Management 1 **Principles of Economics & Software Project Management**	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
CE124VE308	Value Education Course 1 **Sustainable Development Goals I**	2	0	0	2	CCE	50	20						
CE124FP309	Field Engineering Project	0	0	4	2	CCE				100	40			
CE124NC310	Non Credit Course 1- **Design Thinking**	1	0	2	0	CCE	50	20						
CE124NC311	Non Credit Course 2- **Aptitude and Technical Mastery for Placements-1**	0	0	2	0	CCE				50	20			
	Total	**20**	**0**	**10**	**22**									
				Hrs										
L	Lecture	**Theory**		**20**										
T	Tutorial	**Pract/Lab**		**10**										
P	Practical	**Total**		**30**										
Cr	Credits													
NC	Non Credit Course (Pass/Fail)													
CCE	Continuous and Comprehensive Evaluation													
ESE	End Semester Examination													

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Computer Engineering |S Y B Tech Semester III /IV (2024 COURSE)

D Y Patil College of Engineering, Akurdi, Pune														
Second Year Computer Engineering SY B Tech Semester IV(2024 Course)														
Course Code	**Course**	**Teaching Scheme**				**Evaluation Scheme**								
		L	**T**	**P**	**Cr**	**Exam**	**Theory Marks**			**Practical Marks**				
							Max	**Min for Pass**		**Max**	**Min for Pass**			
CE124PC401	**Advanced Data Structures and Algorithms**	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
CE124PC402	**Advanced Data Structures and Algorithms Lab**	0	0	2	1	CCE				50	20	40		
						ESE				50	20			
CE124PC403	**Digital Electronics & Microprocessor**	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
CE124PC404	**Digital Electronics & Microprocessor Lab**	0	0	2	1	CCE				50	20	40		
						ESE				50	20			
CE124PC405	**Software Engineering**	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
CE124MD406	Multidisciplinary Minor 2 **Introduction to Power BI**	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
CE124OE407	Open Elective 2 **Decision Support Systems**	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
CE124VS408	Vocational and Skill Enhancement Course 3 **Cyber Security and Data Protection -1**	1	0	2	2	CCE				100	40			
HSM2401P01	Ability Enhancement Course2 **Soft Skills – Work Place and Life Readiness**	1	0	2	2	CCE				100	40			
CE124EE410	Entrepreneurship/Economics and Management 2 **Entrepreneurship, Management & Software Project Execution**	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
CE124VE411	Value Education Course 2 **Sustainable Development Goals II**	2	0	0	2	CCE	50	20						
CE124NC412	Non Credit Course 3- **Competitive Programming**	0	0	2	0	CCE				50	20			
CE124NC413	Non Credit Course 4- **Aptitude and Technical Mastery for Placements-2**	0	0	2	0	CCE				50	20			
	Total	**18**	**0**	**12**	**22**									
				Hrs										
L	Lecture	**Theory**		**18**										
T	Tutorial	**Pract/Lab**		**12**										
P	Practical	**Total**		**30**										
Cr	Credits													
NC	Non Credit Course (Pass/Fail)													
CCE	Continuous and Comprehensive Evaluation													
ESE	End Semester Examination													

D Y Patil College of Engineering, Akurdi, Pune

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B Tech in Computer Engineering |S Y B Tech Semester III /IV(2024COURSE)

Course Category	Program Core Course 3	**Course Code**	**CE124PC301**
Course Title: Fundamentals of Data Structures			

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

Prerequisites: Programming and Problem Solving

Course Objectives: After successful completion of the course students will

1. To understand types of data structures with algorithmic design tools.
2. To acquaint with array data structure and its applications.
3. To understand dynamic memory allocations and operations on linked list.
4. To understand stack data structure and its applications.
5. To understand queue data structure and its applications

Course Outcomes:

CO1	Design algorithms for problem solving and analyze time and space complexity
CO2	Demonstrate use of array data structure to store and process data
CO3	Demonstrate use of linked list data structure for various applications like student's club, Ticket booking applications
CO4	Implement and apply principles of stack data structure for applications like expression conversion, recursion etc.
CO5	Implement and apply principles of queue data structure for various applications

Syllabus

Unit I	**Introduction To Data Structure**	**8 Hrs**

Introduction: From Problem to Data Structure. Data Structures: Data, Information, Knowledge, and Data structure, Abstract Data Types (ADT), Data Structure Classification (Linear and Non-linear, Static and Dynamic, Persistent and Ephemeral data structures) **Algorithms**: Problem Solving, Introduction to algorithm, Characteristics of algorithm, Algorithm design tools: Pseudo-code and flowchart Complexity of algorithm- Space complexity, time complexity, Asymptotic notation - Big-O, Theta and Omega finding complexity using step count method, Analysis of Programming constructs- Linear, quadratic Cubic, Logarithmic

Case Study: Transpose of Matrix.

Unit II	**Linear Data Structure and Searching, Sorting**	**7 Hrs**

Concept of Sequential Organization, **Array**: Overview of Array, Array as an Abstract Data Type, Operations on Array, Storage Representation and their Address Calculation: Row major and Column Major, Multidimensional Arrays: Two-dimensional arrays, n-dimensional arrays. Concept of Ordered List **String:** Concept of String and String Operations **Searching**: Linear Search, Sentinel Search, Binary Search **Sorting:** Types of Sorting-Internal and External Sorting, Bubble Sort, Selection Sort, Quick Sort, Merge Sort, and Bucket Sort **Analysis and Applications:** Comparison, Analysis and

Applications of various Searching and Sorting Algorithms C a s e **Study**: 1. Study of other sorting algorithms (radix, counting etc) with its applications

Unit III	Linked List	8Hrs

Introduction to Static and Dynamic Memory Allocation, **Linked List**: Introduction, of Linked Lists Operations, Linked List as ADT, Types of Linked List: singly linked, linear and Circular Linked Lists, Doubly Linked List, Doubly Circular Linked, Applications
Case study: Garbage Collection

Unit IV	Stack	8Hrs

Stack: Basic concept, Stack Abstract Data Type, Representation of Stack, stack operations, Applications of Stack- Expression Evaluation and Conversion, Polish notation and expression conversion, Stack Operations. Recursion- concept, variants of recursion- direct, indirect, tail
Case study: Debugging using stack.

Unit V	Queue	8Hrs

Queue: Basic concept, Queue as Abstract Data Type, Representation of Queue, Queue Operations, Circular Queue and its advantages, Applications, De queue -Basic concept, types (Input restricted and Output restricted), Applications, Priority Queue- Basic concept, types (Ascending and Descending)
Applications:
Case study: Priority queue in bandwidth management

Text Books (* Note : Recent 10 Years books should be used)

1. Horowitz and Sahani—Fundamentals of Data Structures in C++, University Press, ISBN 10:0716782928 ISBN 13: 9780716782926
2. Tannenbaum, "Data Structures", PHI,2007(5th impression)

Reference Books(* Note : Recent 10 Years books should be used)

1. R. Gillberg, B. Forouzn —Data Structures: A Pseudo code approach with C, Cengage Learning, ISBN: 9788131503140.
2. Allen Downey, Jeffery Elkner, Chris Meyers-How to think like a Computer Scientist: Learning with Python, Dreamtech Press, ISBN:9789351198147.
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley Publication, ISBN: 978-1-118-290279
4. An introduction to the Data Structure and application by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill)

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	1	0	0	1	0	3	2	1	2
CO2	2	2	1	2	1	1	0	0	1	0	3	2	1	2
CO3	2	1	2	1	1	1	0	0	1	0	3	2	1	1
CO4	2	2	1	2	1	1	0	0	1	0	3	1	1	2
CO5	2	2	2	2	1	1	0	0	1	0	3	2	1	1

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

Course Category	Program Core Course 3	**Course Code**	**CE124PC302**
Course Title: Data Structures Lab			

Teaching Scheme				**Evaluation Scheme**						
L	**T**	**P**	**Cr**	**Exam**	**Theory Marks**			**Practical Marks**		
					Max	**Min Marks for Pass**		**Max (%)**	**Min for Pass(%)**	
0	0	2	1	CCE				50	20	40
Total Hours				ESE				50	20	
26	0	0	Total hrs:26					100		

Prerequisites: Programming and Problem Solving

Course Objectives: This course aims to build the

1. To provide students with a strong foundation in problem-solving using Python programming language, enabling them to develop algorithms and write code to solve various computational problems.
2. To familiarize students with fundamental algorithms such as searching and sorting, and teach them how to evaluate their performance and optimize them for various applications.
3. To introduce students to key data structures such as linked lists, stacks, and queues, and to enable them to implement these structures effectively for handling real-world data efficiently.
4. To help students understand and apply advanced data structures in solving complex problems like memory management, task scheduling, and simulation of real-life systems.
5. To equip students with the skills to design, implement, test, and debug Python applications, fostering their ability to solve problems with practical software development techniques.

Course Outcomes: After successful completion of the course units the student will

CO1	To Apply fundamental problem-solving techniques and demonstrate the use of Python programming to develop efficient algorithms, analyze real-world data, and solve computational problems.
CO2	To Analyze and implement basic searching and sorting algorithms (e.g., Linear Search, Binary Search, Selection Sort) to solve problems, and evaluate their efficiency in different scenarios
CO3	To Construct and apply different data structures (e.g., singly linked lists, doubly linked lists, stacks, and queues) to model and manipulate data, and solve problems efficiently
CO4	To Evaluate and apply advanced data structures, such as stacks, queues, and circular queues, in solving real-world problems like task scheduling, job queuing, and browser history management.
CO5	To Design, develop, and debug Python applications that incorporate advanced algorithms, data structures, and memory management techniques to solve complex problems in a variety of contexts

CO	Topic		Assignment 1	2hrs
CO1	Linear Data Structures	A)	Write a Python program to store marks scored in subject "Fundamental of Data Structure" by N students in the class. Write functions to compute following: 1. The average score of class 2. Highest score and lowest score of class 3. Count of students who were absent for the test 4. Display mark with highest frequency After performing each operation, you need to determine the time and Space complexity of each operation.	
			Assignment 2	
		A)	In second year computer engineering class, group A student's play cricket, group B students play badminton and group C students play football. Write a Python program using functions to compute following: - 1. List of students who play both cricket and badminton 2. List of students who play either cricket or badminton but not both 3. Number of students who play neither cricket nor badminton 4) Number of students who play cricket and football but not badminton.	
Group B				
			Assignment 3	
CO2	Searching and Sorting	A)	Write a python program to store roll numbers of students in an array who attended training programs in random order. Write a function for searching whether a particular student attended a training program or not, using Linear search and Sentinel search.	
			Assignment 4	
		A)	Write a python program to store roll numbers of student arrays who attended training programs in sorted order. Write function for searching whether particular student attended training program or not, using Binary search and Fibonacci search	
			Assignment 5	
		A)	Write a python program to store the first year percentage of students in an array. Write function for sorting array of floating point numbers in ascending order using 1. Selection Sort 2. Bubble sort and display top five scores.	
			Assignment 6	
		A)	Write a python program to store the first year percentage of students in an array. Write function for sorting array of floating point numbers in ascending order using quick sort and display top five scores	
			Assignment 7	
		A)	Write a Python program to sort a list of names based on the length of the names using bucket sort. Example Input: ["John", "Alexander", "Paul", "Victoria", "Mary", "Charles", "Elizabeth"]	
Group C				
Assignment 8				

CO3	Linked List	A)	The Department of Computer Engineering has a student's club named 'Pinnacle Club'. Students of second, third and final year of department can be granted membership on request. Similarly, one may cancel the membership of a club. First node is reserved for the president of the club and the last node is reserved for the secretary of the club. Write C++ program to maintain club member ‘s information using singly linked list. Store student PRN and Name. Write functions to: 1. Add and delete the members as well as president or even secretary. 2. Compute total number of members of club 3. Display members 4. Two linked lists exist for two divisions. Concatenate two lists.
			Assignment 9
		A)	A bookstore needs to maintain a list of books available in the store. Each book has the following attributes: ● Book ID (a unique identifier) ● Title (string) ● Author (string) ● Price (floating point) ● Publication Year (integer) The task is to manage the book records using a Doubly Linked List and implement the following operations: 1. Add Book: Add a new book record to the list. 2. Remove Book: Remove a book from the list by its Book ID. 3. Search Book: Search for a book by its Book ID and display its details. 4. Update Book: Update the price or other details of an existing book. 5. Display All Books: Display all books in the list, showing their details in order of insertion. 6. Find Total Books: Return the total number of books in the list.
Group D			
			Assignment 10
CO4	Stack	A)	In any language program mostly syntax error occurs due to unbalancing delimiter such as (),{},[]. Write C++ program using stack to check whether given expression is well parenthesized or not.
			Assignment 11
		A)	Implement the undo and redo functionality using a stack. Each operation (like typing a character or deleting a character) can be undone or redone. Instructions: Use a stack to store the operations. Implement the following methods: undo(): Undo the last operation. redo(): Redo the last undone operation. addOperation(op): Add a new operation to the stack.
Group E			
			Assignment 12

CO5	Queue	A)	Queues are frequently used in computer programming, and a typical example is the creation of a job queue by an operating system. If the operating system does not use priorities, then the jobs are processed in the order they enter the system. Write C++ program for simulating job queue. Write functions to add job and delete job from queue
			Assignment 13
		A)	A printer has multiple print jobs sent by different users. The print jobs need to be processed in the order they are received, but in a round-robin fashion, so that no single user monopolizes the printer for too long. Design and implement a Circular Queue to manage the print jobs. The system should support the following operations: enqueue(jo2.: Add a new print job to the queue. dequeue(): Process and remove the print job from the front of the queue. front(): Check the print job at the front of the queue. isEmpty(): Check if the queue is empty. isFull(): Check if the queue is full (i.e., maximum number of print jobs in the system). printJobCount(): Get the current number of print jobs in the queue.
			Assignment 14
		A)	A double-ended queue (deque) is a linear list in which additions and deletions may be made at either end. Obtain a data representation mapping a deque into a one dimensional array. Write C++ program to simulate deque with functions to add and delete elements from either end of the deque
			Assignment 15
		A)	Given a singly linked list containing integers. Your task is to implement a system that can reverse the order of the nodes in the linked list using a stack.

Rubrics for Continuous Evaluation

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Attendance	12	50	20
		Implementation of Assignments	18		
		Quality of Journal	10		
		Viva-Voce	10		
	End Evaluation	Practical Examination	50	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	1	0	1	1	0	3	2	2	2
CO2	3	3	3	3	2	1	0	1	1	0	3	3	3	2
CO3	3	3	3	3	2	1	0	1	1	0	3	3	3	2
CO4	3	3	3	3	2	1	0	1	1	0	3	2	2	2
CO5	3	3	3	3	2	1	0	1	1	0	3	2	3	2

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

Course Category	Program Core Course 3	**Course Code**	**CE124PC303**
Course Title: Mathematical Foundations of Computer Engineering			

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			
Total Hours				ESE	50	40	40	-	-
39	0	0	Total hrs:39		100				

Prerequisites: Differential Equation and Integral Calculus

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

1. To introduce students to understand, describe, and apply the foundational mathematical concepts at the core of computer science.
2. To understand usage of function and relation models to understand practical examples, and interpret the associated operations and terminologies in context.
3. To obtain knowledge fundamental counting principle, permutations, and combinations.
4. To learn how abstract algebra is used.
5. To study how to model problem using graph and tree.

Course Outcomes: After successful completion of the course units the student will

CO1	Solve problems precisely and apply formal proof techniques like proof by mathematical induction, direct proof.
CO2	Design and evaluate Engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.
CO3	Apply the fundamentals of counting principle in real time applications
CO4	Analyze Algebraic Structure used for fundamentals of mathematics in Engineering.
CO5	Apply statistical methods in analyzing and interpreting experimental data applicable to engineering and probability theory in testing and quality control.

Syllabus

Unit I	**Set Theory and Logic**	**8 Hrs**

Introduction and significance of Discrete Mathematics, Set Operations, Cardinality of set, Principle of inclusion and exclusion. **Types of Sets** – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Power set.

Propositional Logic- logic, Propositional Equivalences, Application of Propositional Logic Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.
CASE STUDY: Know about the Set theory by - Georg Cantor, Richard Dedekind

Unit II	**Relations and Functions**	**8 hrs**

Relations and their Properties, n-ary relations and their applications, Representing relations, Closures of relations, Equivalence relations, Partial orderings, Partitions, Hasse diagram, Lattices, Chains and Anti-Chains, Transitive closure and Warshall's algorithm. **Functions**- Surjective, Injective and Bijective functions, Identity function, Partial function, Invertible function, Constant function, Inverse functions and Compositions of functions, The Pigeonhole Principle. **CASE STUDY:** Know about the great philosophers-Dirichlet		
Unit III	**Counting**	**8 Hrs**
The Basics of Counting, The Pigeonhole Principle, Extended Pigeonhole Principle, rmutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations **CASE STUDY:** Study Hank-shake Puzzle and algorithm to solve it.		
Unit IV	**Algebraic Structure**	**7Hrs**
Algebraic Systems, Structured set with respect to Binary Operations, Groups, Abelian groups, Subgroups, Semigroups, Monoids, Rings and fields, Homomorphism, isomorphism **CASE STUDY:** Study of technologies such as satellite communications, QR codes, and data storage devices.		
Unit V	**Statistics and Probability**	**8 Hrs**
Statistics Measures of Central Tendency, Measures of Dispersion, Coefficient of Variation, Moments, Skewness and Kurtosis **Probability:** Basics of probability, Bayes Theorem, Random Variables, Mathematical Expectation Test of Hypothesis: Chi-Square test, t-test **CASE STUDY:** Statistics and Probability in Healthcare Decision-Making		

Text Books:

1. C. L. Liu, "Elements of Discrete Mathematics" ǁ, TMH, ISBN 10:0-07-066913-9,4th Edition.
2. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill

References Books:

1. Rosen, Kenneth H., author. Title: Discrete mathematics and its applications
2. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8
3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi,45th Edition

NPTEL: https://onlinecourses.nptel.ac.in/noc24_cs98/course

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	1	0	1	1	1	2	2	2	2
CO2	1	2	1	2	2	1	0	1	1	1	2	3	3	3
CO3	2	1	2	1	1	1	0	1	1	1	2	3	3	3
CO4	1	2	1	2	1	1	0	1	1	1	2	2	2	2
CO5	1	2	2	2	2	1	0	1	1	2	2	2	3	3

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

Course Category	Program Core Course 4	**Course Code**	**CE124PC304**
Course Title: Computer Organization & Architecture			

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			
Total Hours				ESE	50	20	40	-	-
39	0	0	Total hrs:39		100				

Prerequisites: Fundamentals of Computer Programming

Course Objectives: This course aims to

1. Understand the structure, function and characteristics of computer systems.
2. Understand the characteristics and various types of memory systems.
3. Identify the elements of modern instructions sets and explain their impact on processor design.
4. Explain elements of a memory hierarchy, identify and compare different methods for computer I/O.
5. Study control unit design and processor organization.

Course Outcomes: Students will

CO1	**Apply** the knowledge of the architecture of a computer for hardware design
CO2	**Analyze** and **differentiate** the types of computer memory for better efficiency.
CO3	**Apply** the knowledge of instruction sets and addressing modes in real life applications.
CO4	**Analyze** the role of I/O systems and their techniques highlighting their impact and effectiveness for better speed and efficiency.
CO5	**Analyze** and compare the different design alternatives in control unit and processor organization for embedded systems.

Syllabus

Unit I	**Basic Concepts of Computer Systems**	**8 Hrs**

Organization and Architecture: Computer Components, Computer Functions, Interconnection Structure: Bus Interconnection, Arithmetic and Logical Unit(ALU), Integer representation, Integer Arithmetic, Floating point Representation, Floating Point Representation.
Case Study: IEEE 754 Formats.

Unit II	**Computer Memory System**	**8 hrs**

Characteristics of memory system, The memory hierarchy. Cache Memory: Principles, Elements of Cache Design, Replacement Algorithm, Internal Memory: Semiconductor Main Memory, Memory Organization. **Case Study**-RAID

Unit III	**Instruction Sets**	**8 Hrs**

Characteristics of Functions: Machine Instruction characteristics, Types of operands, Case Study: modes, Instruction formats, Types of Addressing Modes x86 and ARM Data Types, Intel X86 Instruction format.**Case study**: Introduction to RISC and CISC Instruction Sets.

Unit IV	**Input/ Output Systems**	**7Hrs**

External devices, I/O modules, Programmed I/O, Interrupt-driven I/O: Intel 82C59A Interrupt Controller, The Intel 8255A Programmable Peripheral Interface, Direct Memory Access: DMA Function, Intel 8237A DMA Controller.
Case Study: 82C59A DMA Controller

Unit V	**Control Unit Design**	**7 Hrs**

The Central Processing Unit: Processor Structure and Functions: Processor organization, register organization, Instruction cycle, Instruction pipeline. Control Unit Operation and Micro operations, control of processor, Hard wired and micro Programmed design approaches.
Case study :EDA tool / Software for Chip Design

Text Books:

1. W. Stallings, Computer Organization and Architecture: Designing for performance, Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7th Edition**.**
2. Zaky S, Hamacher, ―Computer Organization‖, 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5, 5th Edition.

References Books:

1. John P Hays, ―Computer Architecture and Organization‖, McGraw-Hill Publication, 1998, ISBN:978-1-25-902856-4, 3rd Edition.
2. A Tanenbaum, "Structured Computer Organization", Prentice Hall of India, 1991 ISBN: 81 – 203 – 1553 – 7, 4th Edition.
3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan.

e-Books :
https://www.pearson.com/en-us/subject-catalog/p/computer-organization-and- architecture /P200000003394/9780135205129

Tutorial:
https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

NPTEL Courses:
- Computer architecture and organization: https://onlinecourses.nptel.ac.in/noc21_cs61/preview
- Computer architecture and organization: https://archive.nptel.ac.in/courses/106/105/106105163/
- Computer Architecture: https://onlinecourses.nptel.ac.in/noc23_cs67/preview

CO-PO Mapping

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

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

Course Category	Multidisciplinary Minor 1	Course Code	CE124MD305
Course Title: Introduction to Data Handling with MS-Excel			

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	40		-	-
Total Hours				ESE	50	40	40		
26	0	0	Total hrs: 26		100				

Prerequisites: Programming and problem solving, C Programming.

Course Objectives:

1. To Understand Fundamentals of Data Analytics.
2. To Learn essentials of MS Excel functions and Tools for data manipulation and Exploration.
3. To Identify missing, inconsistent and duplicate data by using different tools.
4. To Apply Advanced Excel Features for Analysis.
5. To Understand the fundamentals of open source environments

Course Outcomes: After successful completion of the course units the student will

CO1	**Understand** Basics of data analytics and Excel.
CO2	**Apply** Data manipulation and formatting techniques for data processing.
CO3	**Apply** data analytics techniques in MS-Excel.
CO4	**Apply** different data visualization techniques and Lookup functions.
CO5	**Apply** advanced techniques in Excel and Understand Basic concepts of Linux.

Syllabus

Unit I	Introduction to Data Analytics and Excel Basics	6 hrs

Introduction to Excel and Data Analytics: Introduction to Excel, The data analytics process, Data collection, data cleaning, data exploration, and data visualization. Organization of data, Data Types, Handling Data, Data Size and formatting. Types of analytics: Descriptive, diagnostic, predictive, and prescriptive. Applications of data analytics in business and decision-making.

Unit II	Data Manipulation and Formatting	5 hrs

Data Manipulation and Formatting: Experiencing to Excel, Data Manipulation, Formatting Data. Data Manipulation Techniques: Sorting and Filtering, Data Cleaning, Text Functions, Mathematical and Logical Functions**. Data Formatting Techniques:** Formatting Cells, Data Alignment, Freezing and Locking Data, Formatting Tables, Custom Styles. Data Validation, Practical Applications.

Unit III	Data Analysis Techniques in MS Excel	5 Hrs

Data Analysis Techniques: Introduction to Pivot Tables and Slicers for summarizing data, Sorting data for better organization. Data Analysis Techniques in MS Excel: Descriptive Statistics, Data Summarization, Trend Analysis, Correlation and Regression, Data Filtering and Segmentation, Advanced Tools: Solver, Power Query, Power Pivot., MACRO

Unit IV	Data Visualization	5 Hrs
Data Visualization: Charts (Bar, Line, Pie, Etc), Graphs & Sarkline's, Data Bars and Icon Sets, **Lookup functions:** VLOOKUP, HLOOKUP, INDEX, MATCH, Date and time functions for temporal data analysis, Advanced Tools and Techniques, Data validation for user inputs.		
Unit V	**Advanced Techniques in Excel**	**5 hrs**
Advanced Techniques in Excel: Statistical functions, Array formulas, Financial functions Latex :- Introduction to Latex tools. Case Study:-Stock Market Data Analysis(Do Data Gathering , Cleaning and perform different operations using Pivot Tables and Charts)		

Text Books (* Note : Recent 10 Years books should be used)

1. Data Analytics for Absolute Beginners: Make Decisions Using Every Variable: (Introduction to Data, Data Visualization, Business Intelligence & Machine ... Science, Python & Statistics for Beginners).
2. LINUX: THE COMPLETE REFERENCE, 6TH EDITION by Richard Petersen (Author), McGraw Hill.
3. Data Analysis in Microsoft Excel: Deliver Awesome Analytics in 3 Easy Steps Using VLOOKUPS, Pivot Tables, Charts And More by Alex Holloway (Author).

Reference Books(* Note : Recent 10 Years books should be used)

1. INTRODUCTION TO DATA SCIENCE AND ANALYTICS Paperback – 23 May 2024 by Mr. Swapnil Kisan Shinde, Prof. Vijay Kumar Raghubath Ghule, Dr. Ratna Niti Patil, Mrs. Prema Subhas Kadam, Dr. Yogita Deepak Sinkar.
2. Data Analysis with Excel by Manisha Nigam.
3. Excel 2019 All-In-One: Master the new features of Excel by Lokesh Lalwani.

E-contents :

MOOCs courses link :

1. https://www.youtube.com/watch?v=0gJlNCIYPJs.
2. https://archive.nptel.ac.in/courses/110/106/110106064/.
3. https://nptel.ac.in/courses/117106113.

4:Excel2016 for Windows:-
https://www.mcrhrdi.gov.in/5th_mesfc2023/material/Microsoft%20Office(Ms-Excel%202016).pdf

Case Study:-https://mydataroad.com/data-analysis-using-excel-case-study/

CO-PO-PSO Mapping

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

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

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Course Category	Open Elective 1	**Course Code**	**CE124OE306**
Course Title: Digital Marketing and Advertising Management			

Teaching Scheme				**Evaluation Scheme**					
					Theory Marks			**Practical Marks**	
L	**T**	**P**	**Cr**	**Exam**	**Max (%)**	**Min Marks for Pass (%)**		**Max**	**Min for Pass**
4	0	0	4	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
52	0	0	Total hrs:52		100				

Prerequisites: Digital marketing basics and Knowledge of Advertising Management

Course Objectives:

1. To understand the basic concept of Digital Marketing.
2. To understand the basics of Mobile Marketing.
3. To comprehend the concept of Online, Email and Social Media Marketing.
4. To Understand the fundamentals of advertising and Advertising models.
5. To Develop and evaluate advertising strategies.

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

CO1	**Understand** the core concepts of Digital Marketing.
CO2	**Analyze** the basics of Mobile Marketing and its trends.
CO3	**Analyze** the core concepts of Online Marketing and Discuss E-mail and social media marketing techniques.
CO4	**Understand** the fundamentals of advertising and its Models
CO5	**Create ,** Develop and evaluate advertising strategies

Syllabus

Unit I	**Introduction to Digital marketing**	**10 Hrs**
Digital Marketing: Fundamentals of Digital marketing and its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, Digital Consumer & Communities, Gen Y & Netizen's expectation & influence wrt Digital Marketing. Digital marketing Strategy- Consumer Decision journey, POEM Framework, Segmenting & Customizing messages. Skills in Digital Marketing, Digital marketing Plan. Case Study on Digital Marketing		
Unit II	**Frontend Development : CSS and JavaScript**	**10 hrs**

Mobile Marketing: Definition of Mobile Marketing, Types & Evolution, Mobile – market size and rate of growth, Mobile applications, Types of Mobile Marketing, Advantages and Disadvantages of Mobile marketing, Performance marketing: definition, benefits. **Mobile Marketing Channels:** SMS and MMS Marketing, Mobile Apps and In-App Advertising, Push Notifications & Location-Based Marketing, Mobile-Friendly Websites & Landing Pages, QR Codes and NFC Marketing **Trends in Mobile Marketing:** Use of AI & Chabot's in Mobile Marketing, Cellular network 5G and Its Impact on Mobile Marketing, Augmented Reality (AR) & Virtual Reality (VR) in Mobile Advertisements Voice Search & Conversational Marketing. **Case Study: on Mobile Marketing.**

Unit III	**Online, Email and Social Media Marketing**	**10 Hrs**

Online Marketing: The concept of Digital Marketing Mix, 7 P's of Online Marketing: Product, Price, Promotion, Place People, Process, Physical evidence, Methods of Online Marketing promotions.

Email Marketing: Need for Emails and Types of Emails used for Marketing, options in Email advertising, Do's and Don'ts of an email marketing campaign, Introduction to E-mail marketing tool- Mail chimp. **Social Media Marketing**: Fundamentals of Social Media Marketing& its significance, Necessity of Social Media Marketing, Building a Successful strategy: Goal Setting, Implementation. **LinkedIn Marketing**: Importance of LinkedIn presence, LinkedIn Strategy, Content Strategy, LinkedIn analysis, Targeting, Ad Campaign. **Twitter Marketing**: - Basics, Building a content strategy, Twitter usage, Twitter Ads, Twitter ad campaigns, Twitter Analytics, Twitter Tools and tips for mangers. Instagram & Snapchat basics.

Case Study on Online Marketing/Email /Social Media Marketing

Unit IV	**Introduction to Advertising and Advertising Models**	**10 Hrs**

Introduction to Advertising: Definition, Nature, and Scope of Advertising, Evolution and History of Advertising, Role of Advertising in Marketing and Communication, Types of Advertising such as Print, Digital, TV, Radio, Outdoor, Comparative, Surrogate, and Ethical Advertising, etc.

Advertising Theories & Models: AIDA Model (Attention, Interest, Desire, Action), DAGMAR Approach (Defining Advertising Goals for Measured Advertising Results), Hierarchy of Effects Model, Consumer Behavior and Decision-Making Process.

Case Study on Advertising Management- Eg.-Coca-Cola's **" Share a Coke**"

Unit V	**Advertising Planning and Strategy**	**12 Hrs**

Advertising Planning: Factors in Media Selection, Elements of an Advertisement (Headline, Copy, Visuals, Slogan, etc.), Budgeting & Cost Considerations in Advertising, Measuring Media Effectiveness, Setting Advertising Objectives.

Creative Strategy : Media Buying & Media Scheduling Strategies, Message Strategy & Appeal (Emotional, Rational, Fear, Humor, etc.),Creativity in Advertising, Role of Advertising Agencies & Creative Brief, Target Audience Analysis & Market Segmentation, Advertising Campaign Development, Positioning & Branding Strategies

Text Books:

1. Damian Ryan& Calvin Jones. Understanding DIGITAL Marketing, 2009, ISBN 9780749453893
2. Advertising Management, Fifth Edition, Pearson(Paperback, RAJEEV BATRA, DAVID A. AAKER), ISBN: 9789356065130

Reference Books:

- Dave Evans., Susan Bratton, Social Media Marketing: The Next Generation of Business Engagement. Wiley , 2010, ISBN: 978-0-470-63403-5
- Vandana Ahuja, Digital Marketing, Oxford University Press, New Delhi, 2015, ISBN: 9780199455447 Jodie the Mom (2023) Email Marketing Planner: Organize and Track Your Emails, 2023, ASIN : B0C5KNF1BM
- George Pain (2019). Marketing Automation and Online Marketing: Automate Your Business through Marketing Best Practices such as Email Marketing and Search Engine Optimization, 2019, ISBN-10: 1922301132
- Tyagi C. L , Advertising Management, Atlantic Publishers & Distributors Pvt Ltd,2013, ISBN: 9788126903733, 9788126903733

e- Books :

1. https://www.coursera.org/learn/foundations-of-digital-marketing-and-e-commerce
2. Fundamentals of Digital Marketing
3. https://open.umn.edu/opentextbooks/textbooks/1602
4. https://www.coursera.org/learn/marketing-strategy
5. Marketing Strategy & Advertising
6. https://onlineamrita.com/blog/top-20-digital-marketing-case-studies-every-marketer-should-know/

NPTEL video lecture link

1. https://onlinecourses.nptel.ac.in/noc25_mg04/preview
2. https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	0	1	1	1	3	1	1	2
CO2	2	2	2	2	3	2	0	2	2	2	3	2	1	2
CO3	2	2	3	2	3	2	1	2	2	2	3	2	1	2
CO4	2	2	3	3	3	2	1	2	2	2	3	2	1	2
CO5	2	2	3	3	3	2	0	2	2	2	3	2	2	2

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

Course Category	Entrepreneurship/Economics and Management 1	Course Code	CE124EE307
Course Title: Principles of Economics & Software Project Management			

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max (%)	Min Marks for Pass (%)		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
				ESE	50	20			
26	0	0	Total hrs: 26		100				

Course Objectives: Purposes of Course are:

1. Understand economic principles and their relevance to IT and software industries.
2. Analyze financial decision-making in software project management.
3. Evaluate cost estimation, budgeting, and resource allocation for IT projects

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

CO1	Analyze economic principles and their applications in IT and software project management. (Analyze-Level 4)
CO2	Assess cost estimation, budgeting, and investment strategies in software projects. (Evaluate- Level 5)
CO3	Evaluate financial risks, software pricing models, and IT market structures. (Evaluate Level 5)
CO4	Utilize tools like JIRA, Trello, and MS Project to plan and manage software projects efficiently. (Apply – Level 3)
CO5	Examine government policies, intellectual property rights, and sustainable software practices. (Evaluate- Level 5)

Syllabus

Unit I	Introduction to Economics for IT & Software Industry	5 hrs
Basic economic principles: Demand, Supply, Opportunity Cost, Economic impact of IT industry and software development, Scarcity and resource allocation in software projects		
Unit II	**Market Structures and Cost Estimation in Software Development**	**5 hrs**
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)		
Unit III	**Financial Planning, Investment, and Risk in IT Projects**	**5 Hrs**
Budgeting and funding strategies for software projects, Investment decision-making in IT companies, Risk management in software development and project planning		

Unit IV	Software Project Management & Scheduling	6 Hrs
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		
Unit V	**Government Policies, Intellectual Property, and Green IT**	**5 hrs**
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		

Textbooks:

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

Course Category	Value Education Course1	Course Code	CE124VE308
Course Title: Sustainable Development Goals I			

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

Prerequisites :None

Subjects Included: Sustainable Development Goals (SDG - Basic) 2 units
Environment Studies 2 units
Intellectual Property Rights (IPR) 1 unit

Course Objectives: Purposes of Course are:

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. Understand Environmental Issues – Examine environmental challenges and their impact on sustainable development.
4. Study Environmental Policies – Analyze national and global policies related to environmental sustainability.
5. Learn Intellectual Property Rights (IPR) – Understand the basics of patents, copyrights, trademarks, and their role in innovation.

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

CO1	**DEFINE** the key concepts of SDGs and LIST the 17 SDGs with their significance
CO2	**EXPLAIN** interconnections between different SDGs and analyze their holistic impact.
CO3	**DESCRIBE** key environmental challenges and their implications for sustainable development.
CO4	**DISCUSS** major environmental policies and governance frameworks.
CO5	**UNDERSTAND** fundamental concepts of Intellectual Property Rights (IPR) and their applications.

Syllabus

Unit I	**Introduction to SDGs & Sustainability**	**6 Hrs**
Evolution from MDGs to SDGs, significance in the UN 2030 Agenda, India's contributions, real-world applications.		
Unit II	**SDG Targets & Interconnections**	**6 Hrs**
Understanding SDG indicators, inter linkages, roles of stakeholders, case studies, impact assessment frameworks.		
Unit III	**Environmental Challenges & Sustainability**	**5 Hrs**
Key environmental issues like climate change, biodiversity loss, pollution; impact on health and society, mitigation strategies.		
Unit IV	**Environmental Policies & Governance**	**5 Hrs**
National and global environmental policies, role of regulatory bodies, sustainability standards, case studies of successful interventions.		
Unit V	**Introduction to Intellectual Property Rights (IPR)**	**4 Hrs**
Basics of patents, copyrights, trademarks, importance in innovation and sustainability, protection of intellectual property in academia and industry.		

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)

Course Category	Field Engineering	Course Code	CE124FP309
Course Title: Field Engineering Project			

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max(%)	Min Marks for Pass (%)		Max	Min for Pass
0	0	4	0	CCE				100	40
Total Hours 52									

Prerequisites: Fundamentals of Computer Programming

Course Objectives: This course aims to build the

- To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problem and evaluate alternative approaches, and justify the use of selected tools and methods.
- To emphasizes learning activities that are long-term, inter-disciplinary and student-centric.
- To engages students in rich and authentic learning experiences.
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
- To develop an ecosystem this may promote entrepreneurship and research culture among the students.

Course Outcomes: After successful completion of the course units the student will

CO1	Ability to solve real life problems by applying knowledge.
CO2	Ability to analyze alternative approaches, apply and use most appropriate one for feasible solution.
CO3	Ability to understand basics of IT Project management
CO4	Students should be able to accept and meet challenges in the real world, mirroring what professionals do every day.
CO5	Able to Classify software applications and identify unique features of various domains and replicable skill.

Course Content

Preamble:

Guidelines for Instructor for Laboratory Conduction:

- Instructor must regularly monitor and mentor students for successful completion of the project throughout semester as per instructions given in list of assignments.
- The Batch should be divided into sub-groups of 4 to 5 students. Idea implementation
- Real life problem/Complex assignments / activities / projects. under project based learning is to be carried throughout semester and Credit for Field Engineering Project has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester
- Instructor is expected to coverall concepts Inheritance, Polymorphism, exception handling, generic programming, file handling, STL.
- Instructor is expected to encourage students for appropriate use of Hungarian notation, proper indentation and comments.
- Instructor is expected to encourage use of open-sources software.

Guidelines for Students:

Prepare students for FEP before starting the sessions.

- Students must have ability to initiate the task/idea. they should not be mere imitators
- They must learn to think.
- Students working in FEP must be responsible for their own learning.
- Throughout the FEP process, students have to define and analyze the problem, generate learning issues and apply what they have learned to solve the problem and act for themselves and be free.
- Students must quickly learn how to manage their own learning, instead of passively Receiving instruction.
- Students in FEP are actively constructing their knowledge and understanding of the situation in groups.
- Students in FEP are expected to working groups.
- They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem/project within an articulated interdisciplinary or subject frame. A problem can be theoretical, practical, social, technical, symbolic, cultural, and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both the analysis and solving phases. By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and structure of the activity.

- A few hands-on activities that may or may not be multidisciplinary.
- Use of technology in meaningful ways to help them investigate, collaborate, analyses, synthesize, and present their learning.
- Activities may include-be Solving real life problem, investigation, /study and Writing reports of in depth study, field work.

Assessment: The institution/head/mentor is committed to assessing and evaluating both student performance and Program effectiveness.

Progress of FEP is monitored regularly on weekly basis. Weekly review of the work is necessary.
During process of monitoring and continuous as assessment and evaluation of the individual and the team performance is to be measured. FEP is monitored and continuous assessment is done by supervisor/mentor and authorities. Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services.

Supervisor/mentor and Students must actively participate in assessment and evaluation processes. Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project).
2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
3. Documentation and presentation.

Evaluation and Continuous Assessment:
It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (Field Engineering Project work book). **Continuous Assessment Sheet (CAS)** is to be maintained by all mentors/department and institutes.

Recommended parameters for assessment/evaluation and weightage:

1. Idea Inception and Awareness/Consideration of- Environment/Social/Ethics/Safety measures/Legal aspects (10%)
2. Outcomes of FEP/Problem Solving Skills/Solution provided/Final product (Individual assessment and team assessment) (40%)
3. Documentation (Gathering requirements, design & modeling, implementation/ execution, use of technology and final report, other documents) (15%)
4. Demonstration (Presentation, User Interface, Usability) (20%)
5. Contest Participation/publication (15%)

FEP workbook will serve the purpose and facilitate the job of students, mentor and project coordinator. It will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

Mini Projects(Compulsory):

1. Based on Python Programming
2. Based on Open Elective Chosen by Student

Text Books

1. A new model of problem based learning. By Terry Barrett. AllIrel and Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017
2. Problem Based Learning. by Mahnaz moallem, woeihung and Nada Dabbagh, Wiley Publishers. 2019.
3. Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Robart Capraro, Mary Margaret Capraro

Course Category	Non Credit Course 1	**Course Code**	**CE124NC310**
Course Title: Non Credit Course- Design Thinking			

Teaching Scheme				**Evaluation Scheme**					
					Theory Marks			**Practical Marks**	
L	**T**	**P**	**Cr**	**Exam**	**Max (%)**	**Min Marks for Pass(%)**		**Max (%)**	**Min for Pass (%)**
1	0	2	0	CCE	50	20		-	-
Total Hours: 39									

Prerequisites: Digital Mindset.

Course Objectives:

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 the course the student will be able to

CO1	**Comprehend**& analyze an Opportunity from a Problem.
CO2	**Demonstrate** and frame a Product/Service Idea.
CO3	**Analyze** how to empathize with the customers.
CO4	**Create** design and develop a Prototype.
CO5	**Select** and pitch their idea.

Syllabus

Unit I	**Introduction to Design Thinking**	**6 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	**Design Thinking Methodology**	**5 hrs**
Design Thinking Methodology: The 5 Stages of the Design Thinking Process-Empathies, define (the problem), Ideate, Prototype, and Test.		
Unit III	**Ideation tools & exercises**	**5 Hrs**
Ideation tools & exercises. Sample Design Challenge, Introduction to the Design Challenge Themes, Storytelling and Tools for Innovation		
Unit IV	**Empathize-Understand customers**	**5 Hrs**
Empathize-Understand customers, Empathy Maps, Empathies-Step into customer's shoes Customer Journey Maps, Define- Analysis & Drawing Inferences from Research.		

Unit V	The Design Challenge	5 hrs
The Design Challenge: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing Documentation and the Pitching		
Assignments		
Assignment 1 Stages of thinking The Design Process: Stage 1-Define, Stage 2- Research, Stage 3-Ideate, Stage 4-Prototype, Stage 5-Select, Stage 6-Implement, Stage 7-Learn Research Identifying drivers, Information gathering		
Assignment 2 Idea generation Basic design directions, Themes of thinking, Inspiration and references, Brainstorming, Value, Inclusion, Sketching, Presenting ideas Refinement Thinking in images, thinking in signs, Appropriation, Humour, Personification, Visual metaphors, Modification, thinking in words, Words and language, Type 'faces", Thinking in shapes, Thinking in proportions, Thinking in color		
Assignment 3 Ideation & Concept Development Prototyping Developing designs, "Types of prototype, Vocabulary Implementation Format, Materials, Finishing, Media, Scale, Series/Continuity		
Text Books		
1. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School-IdrisMootee 2. Christoph Menial and Larry Lifer, "Design Thinking", Springer, 2011		
Reference Books(* Note : Recent 10 Years books should be used)		
1.Zero to One: Note on Start-Ups, or How to Build the Future 2.The Lean Startup. How Constant Innovation Creates Radically Successful Businesses 3.Start with Why: How Great Leaders Inspire Everyone to Take Actions.		
E-Books:. 1. Design Thinking-A Primer online course video lectures by IIT Madras (freevideolectures.com) Curriculum for Third Year of Artificial Intelligence and Data Science (2019 Course), Savitribai Phule 2. NPTEL: Humanities and Social Sciences - NOC: Understanding Design Thinking & People		

CO-PO-PSO Mapping

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

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

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY2024-25, Affiliated to Savitribai Phule Pune University, Pune

B Tech in Computer Engineering |S Y B Tech Semester III /IV (2024 COURSE)

Course Category	Non Credit Course 2	Course Code	CE124NC311
Course Title: Aptitude and Technical Mastery for Placements-1			

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

Prerequisites: Basic Mathematics

Course Objectives: Purposes of Course are:

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

Unit II	Verbal Ability	3 hrs

1. Sentence Correction - Intermediate and Advanced
2. Sentence Completion

Unit III	Reasoning Ability	6 Hrs

1. Analytical Reasoning - I
2. Clock & Calendars
3. Coding and Decoding & Odd Man Out

Unit IV	Career Skills	3 Hrs

Resume Building

1. ATS Resume Hard Copy
2. Video Resume
3. Cover Letter

Reference Books:

1. R. S. Aggarwal,. *Quantitative Aptitude for Competitive Examinations*, 3rd (Ed.). New Delhi: S. Chand Publishing
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

SEMESTER IV

Course Category	Program Core Course3	**Course Code**	**CE124PC401**
Course Title: Advanced Data Structures and Algorithms			

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

Prerequisites:

Course Objectives: This course aims to build the

1. To develop a logic for graphical modeling of there all life problems.
2. To suggest appropriate data structure and algorithm for graphical solutions of the problems.
3. To understand advanced data structures to solve complex problems in various domains.
4. To build the logic to use appropriate data structure in logical and computational solutions.
5. To understand various algorithmic strategies to approach the problem solution.

Course Outcomes: Students will

CO1	**Identify and Express** the complexity goals and benefits of a good hashing scheme for real world applications testing and software quality assurance.
CO2	**Understand and apply** non-linear data structure for solving problems of various domain operations.
CO3	**Design and specify** the operations of non-linear based abstract data type.
CO4	**Use** efficient indexing methods and multi way search techniques to store and maintain data
CO5	**Understand and Analyze** secondary storage

Syllabus

Unit I	**Introduction to Algorithms**	**7 hrs**

Algorithm-Introduction of algorithmic strategies, Iterative and recursive algorithms

Divide and conquer- Solving recurrences- substitution method, recursion-tree method, master method, Strassen's algorithm for matrix multiplication **Greedy strategy**: Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms- Job scheduling and activity selection problem

Unit II	**Hashing**	**8 hrs**

Hash Table-Introduction and Concepts. Types of Hashing open hashing, closed hashing, Rehashing, Issues in hashing, hash functions-properties of good hash function, Types of Hash Functions Collision resolution strategies-open addressing and chaining, closed addressing and separate chaining. Extendible hashing, Skip List. **Case Study**: Book Call Number and Dictionary

Unit III	Trees	8 hrs
Tree- basic terminology, General tree Binary tree-properties, binary tree traversals, depth first and breadth first, Huffman Tree, Binary Search Tree(BST),Threaded binary search tree- insertion and deletion of nodes Weight balanced tree-Optimal Binary Search Tree(OBST), Height Balanced Tree-AVL tree, Red-Black Tree		
Unit IV	**Graphs**	**8 hrs**
Graph-Storage representation, Adjacency matrix, adjacency list, adjacency multilist, inverse adjacency list, Traversals, Minimum spanning Tree, Primsand Kruskal Algorithms, Dijkstra's algorithm, Single source shortest path, All pairs shortest paths-Floyd-Warshall Algorithm		
Unit V	**Indexing and File Organization**	**8 hrs**
Indexing and Multiway Trees- Indexing, indexing techniques-primary, secondary, dense, sparse Multiway search trees, B-Tree-insertion, deletion, B+Tree -insertion, deletion, use of B+ tree in Indexing tree. **Files:** concept, primitive operations. Sequential file organization- concept and primitive operations, Direct Access File, Indexed sequential file organization, Linked Organization		

Text Books(*Note:Recent10Yearsbooksshouldbe used)

1. Horowitz, Sahani, Dinesh Mehta, "Fundamentals of Data Structures in C++"‖,GalgotiaPublisher,ISBN:8175152788,9788175152786.
2. Introduction to Algorithms (Eastern Economy Edition)- by Thomas H. Carmen, Charles E. Leadsperson, Ronald L. Rivets, Clifford Stein

Reference Books(*Note:Recent10Yearsbooksshouldbe used)

1. A. Aho, J. Hopcroft, J. Ullman, "Data Structures and Algorithms" , Pearson Education, 1998,ISBN-0-201-43578-0.
2. Michael J Folk, "File Structures an Object Oriented Approach with C++", Pearson Education, ISBN: 81-7758-373-5.
3. Sartaj Sahani, "Data Structures, Algorithms and Applications in C++", Second Edition,University Press, ISBN:81-7371522X.
4. GAVPai,"Data Structures and Algorithms",McGraw-HillCompanies,ISBN-9780070667266.
5. Goodrich, Tamassia, Goldwasser, "Data Structures and Algorithms in Java"‖, Wiley Publication, ISBN: 9788126551903

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	1	1	2	0	2	2	2	2
CO2	3	3	3	3	2	2	1	1	2	0	3	3	3	3
CO3	3	3	3	3	2	2	1	1	2	0	3	3	3	3
CO4	3	3	2	2	2	2	1	1	2	0	1	2	2	2
CO5	3	3	2	2	1	1	1	1	2	0	1	1	1	1

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

Course Category	Program Core Course 5 Lab	**Course Code**	**CE124PC402**
Course Title : Advanced Data Structures and Algorithms Lab			

Teaching Scheme				**Evaluation Scheme**						
L (Hr)	**T (Hr)**	**P (Hr)**	**Cr**	**Exam**	**Theory Marks**			**Practical Marks**		
					Max %	**Min For passing(%)**		**Max (%)**	**Min Marks for Passing(%)**	
0	0	2	1	CCE	-	-	-	50	20	40
0	0	26	Total:26					50	20	

Prerequisites: Data Structures Lab

Course Objectives: This course aims to build the basic introduction of C++ programming language. Purpose of Course are:

1. To acquire hands-on experience in implementing and utilizing non-linear data structures to solve problems across various domains.
2. To enhance the ability to recognize and apply the most appropriate data structure for addressing real-world challenges.
3. To evaluate advanced data structures, including hash tables, dictionaries, trees, graphs, sorting algorithms, and file organization techniques.

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

CO1	**Apply** concepts of ADTs, libraries, hash tables, and dictionaries to develop advanced algorithms to specific problems.
CO2	**Evaluate** the performance of non-linear data structures to design solutions for complex real-world problems.
CO3	**Justify** the selection of optimal data structures to design and implement algorithms for solving graphical representations of problems.
CO4	**Design and implement** algorithmic techniques for indexing, sorting, multi-way searching, file organization.
CO5	**Optimize** the efficiency of the most suitable data structures, applying them to create innovative and effective solutions for engineering design problems.

CO	Topic	Question	Practical Sessions (Assignments)	26 hrs
CO1	Hashing	A	Design a hash table for a product inventory system where keys are product IDs, and values are stock details. Implement separate chaining and linear probing for collision handling. Analyse time complexity.	2 Hrs
CO1	ADT	A	To create ADT that implements the "set" concept. a. Add (new Element) -Place a value into the set , b. Remove (element) Remove the value c. Contains (element) Return true if element is in collection, d. Size () Return number of values in collection Iterator () Return an iterator used to loop over collection , e. Union of two sets, f. Difference between two sets, g. Subset Analyse time complexity.	2 Hrs
CO2	Tree	A	A book consists of chapters, chapters consist of sections and sections consist of subsections. Construct a tree and print the nodes. Find the time and space requirements of your method.	2 Hrs
CO2	Tree	A	Starting with an empty organizational hierarchy, construct the structure by adding employees in the given order. After building the hierarchy: i. Add a new employee to the team, ensuring they are placed in the correct position based on their role. ii. Determine the number of employees in the longest reporting chain starting from the CEO. iii. Identify the employee with the least seniority in the organization. iv. Search for an employee within the hierarchy to check if they are part of the organization. Find the time requirements of your method.	2 Hrs
CO2	Tree	A	Develop a data structure to manage inventory items using AVL trees. The structure should support dynamic addition of products and provide functions to find the most valuable item and calculate the total value of all products. Node Structure: Each node in the tree will contain the following data: • Item ID (for sorting) • Item Name • Price • Quantity • Total Value (Price * Quantity • Left and Right child pointers for AVL tree structure Analyse time complexity.	2 Hrs
CO2	Tree	A	Construct an expression tree from the given prefix expression, for example, +a^bc-defgh. Then, traverse the tree using post-order traversal (non-recursive), and finally, delete the entire tree. Analyse time complexity.	2 Hrs
CO3	Graph	A	Represent a given graph using adjacency matrix to perform DFS and using adjacency list to perform BFS. Use the map of the area around the college as the graph. Identify the prominent land marks as nodes and perform DFS and BFS on that. Analyse time complexity.	

CO3	Graph	A	Represent a city's utility grid network using an adjacency list graph. Simulate power flow analysis using Dijkstra's algorithm. Add an option to display all reachable power stations within a specified time limit for maintenance. Find time complexity.	
CO3	Graph	A	You run a delivery service with multiple warehouses, and you want to establish delivery routes between them. The delivery company charges different rates for each route, and you aim to minimize the total cost of connecting all your warehouses. Solve this problem by suggesting appropriate data structures for efficient route management and cost minimization. Find time complexity.	2 Hrs
CO4	OBST	A	Given sequence k = k1 <k2 < … <kn of n sorted keys, with a search probability pi for each key ki . Build the Binary search tree that has the least search cost given the access probability for each key? Analyze time complexity	2 Hrs
CO4	Heap	A	Consider a scenario for a customer support center that handles different types of service requests: a) Urgent issues (top priority), b) Moderate issues (medium priority), c) Routine inquiries (least priority). Implement a priority queue to manage and process the service requests based on their priority levels. Analyze time complexity	2 Hrs
CO5	File Organization	A	A library system maintains a collection of books. The file contains book ID, title, author, genre, and availability status. The system allows users to add, delete, and update book information. Users can search for a specific book by its ID. If the book record does not exist, an appropriate message is displayed. If the book is found, the system will show the details of the book. Use a sequential file to store and manage the data.	2 Hrs
			Mini Project One real life application in the form of a mini-project based on the concepts learned. Students may also select one assignment or mini-project from given list or any other topic that is beyond the scope of syllabus. 1. Design a mini project to implement Snake and Ladders Game using Python. 2. Design a mini project to implement a Smart text editor. 3. Design a mini project for automated Term work assessment of student based on parameters like daily attendance, Unit Test / Prelim performance, Students achievements if any, Mock Practical.	2 Hrs

Text Books:

1. E Balagurusamy, Object-Oriented Programming with C++, 7th edition, McGraw-Hill Publication, 2018, ISBN 10: 9352607996, ISBN 13: 9789352607990.
2. Robert Lafore, — Object-Oriented Programming in C++, fourth edition, Sam's Publishing, 2001, ISBN:0672323087 ISBN 13: 9780672323089.

Reference Books
1. Herbert Schildt, ―C++ The complete reference‖, Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805. 2. Deitel, "C++ How to Program", 4th Edition, Pearson Education, ISBN:81-297-0276-2.
NPTEL Link
1. https://nptel.ac.in/courses/106102064

Scheme for Continuous Evaluation

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	2	20	
		Involvement, Participation, and Engagement	5		
		Quality of Submission of Report	5		
		Attendance	5		
	End Evaluation	Performance	30	30	
		Oral Examination			

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	2	0	1	2	0	2	2	2	2
CO2	3	3	3	3	3	2	0	1	2	0	3	3	3	3
CO3	3	3	3	3	3	2	0	1	2	0	3	3	3	3
CO4	3	3	3	2	2	1	0	1	2	0	1	2	2	2
CO5	3	3	1	2	2	1	1	2	2	2	1	1	1	1

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

Course Category	Program Core Course 6	**Course Code**	**CE124PC403**
Course Title: Digital Electronics & Microprocessor			

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 : 39				ESE	50	20			

Prerequisites:

Course Objectives: This course aims to build the

1. To study number systems and develop skills for design and implementation of combinational logic circuits
2. Develop skills for design and implementation of sequential circuits
3. To introduce programmable logic devices, ASM charts and synchronous state machines.
4. To study basics of microprocessor.
5. To acquaint students with architectures of Intel Microprocessors and ARM processors.

Course Outcomes: After successful completion of the course units the student will

CO1	Design and Implement Combinational Circuits
CO2	Design and Implement Sequential Circuits
CO3	Develop real world applications using ASM and PLD
CO4	Exhibit the skill of Assembly Language Programming for the application
CO5	Discuss the architecture of ARM Processor

Syllabus

Unit I	**Minimization Techniques and Combinational Circuits**	**8 hrs**

Minimization: Minimization of Boolean function using K-map (Up to 4 variables) ,Quine Mc-Clusky Method, Minimization of SOP and POS using K-map.

Introduction to Combinational Circuit- Adder, Subtractor & Code Converter, Multiplexer & Demultiplexer, Implementation of SOP,POS using Multiplexer, Parity Generator, Parity Checker , Comparator

Case Studies- Digital locks using logic gates

Unit II	**Sequential Circuits**	**8 hrs**

Sequential Circuit-Flip-Flop-SR,JK. D,T , Preset & Clear, Truth table and Excitation Table, Conversion from one type to another type of flip flop, **Counters**: Asynchronous, Synchronous Counter, **Sequential Circuit Design**: Moore and Mealy Machine, State diagram and state Table, Sequence Generator and Detector.

Case Studies- Electronic Voting Machine (EVM)

Unit III	Algorithmic State Machine and Programmable Logic Devices	8 hrs

Algorithmic State Machines: ASM, ASM charts, notations, Construction of ASM chart, and realization for sequential circuit. **Programmable Logic Devices**: PLD, ROM as PLD, Programmable Logic Array(PLA), Programmable Array Logic(PAL), Designing combinational circuits using PLDs.

Case Studies- Wave form generator using MUX controller method

Unit IV	80386 Microprocessor	8 hrs

Introduction to 80386 Microprocessor, Architecture, Applications of Microprocessor, Instruction set- Data Movement Instructions, Binary Arithmetic Instructions, Decimal Arithmetic Instructions, Logical Instructions, Control Transfer Instructions, String and Character Transfer Instructions, Instructions for Block Structured Language, Flag Control Instructions, Coprocessor Interface Instructions, Segment Register Instructions, Miscellaneous Instructions.

Case Studies- Study-Evolution of Microprocessor

Unit V	ARM Architecture	7 hrs

Overview of ARM architecture; States [ARM, Thumb, Jazelle]; Registers, Modes; Conditional Execution; Pipelining; Vector Tables; Exception handling. Introduction to ARM processors and it's versions,ARM7,ARM9 &ARM11 features, Advantages and suitability in embedded applications, ARM and RISC design philosophy,ARM7 data flow model, Programmers model.

Case Studies- Study-Arm Processor and Instruction Set

Text Books(*Note:Recent10Yearsbooksshouldbe used)

1. R.P.Jain, " Modern Digital Electronics", Tata McGraw Hill 4th Edition, ISBN 978-0-07-06691-16
2. James Turley, "Advanced 80386 Programming Techniques", McGraw-Hill, ISBN: 10: 0078813425, 13: 978-0078813429.

Reference Books(*Note:Recent10Yearsbooksshouldbe used)

1. D. Leach, Malvino, Saha, "Digital Principles and Applications"‖, Tata McGraw Hill, ISBN – 13:978-0-07-014170-4.
2. Muhammad Ali Mazidi, ARM Assembly Language Programming & Architecture: 1, 2016, 2nd Edition, Microdigitaled.com
3. Morris Mano, "Digital Logic and Computer Design", Pearson , ISBN 978-93-325-4252-5
4. G. K. Kharate, "Digital Electronics", Oxford Press, ISBN-10: 0198061838
5. A.K. Ray, K.M. Bhurchandi, Advanced Microprocessor and Peripherals, 2012, 2ndEdition, Tata McGraw-Hill, India..
6. Mohammad Ali Mazidi, Janice G. Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems, 2014, 2nd Edition, Pearson, India.
7. Chris H. Pappas, William H. Murray, "80386 Microprocessor Handbooks", McGraw-Hill Osborne Media, ISBN-10: 0078812429, 13: 978-0078812422.

CO-PO Mapping

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

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

Course Category	Program Core Course 7	**Course Code**	**CE124PC404**
Course Title: Digital Electronics and Microprocessor Lab			

Teaching Scheme				**Evaluation Scheme**						
L	**T**	**P**	**Cr**	**Exam**	**Theory Marks**			**Practical Marks**		
					Max	**Min Marks for Pass(%)**		**Max (%)**	**Min for Pass (%)**	
0	0	0	2	CCE				50	20	40
Total Hours:26				ESE				50	20	

Prerequisites: Digital Electronics and Microprocessor

Course Objectives: After Successful completion of course units, students will be able to

1. Understand fundamentals and functionality of electronic circuits, design and implement Combinational circuits.
2. Understand fundamentals and functionality of electronic circuits, design and implement sequential circuits
3. Understand assembly language programming instruction set
4. Apply instruction set for implementing X86/64 bit assembly language programs

Course Outcomes:

CO1	**Apply** the knowledge to appropriate IC as per the design specifications.
CO2	**Implement** Combinational digital circuits as per the design specifications using Universal Gates
CO3	**Implement** Sequential digital circuits as per the design specifications using suitable Flip flops.
CO4	**Implement** the code in ALP to perform arithmetic and logical operations on numbers using different addressing modes.
CO5	**Demonstrate** processor mode of operation to access system registers.
CO6	**Implement** the code in ALP to perform operations on stack memory, quadratic equation.

Sr. No.	CO	Topic	Question	Practical Sessions (Assignments)	26 Hrs
1	CO1	**Logic Gates**	A	To Realize Truth Tables of Basic gates / Universal Gates.	2 Hr
			B	To implement Boolean Expressions using Universal Gates.	
			C	To Realize Half Adder using a) Basic Gates and b) Universal Gates.	
			D	To Realize Half Subtractor using a) Basic Gates and b) Universal Gates.	
2	CO1	**Combinational Circuit**	A	To Realize Full Adder using a) Basic Gates and b) Universal Gates.	2 Hr
			B	To Realize Subtractor using a) Basic Gates and b) Universal Gates	
			C	Design & Implement Parity Generator and checker using EX-OR**.**	
			D	Realization of Boolean Expression for suitable combination logic using MUX 74151 /74153	
3	CO2	**Code Conversion**	A	Design and implement Code Converters-Binary to Gray.	2 Hr
			B	Design and implement Code Converters- Gray to Binary	
			C	Design and implement Code Converters- BCD to Excess-3	
			D	Design and implement Code Converters- Excess-3 to BCD	
4	CO2	**MUX/D-MUX**	A	Realization of combinational Circuits using MUX 74151 /74153	2 Hr
			B	Realization of combinational Circuits using D-MUX 74139	
			C	To Verify the truth table of two bit comparators using logic gates.	
			D	Design & Implement 4 bit Comparator.	2 Hr
5	CO3	**Flip-Flop Conversion**	A	Design and Realization: Flip Flop conversion- JK to SR	
			B	Design and Realization: Flip Flop conversion- SR to D	
			C	Design and Realization: Flip Flop conversion- SR To JK	
			D	Design of ASynchronous 3 bit Up Counter using MS-JK Flip Flop / D Flip Flop	
6	CO3	**Sequential**	A	Study of Shift Registers (SISO,SIPO, PISO, PIPO)	2 Hr

		Circuits	B	Design of 2 bit Synchronous Counter using MS JK flip-flop.	
			C	Design and implement Sequence generator (for Prime Number/odd and even) using MS JK flip-flop.	
			D	Design of 3 bit Asynchronous Down Counter using MS-JK Flip Flop / D Flip Flop	
7	CO4	**Addressing Modes**	A	Write an 80386 32/64 ALP to accept five 64 bit Hexadecimal numbers from the user and store them in an array and display the accepted numbers.	2 Hr
			B	Write 80386 32/64 ALP to count the number of positive and negative numbers from the array.	
			C	Write an 80386 32/64 ALP to accept a string and to display its length.	
			D	Write 80386 32/64 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition method (use of 64-bit registers is expected).	
8	CO4	**Arithmetical and Logical Operations**	A	Write 80386 32/64 ALP to count the number of Odd and Even numbers from the array.	2 Hr
			B	Write 80386 32/64 ALP to find Largest number in given array	
			C	Write 80386 32/64 ALP to find Smallest number in given array	
			D	Write 80386 32/64 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use add and shift method (use of 64-bit registers is expected).	
9	CO5	**Processor Modes**	A	Write 80386 32/64 ALP to perform non-overlapped block transfer without string specific instructions. Block containing data can be defined in the data segment.	2 Hr
			B	Write 80386 32/64 ALP to perform overlapped block transfer without string specific instructions. Block containing data can be defined in the data segment.	
			C	Write 80386 32/64 ALP to switch from real mode to protected mode and display the values of GDTR, LDTR, IDTR.	
			D	Write 80386 32/64 ALP to convert 4-digit Hex number into its equivalent BCD number.	
10	CO5	**Macros and Subroutines**	A	Write 80386 32/64 ALP to switch from real mode to protected mode and display the values of TR and MSW Registers also identify CPU type using CPUID instruction.	2 Hr

			B	Write a switch case driven 80386 32/64 ALP to perform 64-bit hexadecimal arithmetic operations (+,-,*, /) using suitable macros. Define procedure for each operation.	
			C	Study of Mother Board of CPU.	
			D	Write 80386 32/64 ALP to convert 5-digit BCD number into its equivalent HEX number. Make your program user friendly to accept the choice from user	
11	CO6	**String Operations**	A	Write x86 ALP to find the factorial of a given integer number on a command line by using recursion. Explicit stack manipulation is expected in the code	2Hr
			B	Write 80387 ALP to find the roots of the quadratic equation. All the possible cases must be considered in calculating the roots.	
			C	Write 80386 32/64 ALP to find, a) Number of Blank spaces b) Number of lines c) Occurrence of a particular character. Accept the data from the text file. The text file has to be accessed during Program_1 execution and write FAR PROCEDURES in Program_2 for the rest of the processing. Use of PUBLIC and EXTERN directives is mandatory.	
			D	Write 80386 32/64 program to sort the list of integers in ascending order. Read the input from the text file and write the sorted data back to the same text file using bubble sort.	
12	CO6	**Math Processor**	A	Write 80387 32/64 ALP to perform the real number arithmetic operations.	2Hr
			B	Write 80387 ALP to list the Prime numbers in the given array.	
			C	Write 80386 32/64 ALP to find, a) Concatenation of the String b) Comparison of the String.	
			D	Write 80386 32/64 ALP program to sort the list of integers in descending order. Read the input from the text file and write the sorted data back to the same text file using bubble sort.	

Syllabus Text Books:

1. R.P.Jain, " Modern Digital Electronics", Tata McGraw Hill 4th Edition, ISBN 978-0-07-06691-16
2. James Turley- "Advanced 80386 Programming Techniques", Mc GrawHill, ISBN: 10:0078813425, 13: 978-0078813429.

1. e Books- https://www.springer.com/gp/book/9783030361952
2. https://www.mheducation.co.uk/ebook-fundamentals-of-digital-logic- 9780077144227-emea
3. Assembly Language Programming By Richard Pawson 2020
4. Assembly Language Step-by-step: Programming with Linux, 3rd Edition, Jeff Duntemann, Wiley ISBN:-10 0470497025, ISBN-13: 978- 0470497029, 2009.
5. Introduction to 64 bit Intel Assembly Language Programming for Linux, 2nd Edition, Ray Seyfarth, ISBN10: 1478119209, ISBN-13: 9781478119203, 2012.
6. Chris H. Pappas, William H. Murray, "80386 Microprocessor Handbooks", McGraw-Hill Osborne Media, ISBN-10: 0078812429, 13: 978-0078812422.

V Lab Link

1. https://coa-iitkgp.vlabs.ac.in/exp/karnaugh-map/
2. https://coa-iitkgp.vlabs.ac.in/exp/quine/
3. https://de-iitg.vlabs.ac.in/exp/half-adder-full-adder/
4. https://cse11-iiith.vlabs.ac.in/exp/integers-arithmetic/
5. https://cse11-iiith.vlabs.ac.in/exp/virtual-memory/

NPTEL Link

1. https://nptel.ac.in/courses/106/108/106108100/
2. https://nptel.ac.in/courses/108/107/108107029/

Scheme for Continuous Evaluation

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Attendance	12	50	20
		Implementation of Assignments	18		
		Quality of Journal	10		
		Viva-Voce	10		
	End Evaluation	Oral Examination	50	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	2	1	3	2	1	2	3	-	3
CO2	3	2	3	2	3	2	1	3	2	2	2	3	-	3
CO3	3	2	2	1	3	2	1	3	2	2	2	3	-	3
CO4	2	1	2	2	2	2	1	2	2	2	2	3	-	3
CO5	2	1	2	2	2	2	2	2	2	2	2	3	-	3
CO6	2	1	2	2	2	2	2	2	2	2	2	3	-	3

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

Course Category	Program Core Course 7	**Course Code**	**CE124PC405**
Course Title: Software Engineering			

Teaching Scheme				**Evaluation Scheme**					
					Theory Marks			**Practical Marks**	
L	**T**	**P**	**Cr**	**Exam**	**Max (%)**	**Min Marks for Pass (%)**		**Max**	**Min for Pass**
2	0	0	2	CCE	50	20	40	-	-
Total Hours:26				ESE	50	20			

Prerequisites: Programming and Problem Solving	
Course Objectives: This course aims to build the 1. To learn and understand the principles of Software Engineering. 2. To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements. 3. To apply design and testing principles to software project development.	
Course Outcomes: After successful completion of the course units the student will	
CO1	**Apply** software engineering principles and process models to develop software solutions.
CO2	**Develop** and analyze software requirements using engineering techniques and modeling approaches to ensure accurate system representation.
CO3	**Analyze** and apply software design principles, concepts, and models to create high- quality, modular, and scalable software architectures
CO4	**Analyze** and design software architecture, architectural styles, and components, applying data flow mapping and component-based development principles
CO5	**Apply** software testing techniques, including white-box and black-box testing, to evaluate software quality across different environments and architectures

Syllabus

Unit I	**Introduction to Software Engineering**	**5 hrs**
Software Engineering Fundamentals: Nature of Software, Software Engineering Principles, The Software Process, Software Myths. Process Models: Generic Process Model, Prescriptive Process Models- The Waterfall, Incremental Process (RAD), Evolutionary Process, Unified Process, Concurrent. Advanced Process Models: Agile Process Model Methods, Plan driven and agile development, Extreme Programming (XP) Practices. **Self-Study/Case Study:** Design a software development plan for a mobile app, incorporating software engineering principles, process models like Waterfall and Agile, and comparing plan-driven and agile approaches.		

Unit II	Requirement Engineering & Modeling	5 hrs

Requirements Engineering: Eliciting requirements Developing Use Cases, Building the Requirements Model, Negotiating requirements, Validating Requirements. Requirements Modeling: Requirement Analysis, Scenario Based Modeling, UML Models, Data Modeling concepts, Class Based Modeling, Flow Oriented Modeling and Creating Behavioral Model.
Case Study/Self Study : Develop a requirements model for a banking system, including eliciting requirements, use cases, UML models, and behavioral modeling.

Unit III	Design Engineering	5 hrs

Design Process: Software Quality guidelines and Attributes, Evolution of Software Design Design Concepts**:** Abstraction, Architecture, Pattern, separation of concern, modularity, information hiding, functional independence, refinement, aspects, refactoring, and object oriented design concepts and design classes. Design Model**:** Data Design Elements, Architectural Design Elements, and Interface Design Elements, component level Design Elements and Deployment Level Design Elements**.**
Case Study/Self Study: Design an e-commerce system applying software quality guidelines, design concepts, and design models for data, architecture, and components.

Unit IV	Architectural Design	5 hrs

Software Architecture, Architectural styles, Architectural Design, Architectural mapping using data flow, what is Component? Designing class based component, Conducting Component level design, designing traditional component, Component based development.
Case Study/Self Study: Develop an Component level design for WebApps

Unit V	Software Testing	5 hrs

Software Testing Fundamentals, Internal and External Views of testing, White Box Testing, Basis Path Testing, Control Structure Testing, Black Box testing, Model Based Testing, Testing for Specialized Environment, Architectures and Applications. **Case Study/Self Study**: Design and test a simple online shopping cart system using both White Box and Black Box testing techniques, focusing on control structures and model-based testing.

Text Books(*Note:Recent10Yearsbooksshouldbe used)

1. Roger Pressman, “Software Engineering: A Practitioner‘s Approach”‖, McGraw Hill, ISBN 0–07–337597–7
2. Ian Sommerville, “Software Engineering”‖, Addison and Wesley, ISBN 0-13-703515-2.

Reference Books(*Note:Recent10Yearsbooksshouldbe used)

1. Carlo Ghezzi, “Fundamentals of Software Engineering & PHI, ISBN-10: 0133056996
2. Rajib Mall, “Fundamentals of Software Engineering”‖, PHI, ISBN-13: 978-8120348981
3. Pankaj Jalote, “An Integrated Approach to Software Engineering”‖, Springer, ISBN 13: 9788173192715.
4. S K Chang, “Handbook of Software Engineering and Knowledge Engineering”‖, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1

NPTEL Courses : https://onlinecourses.nptel.ac.in/noc20_cs68/preview
https://onlinecourses.nptel.ac.in/noc19_cs70/preview

Any of above course(s) applicable for credit transfer as per the institute policy

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	0	2	2	0	0	3	1	2
CO2	3	3	2	2	2	2	0	0	0	0	0	3	1	2
CO3	3	3	3	2	2	2	0	0	0	0	2	3	1	2
CO4	3	3	3	2	2	2	0	0	0	2	0	3	1	2
CO5	3	3	0	3	2	2	0	2	2	0	0	3	1	2

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

Course Category	Multidisciplinary Minor 2	Course Code	CE124MD406
Course Title: Introduction to Power BI			

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max (%)	Min Marks for Pass (%)		Max	Min for Pass
2	0	0	2	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
26	0	0	Total hrs: 26		100				

Prerequisites: Programming and Problem solving.

Course Objectives:

1. To Understand Fundamentals of Data Analytics and Visualization with Power BI
2. To Learn essentials of Power BI Desktop and Data Transformation
3. To design basic Reports using Power BI
4. To Learn Data Analysis using DAX in Power BI
5. To Understand the fundamentals of Data Visualization in Power BI

Course Outcomes: After successful completion of the course units the student will

CO1	Understand Basic Concepts of Business Intelligence Power BI
CO2	Apply Power BI Desktop Knowledge for Data Transformation
CO3	Design Reports in Power BI
CO4	Apply Calculated Columns and Measures for Performing Data Analysis using DAX
CO5	Apply data visualization techniques in Power BI

Syllabus

Unit I	Introduction to Power BI	6 hrs
Introduction to Business Intelligence Self-Service Business Intelligence (SSBI) Introduction to Power BI Traditional BI vs. Power BI Power BI vs. Tableau vs. Qlik View Uses of Power BI The Flow of Work in Power BI Working with Power BI Basic Components of Power BI Comparison of Power BI, Version Introduction to Building Blocks of Power BI, Data model and importance of Data Modeling, Overview of Power BI data Sources		
Unit II	**Power BI Desktop and Data Transformation**	**6 hrs**
Overview of Power BI Desktop, Data Sources in Power BI, Desktop Loading Data in Power BI, Desktop Views in Power BI, Desktop Query Editor In Power BI , Transform, Clean, Shape, and Model Data Manage Data Relationship Editing a Relationship Cross Filter Direction Saving Work file Measures		
Unit III	**Basic Report Design in Power BI**	**5 Hrs**
Power BI Desktop Installation, Data Sources & Visual Types, Canvas, Visualizations and Fields, Get Data and Memory Tables, In-Memory x velocity Database, Table and Tree Map Visuals , Format Button and Data Labels , Legend, Category and Grid , PBIX and PBIT File Formats ,Visual Interaction, Data Points , Disabling Visual Interactions , Edit Interactions - Format Options ,SPOTLIGHT & FOCUSMODE , CSV and PDF Exports. Tooltips , Power BI Ecosystem, Architecture		

Unit IV	Data Analysis using DAX	4 Hrs
Introduction to DAX, Importance of DAX, Data Types in DAX, DAX Calculation Types, Steps to Create Calculated Columns , Measures in DAX ,DAX Syntax , DAX Functions DAX Operators, DAX Tables and Filtering ,DAX Architecture Entity sets, Data Measures and Calculations, Data Modeling Options in DAX, Entity sets and Slicing in DAX,SUM DATEDIFF Examples in DAX		
Unit V	**Data Visualization in Power BI**	**5 hrs**
Introduction to Visuals in Power BI, Visualization Charts in Power BI, Matrixes and Tables, Slicers and Map, Visualizations Gauges and Single Number Cards, Modifying Colors in Charts and Visuals Shapes, Text Boxes, and Images **Case Study:** - Power BI helping HR in recruitment process.		

Text Books (* Note : Recent 10 Years books should be used)

1. Power BI Data Analysis and Visualization Perfect Paperback – 10 September 2018 by Suren Machiraju (Author), Suraj Gaurav (Author)
2. Data Analytics & Visualization All-In-One for Dummies Paperback – 9 April 2024

Reference Books(* Note : Recent 10 Years books should be used)

1.Mastering Power BI Paperback – 30 September 2021 by Chandraish Sinha
2.Introducing Microsoft Power BI by Alberto Ferrari (Author), Marco Russo (Author).
3. Microsoft Power BI for Dummies Paperback – 23 January 2023 by Jack A. Hyman

E-Contents: -

1. https://www.coursera.org/lecture/data-analysis-and-visualization-with-power- bi/course-recap-data analysis-and-visualization-with-power-bi-StWLm
2. Case Study:-https://www.inkeysolutions.com/images/casestody_file/1562926447.pdf Dataset to be used: https://www.kaggle.com/datasets/CooperUnion/cardataset

CO-PO Mapping

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

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

Course Category	Open Elective 2	Course Code	CE124MD407
Course Title: Decision Support Systems			

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max (%)	Min Marks for Pass (%)		Max	Min for Pass
2	0	0	2	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
26	0	0	Total hrs: 26						

Prerequisites: Database Management Systems, Business Intelligence (BI) and Data Analysis.

Course Objectives:

1. To Understand Fundamentals of Decision Support Systems.
2. To Learn Components and Architecture of the DSS.
3. To Understand Techniques and Models for DSS.
4. To Implement DSS to understand and implement different phases of DSS.
5. To implement DSS Sustainability.

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

CO1	Understand Fundamentals of Decision Support Systems.
CO2	Learn Components and Architecture of the DSS.
CO3	Understand Techniques and Models for DSS.
CO4	Implement DSS Applications.
CO5	Implement DSS to provide Sustainable Solutions.

Syllabus

Unit I	Introduction to Decision Support Systems (DSS)	5 hrs

Introduction to Decision Support Systems: What DSS?Data-driven, model-driven, knowledge-driven, and communication-driven decision support system, Features and constituents of DSS, The advantages and difficulties of DSS. **History and Development:** Historical background and evolution, Technology DSS in contrast to other information systems such as expert systems and MIS.

Unit II	Architecture of DSS	6 hrs

Architecture of DSS: Architecture and Components, **DSS Data Management:** Sources of data: internal and external, Data marts and data warehouses, Methods of data mining for decision assistance. **DSS Model Management:** Models' function in decision support, Model types (simulation, optimization, etc.), Tools and software for creating models. **DSS's Knowledge Management :** Knowledge's function in decision support, Techniques for representing knowledge .

Unit III	Techniques and Models for DSS	5 Hrs
Statistical and Mathematical Models: Linear and nonlinear, Models for optimization, Models for forecasting, Models for Simulation: Methods of simulation, Simulation use cases in DSS. AI and Expert Systems in DSS: Expert systems to make decisions, DSS artificial intelligence methods, Data Integration and Processing **Case Study:** AI-Based Decision Support Systems in Industry 4.0		
Unit IV	**DSS Applications**	**5 Hrs**
DSS Application Case Studies: DSS in business management, Healthcare DSS, Finance-related DSS. **Software Tools for DSS:** An overview of widely used DSS tools. **DSS Implementation**: DSS development steps include system design, prototype, and testing, Implementing DSS ,current challenges, Factors affecting DSS.		
Unit V	**Developing An Android Application for Real World**	**5 hrs**
Decision support technology and sustainable development, Sustainable Development and Decision Support Systems, Decision Support for Sustainable Land Development: A Case Study of Dongguan, Water Resource Management: A Case Study for EcoKnowMICS, DSS Application Areas.		

Text Books (* Note : Recent 10 Years books should be used)

1. **"Decision Support and Business Intelligence Systems"** (9th Edition) By Efraim Turban, Ramesh Sharda, Dursun Delen.
2. **"Decision Support Systems: A Knowledge-Based Approach"** by G. D. Shapiro**.**

Reference Books(* Note : Recent 10 Years books should be used)

1. **"Handbook of Decision Support Systems"** edited by Franz J. Radermacher, Hans-Dieter Meyer, and Peter W. D. Strass burger.
2. **"Decision Support Systems: Concepts and Resources for Managers"** by Daniel J. Power**.**
3. **"Decision Support System for Sustainable Development :A Resource Book of Methods and Applications"** Gregory (Grzegorz) E. Kersten Zbigniew Mikolajuk Anthony Gar-On Yeh.

E-contents:

1. Decision Support Systems on Coursera
2. DSS Overview on YouTube
3. Decision Support Systems on ResearchGate
4. https://link.springer.com/content/pdf/bfm:978-0-306-47542-9/1

CO-PO Mapping

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

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

Course Category	Vocational and Skill Enhancement Course 3	Course Code	CE124VS408
Course Title: Cyber Security and Data Protection 1			

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max (%)	Min Marks for Pass (%)		Max	Min for Pass
1	0	2	2	CCE	-	-		100	40
39	0	0	Total hrs: 39				-		

Prerequisites: Computer Fundamentals	
Course Objectives: After successful completion of the course the student will be able to	
• Introduce students to the concepts of cyberspace, computer and web technologies, and the evolution of the Internet. • Explain the structure of Internet infrastructure, Internet governance mechanisms, security frameworks, and challenges in cyberspace. • Develop understanding of various forms of cybercrimes, cybercriminal techniques, modern attack vectors, and methods of reporting and mitigating cyber incidents.	
Course Outcomes: After successful completion of the course units the student will	
CO1	Understand the fundamental concepts of cyberspace, computer/web technology, and internet architecture.
CO2	Understand the fundamental Cyber Security internet architecture and challenges associated with it.
CO3	Explain the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms..
CO4	Classify various types of cybercrimes and analyze cybercriminal techniques, malware and ransomware
CO5	Identify and classify the concepts of data, information, privacy, principles of data protection (CIA Triad).

Syllabus

Unit I	Introduction to Cyber Security	3 Hrs
Defining Cyberspace, Overview of Computer and Web Technology, Architecture of Cyberspace, Communication and Web Technology, Internet and its Components, World Wide Web (WWW), Advent and Evolution of Internet. Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems associated with Computer Crimes, Realms of Cyber world, brief history of the internet.		
Unit II	**Internet Infrastructure & Cyber Security Concepts/ Cyber Threats and Attacks**	**3 hrs**

Internet Infrastructure for Data Transfer, Governance of Internet, Internet Society & Standard, Regulation of Cyberspace, Concept of Cyber Security, Issues and Challenges in Cyber Security.

Types of Cyber Threats: Focus on major threats like malware, phishing, insider threats, and APTs.; Cyber Attack Vectors: Overview of network-based, web-based, endpoint, and cloud-based attacks.; Case Studies of Major Cyber Attacks: Brief analysis of high-profile incidents.; Attack Methodologies: Summary of reconnaissance, scanning, gaining access, maintaining access, and covering tracks.

Unit III	**Cyber Offences/Security Policies and Procedures**	**3 Hrs**

Classification of Cyber Crimes, Common Cyber Crimes, Crimes targeting computers & mobiles, Cyber-crimes against women & children, Financial frauds Social engineering attacks, Malware & ransomware, Zero-day and zero-click attacks and cybercriminals modus-operandi.

Introduction to Security Policies: Purpose and importance, with examples of common policies.; Security Policy Development: Key steps, roles, and responsibilities in creating policies.; Security Procedures: Overview of incident response, change management, and access control.; Security Policy Implementation: Focus on training, awareness, monitoring, and regular updates.

Unit IV	**Cyber Laws/Privacy Laws**	**2 Hrs**

Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies: Ransomware Attack on AIIMS Delhi (2022): A Case Study on Cybercrime and Cybersecurity Response in India.

Overview of Privacy Laws: GDPR, CCPA, HIPAA, and other relevant global regulations.; Comparative Analysis: Differences and similarities between various privacy laws.; Compliance Requirements: Understanding and implementing regulatory obligations.; Cross-Border Data Transfers: Challenges and legal considerations.; Case Studies: Legal cases related to privacy violations and their outcomes.

Unit V	**Introduction to Data Protection/ Data Protection Principles**	**2 Hrs**

Definition of Data, Information and Privacy, Importance of Data Protection in Cyber Security, Principles of Data Protection (Confidentiality, Integrity, Availability – CIA Triad), Sensitive Personal Data and Critical Information Infrastructure.

Introduction to Data Protection: Importance and fundamental concepts.; Key Data Protection Principles: Lawfulness, fairness, transparency, data minimization, accuracy, storage limitation, integrity, and confidentiality.; Data Lifecycle Management: Collection, storage, processing, sharing, and deletion of data.; Roles and Responsibilities: Data controllers, data processors, and data subjects.; Case Studies: Analysis of data protection failures and successes.

Practical Assignments

1. Checklist for reporting cybercrime at Cybercrime Police Station.
2. Checklist for reporting cybercrime online.
3. Reporting phishing emails.
4. Demonstration of email phishing attack and preventive measures.
5. Identify any three commonly occurring cybercrimes (such as phishing, identity theft, or online fraud).
6. Explain a simple social engineering attack scenario (like phishing email or phone-based OTP scam).
7. Study the legal aspects of cybercrime in India and explain how laws are used to prevent, detect, and punish cyber offences.
8. Write a program to check whether the user's input belongs to a list of sensitive personal data types (e.g., password, Aadhaar number, health data).

Text Books:

1. William Stallings – Cryptography and Network Security: Principles and Practice
2. Michael E. Whitman & Herbert J. Mattord – Principles of Information Security
3. Nina Godbole & Sunit Belapure – Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives
4. P. W. Singer & Allan Friedman – Cybersecurity and Cyberwar: What Everyone Needs to Know

Reference Books:

1. R. L. Naik, B. Manjula, S. Jain, and V. Bapuji, *Fundamentals of Cyber Security*, New Delhi, India: IIP Publications, 2025.
2. M. Mishra, K. Singh, and R. P. Singh, Cyber Security in India: Challenges and Options, New Delhi, India: IIP Publications, 2024.
3. V. Sood, Cyber Laws Simplified. New Delhi, India: Tata McGraw-Hill Education, 2013.
4. C. Hadnagy, Social Engineering: The Science of Human Hacking, 2nd ed. Indianapolis, IN, USA: Wiley, 2018.
5. R. Meeuwisse, Cybersecurity for Beginners. SCSP, 2017.
6. M. Ciampa, Security+ Guide to Network Security Fundamentals, 6th ed. Boston, MA, USA: Cengage Learning, 2018.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	-	-	-	-	1	-	2
CO2	3	3	2	2	2	-	-	1	-	2	-	2
CO3	2	3	3	2	2	2	3	2	-	3	-	2
CO4	1	2	1	-	-	3	3	3	-	2	-	2
CO5	2	2	1	1	3	2	2	2	1	3	-	2

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

Course Category	Ability Enhancement Course2	Course Code	HSM2401P01
Course Title: Soft Skills – Work Place and Life Readiness			

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max (%)	Min Marks for Pass (%)		Max	Min for Pass
1	0	2	2	CCE	-	-	-	100	40
39	0	0	Total hrs: 39						

Course Objectives: 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 heterogeneous and multidisciplinary teams 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 constructively participate in group discussion, meetings, prepare and deliver presentations

Syllabus

Unit I	Self-Introduction & SWOC Analysis	2 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. Applications of SWOC in domain specific Industry		
Unit II	**Writing Skills**	**2 hrs**
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**	**3 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. Case studies about development of ethics		
Unit IV	**Group Discussion & Personal Interview**	**5 Hrs**
Introduction to Group Discussion, Difference between Group Discussion and debate, Etiquettes while conducting Group Discussion, Professional Phases to be used in Group Discussion, handling complexities in GD, 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**	**3 Hrs**
Differences of interpersonal and interpersonal 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
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 PushpaLata, "Communication Skills", Oxford University Press.
4. Atkinson and Hilliard'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/

Marking Scheme for Evaluation

Marking Scheme 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	Participation in Teaching Learning Process	10
	Total Marks:	**100**

CO-PO Mapping

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

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

Course Category	Entrepreneurship / Economics and Management 2	Course Code	CE124EE410
Course Title: Entrepreneurship, Management & Software Project Execution			

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max (%)	Min Marks for Pass (%)		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
				ESE	50	20			
26	0	0	Total hrs: 26		100				

Course Objectives: Purposes of Course are:

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

CO1	**Analyze** entrepreneurship principles and software startup ecosystems. (Analyze – Level 4)
CO2	**Design** viable business and financial models for IT and software ventures. (Create – Level 6)
CO3	**Evaluate** software project management methodologies (Agile, Scrum, DevOps). (Evaluate – Level 5)
CO4	**Formulate** leadership, team management, and conflict resolution strategies in IT projects. (Create – Level 6)
CO5	**Apply** project management tools like JIRA, GitHub Projects, and Monday.com for Agile software execution. (Apply – Level 3)

Syllabus

Unit I	IT Entrepreneurship and Software Start-up Ecosystem	5 hrs

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.

Unit II	Business Models, Financial Management & Software Contracts	5 hrs

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.

Unit III	Software Project Execution, Agile Methodologies & Tools	6 Hrs
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.		
Unit IV	**Leadership, Team Management, and Conflict Resolution in IT Projects**	**5 Hrs**
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		
Unit V	**Risk, Quality Assurance, and Scaling IT Start-ups**	**5 hrs**
The 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		

Project Management Tools Covered:

1. JIRA: Agile Project Management, Sprint Tracking.
2. GitHub Projects: Version Control and Collaboration for Software Development.

Textbooks:

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.

Course Category			Value Education Course(VEC) II		Course Code		CE124VE411
Course Title			Sustainable Development Goals II				
Teaching Scheme				Evaluation Scheme			
					Theory Marks		Practical Marks	
L	T	P	Cr	Exam	Max (%)	Min Marks for Pass (%)	Max	Min for Pass
2	0	0	2	CCE	50	20	-	-
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: Purposes of Course are:

1. **Understand Universal Human Values (UHV)** – Develop ethical, moral, and professional values in students.
2. **Apply UHV in Personal and Professional Life** – Explore human relationships, harmony, and responsible behavior.
3. **Develop Ethical Decision-Making Skills** – Analyze real-life scenarios and case studies to build decision-making abilities.
4. **Study Constitutional Rights and Duties** – Understand fundamental rights, directive principles, and governance structure.
5. **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.

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**	**5 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	0	0	0	0	0	0	0	0	3	3
CO2	3	3	3	3	0	0	0	0	0	0	0	0	3	3
CO3	3	3	3	3	0	0	0	0	0	0	0	0	3	3
CO4	3	3	3	3	0	0	0	0	0	0	0	0	3	3
CO5	3	3	3	3	0	0	0	0	0	0	0	0	3	3

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

Course Category	Non Credit Course 3	**Course Code**	**CE124NC412**
Course Title: Non Credit Course- Competitive Programming			

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

Prerequisites: Software Engineering, Any programming Language, Any software designing tools

Course Objectives:

Enable students to develop problem-solving skills, build innovative solutions, and improve teamwork through hackathon participation

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

CO1	Understand the array traversal and conditional logic to solve real-world search problems.
CO2	Implement algorithms for union and intersection without built-in set libraries.
CO3	Understand real-world problem modeling using OOP concepts like data encapsulation.
CO4	Implement interactive console applications using decision-making and iterative constructs.
CO5	Demonstrate the ability to design small management systems using structures and arrays.

Guidelines for Laboratory Conduction:

- Assignments on all concepts are covered and should be implemented on coding platforms such as HackerRank, CodeChef.
- Use of open-source software is to be encouraged.
- Operating System recommended: - 64-bit Open-source Linux or its derivative.
- Programming tools recommended: - G++/GCC, Eclipse.

Guidelines for Students:

- The laboratory assignments are to be submitted by students in the form of a journal.
- Journal consists of prologue, certificate, table of contents and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept, algorithm, time complexity, sample input and expected output, conclusion).
- Participation in Hackathon competition and NPTEL Course Certification is compulsory.

Guidelines for Laboratory /TW Assessment:

- Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
- Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.

Suggested parameters for overall assessment as well as each Laboratory assignment assessment include- timely completion, performance, innovation, efficiency, punctuality and neatness.

Practical Assignments
Assignment 1: **Write a program to find pair of elements whose sum equals a given target.** Title of the Problem: Mobile App for Direct Market Access for Farmers Category: Software Theme: Agriculture, FoodTech & Rural Development Problem Description: Developing solutions, keeping in mind the need to enhance the primary sector of India - Agriculture and to manage and process our agriculture produce
Assignment 2: **Write a Program for implement matrix addition and multiplication.** Title of the Problem: Mobile App for Direct Market Access for Farmers Category: Software Theme: Agriculture, FoodTech & Rural Development Problem Description: Background: Farmers often face challenges in accessing markets, leading to lower income due to middlemen. This gap restricts their ability to sell produce at fair prices. Description: Create a mobile application that connects farmers directly with consumers and retailers. The app should include features for listing produce, negotiating prices, and managing transactions, thereby reducing dependence on intermediaries. Expected Solution: A user-friendly mobile platform that enables farmers to showcase their products and connect with buyers directly, enhancing their income potential.
Assignment 3: Write a program to find **common** elements in two arrays. Title of the Problem: AI-Driven Crop Disease Prediction and Management System Category: Software Theme: Agriculture, FoodTech & Rural Development Problem Description: Background: Crop diseases can devastate yields, leading to significant financial losses for farmers. Early detection and timely intervention are crucial for effective management. Description: Develop an AI-driven system that analyzes crop images and environmental data to predict potential disease outbreaks. This system will provide farmers with actionable insights and treatment recommendations to mitigate risks. Expected Solution: A mobile and web-based application that utilizes machine learning algorithms to identify crop diseases and suggest preventive measures and treatments based on real-time data.

Assignment 4:
Write a Program to find the intersection and union of sets (using arrays).
Title of the Problem: Mobile App for Direct Market Access for Farmers
Category: Software
Theme: Agriculture, FoodTech & Rural Development
Problem Description:
Background: Excessive and improper use of fertilizers leads to soil degradation and reduced agricultural productivity, negatively impacting farmers' income. Description: Create a data-driven solution that recommends optimal fertilizer types and quantities based on soil health, crop type, and weather patterns, ensuring sustainable agricultural practices. Expected Solution: An application that analyzes soil data and provides tailored fertilizer recommendations, promoting sustainable farming while enhancing crop yield and farmer income.

Text Books

1. Competitive Programming 4" by Steven Halim
2. Programming Challenges: The Programming Contest Training Manual" by Steven S. Skiena
3. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" by Antti Laaksonen

Reference Books(* Note : Recent 10 Years books should be used)

1. Introduction to Algorithms" (CLRS) by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
2. The Art of Computer Programming" (TAOCP) by Donald E. Knuth
3. Algorithm Design" by Jon Kleinberg and Éva Tardos

E-Books:

1. Algorithms by Jeff Erickson (freely available online)
2. NPTEL: Getting Started with Competitive Programming By Prof. Neeldhara Misra | IIT Gandhinagar

CO-PO-PSO Mapping

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

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

Course Category	Non Credit Course 4	Course Code	CE124NC413
Course Title: Aptitude and Technical Mastery for Placements - 2			

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

Prerequisites: Basic Mathematics & Fundamentals of Programming
Course Objectives:
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.

Syllabus

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,. Quantitative Aptitude for Competitive Examinations, 3rd (Ed.). New Delhi: S. Chand Publishing 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		

S Y 2025-2026 Pattern Autonomy Curriculum

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