3rd Semester

B.Tech. (Artificial Intelligence & Machine Learning)

B.Tech. (Artificial Intelligence & Data Science)

B.Tech. CSE (Data Science)

B.Tech. CSE (IoT & Cyber Security including Blockchain Technology)

B.Tech CSE (Cyber Security)

B.Tech (Robotics & Artificial Intelligence)

Category	Course Code	Course Title	Subject Type	Hours per week			Marks Distribution			Credits
				L	T	P	Int	Ext	Total	
Basic Sciences	25C1CSU-301	Mathematics – III (Probability and Statistics)	T	3	1	0	40	60	100	4
Professional Core Course	25C1CSU-302	Object Oriented Programming using C++	T	3	0	0	40	60	100	3
Professional Core Course	25C1CSU-311	Object Oriented Programming using C++ Lab	P	0	0	4	30	20	50	2
Engineering Sciences	25C1CSU-303	Digital Electronics	T	3	0	0	40	60	100	3
Engineering Sciences	25C1CSU-312	Digital Electronics Lab	P	0	0	2	30	20	50	1
Professional Core Course	25C1CSU-304	Data Structures and Algorithms	T	3	0	0	40	60	100	3
Professional Core Course	25C1CSU-313	Data Structures and Algorithms Lab	P	0	0	2	30	20	50	1
Open Elective	25C1XXU-XXX	Open Elective - I (Swayam / NPTEL/ MOOCs/Any other Platform/Department Elective pool)	T	3	0	0	0	100	100	3
Skill Enhancement	25C1SEU-301	Career and Placement Planning (CPP) -1	P	0	0	2	50	0	50	1
Skill Enhancement	25C1CSU-314	Future Skills Lab	P	0	0	2	30	20	50	1
NCC	25C1NCU-301	Constitution of India	T	2	0	0	0	0	0	Satisfactory/ Unsatisfactory
Training	25C1CSU-315	Summer Internship – I	P	0	0	6	60	40	100	2
Total				**17**	**1**	**12**	**390**	**460**	**850**	**24**

4th Semester

B.Tech. (Artificial Intelligence & Machine Learning)

B.Tech. (Artificial Intelligence & Data Science)

B.Tech. CSE (Data Science)

B.Tech. CSE (IoT & Cyber Security including Blockchain Technology)

B.Tech CSE (Cyber Security)

B.Tech (Robotics & Artificial Intelligence)

Category	Course Code	Course Title	Subject Type	Hours per week			Marks Distribution			Credits
				L	T	P	Int	Ext	Total	
Basic Sciences	25C1CSU-401	Discrete Mathematics	T	3	0	0	40	60	100	3
Professional Core Course	25C1CSU-402	Operating Systems	T	3	0	0	40	60	100	3
Professional Core Course	25C1CSU-411	Operating Systems Lab	P	0	0	2	30	20	50	1
Engineering Sciences	25C1CSU-403	Computer Organization and Architecture	T	3	0	0	40	60	100	3
Engineering Sciences	25C1CSU-412	Computer Organization and Architecture Lab	P	0	0	2	30	20	50	1
Professional Core Course	25C1CSU-404	Design and Analysis of Algorithms	T	3	0	0	40	60	100	3
Professional Core Course	25C1CSU-413	Design and Analysis of Algorithms Lab	P	0	0	4	30	20	50	2
Humanities and Social Sciences	25C1HSU-401	Universal Human Values	T	3	0	0	40	60	100	3
Professional Elective	25C1CSU-405	Core Elective - I (Swayam / NPTEL/ MOOCs/Any other Platform/Department Elective Pool)	T	3	0	0	0	100	100	3
Skill Enhancement	25C1SEU-401	Career and Placement Planning (CPP) - 2	P	0	0	2	50	0	50	1
Total				**18**	**0**	**10**	**340**	**460**	**800**	**23**

3rd Semester Syllabus

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-301	**Mathematics – III (Probability and Statistics)**	**BSC**	**4**	**3**	**1**	**0**	**40**	**60**	**100**

Pre-requisite: Intermediate Calculus and Basic algebra

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Apply the fundamental concepts of descriptive statistics including measures of central tendency, moments, skewness and kurtosis.
CO2	Identify relationship between variables using correlation, regression analysis and fitting of various curves by method of least square
CO3	Explain the concept of probability theory and expectation for discrete and continuous random variables
CO4	Analyze various probability distributions such as Binomial, Poisson and Normal including their properties, parameter evaluation and applications in real world scenarios.
CO5	Evaluate statistical inference techniques including sampling distributions, standard errors and conduct hypothesis testing for both large and small samples.

Detailed Syllabus

Unit 1: Basic Statistics: Introduction to Basic Statistics: Measures of Central tendency: Mean, Median, Mode, Measures of Dispersion: Standard Deviation, Skewness, Moments and Kurtosis. **(14Hrs.)**

Unit 2: Correlation and Regression: Karl Pearson's coefficient of correlation and rank correlation problems, regression analysis-lines of regression, problems. Curve fitting: Curve fitting by the method of least squares, fitting of straight lines, second degree parabolas and more general curves. **(10Hrs.)**

Unit 3: Probability: Introduction, sample space and events, Axioms of probability, Addition and multiplication theorems, conditional probability, Bayes' Theorem problems. Random variables, discrete random variable, probability mass function, continuous rando m variable, probability density function, mathematical expectation of Discrete and Continuous random variables and variance. **(8Hrs.)**

Unit 4: Probability Distributions: Probability distributions: Bernoulli trials, Binomial, Poisson and Normal, Poisson approximation to the binomial distribution, Evaluation of statistical parameters for these three distributions, Bivariate distributions and their properties. **(8Hrs.)**

Unit 5: Sampling& Testing of Hypothesis: Introduction to sampling distributions, standard error, type-I and type-II errors. Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, Single standard deviation and Difference of standard deviations. Test of significance for small samples: t- Test for single mean, difference of means, paired t-test, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes. **(12Hrs.)**

Statistical Analysis using software R in Mathematics-III(Probability and Statistics): Statistical methods for Data Science and Analytics, Applications of Probability Distribution in Machine Learning and Artificial Intelligence.

Text Books

S.No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Business Statistics and Analytics in Practice	Bruce L. Bowerman, Anne M. Drougas, William M. Duckworth, Lei Fan, Kyle B. Moninger and Patrick J. Schur	McGraw-Hill Education	10th(2025)
2	Introduction to Mathematical Statistics	Robert V.Hogg, Joseph W.Mckean and Allen T.Craig	Pearson Education	8th(2019)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Statistics for Management	Richard I. Levin, David S. Rubin, Masood H. Siddiqui, Sanjay Rastogi	Pearson Education	8th (2017)
2	A Guide to Business Statistics	David M. McEvoy	John Wiley & Sons (Wiley)	1st (2018)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-302	Object-Oriented Programming (OOP) using C++	PCC	3	3	0	0	40	60	100

Pre-requisite: C++

Course Outcomes:

At the end of the course the student will be able to:	
CO1	Apply object-oriented concepts such as classes, objects and abstraction to solve real-world problems.
CO2	Explain the concept of constructor and destructor of objects in C++ classes.
CO3	Illustrate inheritance mechanisms and derived class structures in C++.
CO4	Analyze the concept of data encapsulation, polymorphism with Virtual functions.
CO5	Interpret file handling, exception handling and use of templates to real world applications.

Detailed Syllabus

Unit 1:Introduction**:** Introduction to Procedural and Object Oriented Programming Languages, Different data types, operators, expressions, and statements, arrays and strings, pointers & function components, recursive functions, user-defined types, inline functions, Classes & Objects: classes, Scope resolution operator, passing objects, object assignment, Modern C++ basics: auto, nullptr, range-based for loop. **(8 Hrs.)**

Unit 2: Constructor & Destructor: Constructors (Default, Parameterized, Copy), Destructors, Static data members, Functions, friend functions, inline member function, Pointers to objects, this pointer, Smart pointers: unique_ptr, shared_ptr, weak_ptr, Dynamic memory allocation, move semantics (basic), move constructor, move assignment. **(7 Hrs.)**

Unit 3: Inheritance: Introduction, derived class declaration, types of inheritance inheriting multiple base classes, overriding member function, ambiguity in single inheritance, virtual base class, abstract class, invocation of Constructors & Destructors in Inheritance, passing parameters to base class constructors. **(6 Hrs.)**

Unit4: Polymorphism: Introduction, types of Polymorphism-Compile time and run time, Function Overloading, Operator Overloading (Unary and Binary), Polymorphism with pointers, Virtual Functions, pure Virtual Functions. **(5 Hrs.)**

Unit 5: Exception Handling and File Handling: Exception handling: try, throw, catch, catching by value vs. reference, Multiple catch blocks, Nested try-catch blocks, Rethrowing exceptions, Templates: Need of template, Function template, Class Template, Standard Template Library, File Handling: C++ stream classes, Formatted I/O, File operations: read/write, open/close. **(9Hrs.)**

Recent Trends in Object-Oriented Programming: Design Patterns in Object-Oriented Programming, Object Oriented Programming in Cloud-based Applications

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Object Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill.	8th(2025)
2	Object Oriented Programming with C++	Reema Thareja	Oxford University Press	2nd(2025)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	C++ Primer	Stanley B.Lippmann, JoseeLajoie	Addison Wesley	6th(2025)
2	Professional C++	Marc Gregoire	John Wiley & Sons Inc	6th(2024)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-311	Object-Oriented Programming (OOP) using C++ Lab	PCC	2	0	0	4	30	20	50

Course Outcomes:

At the end of the course the student will be able to:	
CO1	Develop C++ programs using classes and objects to implement object-oriented programming principles.
CO2	Construct programs using constructors, inheritance, and operator overloading.
CO3	Apply runtime polymorphism using virtual functions and abstract classes.
CO4	Design programs using templates and Standard Template Library (STL).
CO5	Develop applications that demonstrate file handling and exception handling in C++.

List of Experiments for Object-Oriented Programming Using C++Lab

S.No.	Experiment Title
1	Write a program that uses a class where the member functions are defined inside a class.
2	Write a program that uses a class where the member functions are defined outside a class.
3	Write a program to demonstrate the use of static data members.
4	Write a program to demonstrate the use of constant objects and member functions.
5	Write a program to demonstrate the use of zero argument and parameterized constructors.
6	Write a program to demonstrate the use of Smart pointers.
7	Write a program to demonstrate the use of dynamic constructor.
8	Write a program to demonstrate the use of explicit constructor.
9	Write a program to demonstrate the use of initializer list.
10	Write a program to demonstrate the overloading of increment and decrement operators.
11	Write a program to demonstrate the overloading of memory management operators.
12	Write a program to demonstrate the use of Inline functions and Default arguments**.**
13	Write a program to demonstrate the use of Friend function and Friend class**.**
14	Write a program to demonstrate the multiple inheritances.
15	Write a program to demonstrate the multilevel inheritance.
16	Write a program to demonstrate the use of Virtual base class to resolve ambiguity in multiple inheritance.
17	Write a program to demonstrate the runtime polymorphism.
18	Write a program to demonstrate the exception handling.
19	Write a program to implement the exception handling with multiple catch statements.
20	Write a program to demonstrate the use of function template.
21	Write a program to demonstrate the use of class template.
22	Write a program to demonstrate the use of Standard Template Library.
23	Write a program to demonstrate the reading and writing of mixed type of data

24	Write a program for reading and writing data to and from the file using command line arguments.

Mini Project

1	Create a Library Management System to add books, display book list, search books, and issue/return books using Classes, encapsulation, file handling.
2	Create a simple Calculator with advanced mathematical operations (modulus, power, square root, factorial, logarithm**)** using C++.

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-303	Digital Electronics	ESC	3	3	0	0	40	60	100

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Explain the concept of binary system and minimize the Boolean's expression using different techniques.
CO2	Design the digital circuits using the concept of combinational logic.
CO3	Design the digital circuits using the concept of sequential logic.
CO4	Compare the various types of semiconductor memories and evaluate the composition of programmable logic devices.
CO5	Analyze the working principle and characteristics of A/D and D/A converters.

Detailed Syllabus

Unit 1: Fundamentals of Digital Systems and Minimization of Boolean's Functions: Number Systems and their conversions, Binary Codes: Weighted BCD, Gray code, Excess 3 code, ASCII, Logic Gates, Boolean postulates and laws – De-Morgan's Theorem, Boolean expression, Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), P roduct of Sums (POS), Minterm, Maxterm, Karnaugh map Minimization, Don't care conditions, Quine-McCluskey method. **(8 Hrs.)**

Unit 2: Design of Combinational Circuits: Design procedure – Adders, Subtractors, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, Encoder/Decoder, Parity Checker, Code Converters, Implementation of combinational logic using MUX, BCD to 7 Segment Decoder. **(8 Hrs.)**

Unit 3: Design of Sequential Circuits: Flip flops: SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Realization of one flip flop using other flip flop, Design of Asynchronous/Ripple Design of Synchronous counters: n-Bit and Modulo-n counter, State Diagram, Circuit Implementation, Introduction to shift registers. **(8 Hrs.)**

Unit 4: Semiconductor Memories and Programmable Logic Devices: Characteristics of memories, read and write memory (RAM), read only memory (ROM), PROM, EPROM, EEPROM, Programmable logic array, Programmable array logic **(6 Hrs.)**

Unit 5: A/D & D/A Convertors**:** Analog & Digital signals, Sampling Theorem, Sample and Hold circuit, Analog to Digital Converters: Flash type, Counter Type, Dual Slope type, Successive Approximation type, Digital to Analog Converters: Weighted Register type, R-2R Ladder Network type**.** **(4 Hrs.)**

High-performance Specialized Hardwares:
Introduction to Field Programmable Gate Array (FPGA), Graphics Processing Units (GPUs), FPGAs, and ASICs

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Fundamentals of Digital Circuits	Anand Kumar	Prentice Hall of India Pvt. Ltd	4th(2016)
2	Digital Fundamentals	Thomas L. Floyd	Pearson Education	11th(2025)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Digital Principles and Applications	Donald P. Leach and Albert Paul Malvino	Tata McGraw Hill	5th(2016)
2	Digital System - Principles and Applications	Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss	Pearson Education	10th(2017)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-312	Digital Electronics Lab	ESC	1	0	0	2	30	20	50

Pre-requisite (if any)

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Experiment with basic logic gates to verify with truth tables.
CO2	Implement and verify different combinational circuits used in digital system.
CO3	Implement and verify different sequential circuits used in digital system.
CO4	Analyze the operation of full adder and full subtractor circuits using decoder and multiplexer.
CO5	Demonstrate the operations of synchronous and asynchronous counters.

List of Activities for Digital Electronics Lab

S.No.	Activity Title
1	To implement and verify the truth-tables of all logic gates using breadboard.
2	To implement and verify the truth-tables of all logic gates using digital kit.
3	To realize and verify the half & full adder circuits using logic gates.
4	To realize half & full subtractor circuits using logic gates.
5	To realize 4-bit binary to gray & gray to binary code converter.
6	To realize Multiplexer circuits.
7	To realize Demultiplexer circuits.
8	To realize Encoder and Decoder circuits.
9	To realize a magnitude comparator circuit for two binary numbers of 2-bit each.
10	To verify the operation of full adder & full subtractor circuits using a decoder.
11	To verify the operation of full adder & full subtractor circuits using a multiplexer.
12	To verify the truth tables of flip-flops: SR, JK, D and T.
13	To verify the operation of a 4 bit synchronous and asynchronous up-down counter.
14	To verify the operation of a decade (Mod-10) synchronous counter.

Mini Projects

1	Develop a microprocessor-based digital stopwatch system using sensors for input control, automation features, digital counters, and display modules to measure, record, and display precise time intervals with real-time monitoring and lap functionalities.
2	Design an automated water level monitoring and control system using sensors and a microprocessor to regulate tank water levels, control pump operations, and provide real-time monitoring through display modules and alert mechanisms.

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-304	**Data Structures and Algorithms**	**PCC**	**3**	**3**	**0**	**0**	**40**	**60**	**100**

Course Outcomes:

At the end of this course, students will be able to:	
CO1	Classify fundamental data structure types and evaluate algorithm efficiency using time and space complexity with asymptotic notations.
CO2	Apply structured data manipulation using arrays, stacks, and queues, while assessing their computational behaviour.
CO3	Analyze the use of dynamic memory structures such as linked lists, and evaluate their role in efficient data organization.
CO4	Design structured solutions for complex problems using trees, graphs, and hashing techniques through algorithmic strategies.
CO5	Compare the operation and efficiency of standard searching and sorting algorithms to support data access and optimization.

Detailed Syllabus

Unit 1: Introduction: Concepts of data and algorithm, Relation between Data structure & algorithm, Data types, Data Structures & Abstract data types, Representation of Arrays, Sparse matrices. Arrays: Array as an ADT, Single and multi-dimensional array, Memory representation (row major and column major) of array, Operations on Arrays. Complexity Analysis: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms. **(4Hrs.)**

Unit 2: Restricted Linear Data Structure: Stacks: Concept of stacks, Operation on stacks, Multiple stacks, Array implementation of stack, Linked list implementation of stack, Application of stacks in Infix, Postfix, Prefix, Recursion, Parenthesis matching, Towers of Hanoi. Queues: Concept of Queues, Operation on Queues, Multiple Queues, Priority Queues, Circular Queues, Array implementation of queue, Linked list implementation of queue. **(6 Hrs.)**

Unit 3: Non-Restricted Linear Data Structure: Linked List: Insertion, Deletion and traversal on Linear Linked Lists, Representation of Linear List- Sequential Representation and Linked Representation. Doubly Linked List, circular Linked List, Linked List as data structure, Header nodes, Dynamic memory management, Garbage Collection. Application of Linked list-Representation of polynomial. **(9Hrs.)**

Unit 4: Nonlinear Data structures: Trees: Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, Heap data structure and its applications as priority queues, heap implementation, insertion and deletion operations, Heapsort. Search & Multi-way Trees: Binary search trees, search efficiency, insertion and deletion operations, importance of balancing, AVL trees, B-trees, B+ trees.Graphs: Representation of Graphs, traversal methods, Applications undirected graphs, Directed Graph & their traversal, Depth first, Breadth First, implementation – adjacency matrix and linked adjacency chains, Shortest path algorithms, Minimum Cost Spanning tree.Hashing: Hashing Functions, hashing as a

search structure, hash table, collision avoidance, linear open addressing, chaining. **(9Hrs.)**

Unit 5: Sorting and Searching: Searching & Sorting: Basic searching in an array of elements (linear and binary search techniques), Sorting Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Shell Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort; Performance and Comparison among all the methods. **(8Hrs.)**

Recent trends in Data Structures and Algorithms
Parallel and distributed algorithms, probabilistic data structures (Bloom filters), and distributed hash tables for large-scale data processing.

Text books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Data Structures using C and C++	Y. Langsam, M. J. Augenstein, A. M. Tanenbaum	Pearson Education	2nd(2025)
2	Data Structures with C (Schaum's Outline Series)	Seymour Lipschutz	McGraw Hill Education	1st(2014)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Algorithms, Data Structures, and Problem Solving with C++	Mark Allen Weiss,	Addison-Wesley Publishing Company	Illustrated Edition
2	Fundamentals of Data Structures in C++	E. Horowitz, S. Sahni , D. Mehta	Universities Press	2nd(2008)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-313	Data Structures and Algorithms Lab	PCC	1	0	0	2	30	20	50

Pre-requisite (if any)

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Outline various data structures algorithms in high level programming language.
CO2	Apply the knowledge of programming skills to implement and analyze different data structures.
CO3	Analyze the appropriate data structure like arrays, stacks, queues and trees to solve real world problems.
CO4	Construct different types of linked lists and perform their operations.
CO5	Implement graph traversal techniques using appropriate data structures.

List of Activities for Data Structures and Algorithms Lab

S.No.	Activity Title
1	Write a program to develop a Student Record Finder system using Linear Search to find the location of a given element.
2	Write a program to develop a Library Book Locator system using Binary Search to find the location of a given element.
3	Write a program to implement push and pop operations on a stack using linear array.
4	Write a program to convert an infix expression to a postfix expression using stacks.
5	Write a program to evaluate a postfix expression using stacks.
6	Write a program to develop a Ticket Booking system by implementing insertion and deletion operations in a queue using a linear array.
7	Write a menu driven program to develop an Employee Management system to perform insertion and deletion operations in a single linked list (at the beginning, at the end, after a given node, and traversal).
8	Write a menu driven program to develop an Employee Management system to perform insertion and deletion operations in a double linked list (at the beginning, at the end, after a given node, and traversal).
9	Write a program to implement push and pop operations on a stack using linked list.
10	Write a program to implement enqueue and dequeue operations in a queue using linked list.
11	Write a program to develop a Student Marks Sorting system to sort an array of integers in ascending order using Bubble Sort.
12	Write a program to sort an array of integers in ascending order using Selection Sort.
13	Write a program to sort an array in ascending order using Insertion Sort.

14	Write a program to sort an array of integers in ascending order using Quick Sort.
15	Write a program to implement Binary Search Tree in Pre-order, In-order, and Post-order using array.
16	Write a program to implement BFS and DFS in graphs using Stack and queue.

Mini Project

1	Write a program to develop an ATM Transaction System using stack/queue concepts with proper error handling (insufficient balance, invalid PIN, transaction limit exceeded).
2	Write a program to implement a Parking Lot Management System using Queue and Stack with overflow and underflow conditions.

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1SEU-301	Career and Placement Planning -1	Value Added	1	0	0	2	50	0	50

Pre-requisite: Basic knowledge of arithmetic operations, elementary mathematics and fundamental logical reasoning skills required for problem solving and analytical thinking.

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Demonstrate mental calculation techniques and mathematical shortcuts to simplify and solve numerical expressions efficiently.
CO2	Analyze coded information and spatial relationships to interpret patterns and determine accurate logical conclusions.
CO3	Apply numerical properties and mathematical methods to solve problems involving factors, multiples, divisibility rules, and HCF–LCM relationships.
CO4	Illustrate quantitative relationships to solve problems involving averages, proportional reasoning, and real-life numerical situations.
CO5	Evaluate patterns and logical sequences to identify inconsistencies and determine the correct classification.

Detailed Syllabus

Unit 1: Vedic Mathematics & Simplification: - Simplification & Approximation, Fractions, Decimals and Percentages.
Number System: - Types of Numbers, Divisibility Rules, Factors and Multiples, Remainders, Unit Digit Problems.
Arithmetic Applications: - Profit, Loss and Discount, Simple Interest and Compound Interest, Partnership, Time and Work, Time, Speed and Distance, Boats and Streams.
Algebra & Advanced Quant: - Quadratic Equations, Sequence and Series, Permutation and Combination, Probability. **(8 Hrs.)**

Unit 2: Coding Decoding: - Introduction to Coding Decoding, Types of Coding Decoding (Letter, Number, Symbol, Mix), Coding Decoding Techniques (Pattern Recognition, Substitution, Logical Reasoning based), Advanced Coding & Decoding Patterns.
Directions: - Introduction to the concept of directions, Types of Directions, Cardinal Directions (N,S,E,W), Intermediate Directions (NE,NW,SE,SW), Movement- Clockwise, Anticlockwise, Shortest Distance & Direction. **(7 Hrs.)**

Unit 3: HCF-LCM: Introduction to the concept of HCF-LCM, Finding LCM-HCF (Prime Factorization, Division Method). HCF-LCM of Fractions, Relation between HCF-LCM and Problems, Co-Primes. **(4 Hrs.**)

Unit 4: Averages: - Introduction to the concept of Averages, Finding Averages (Formula & Approximation Techniques), Problems on Averages.
Ages: - Introduction to the Ages Problems, Types of Problems (Simple, Age Ratio, Age Difference), Techniques for solving.
Ratio and Proportion: - Introduction to Ratio & Proportion, Combining of Ratios, Comparison of Ratio, Duplicate, Sub Duplicate, Triplicate, Sub Triplicate Ratio, Problems on Ratio &

Proportions, Mean Proportional. **(8 Hrs.)**

Unit 5: Odd Man Out: - Introduction to odd man out, Types of patterns & Techniques (Letter Series, Number Series), Identifying Patterns. **(3 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Quantitative Aptitude for Competitive Examinations	R.S. Aggarwal	S Chand and Company Ltd	Revised Edition 2025
2	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal	(S. Chand)	2nd (2018)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Quantitative Aptitude & Logical Reasoning	TPP Department	TPP	6th
2	Fast Track Objective Arithmetic	Rajesh Verma	Arihant Publications (India) Ltd	Latest Edition-2025-2026

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1CSU-314	Future Skills Lab (AIML,AIDS ,DS,IoT,CS)	Skill Enhancement	1	0	0	2	30	20	50

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Demonstrate fundamental python programming concepts to solve computational problems.
CO2	Apply python looping and control statements to develop efficient program solutions.
CO3	Implement file handling and exception handling techniques in python programs.
CO4	Develop python applications with database connectivity using a front-end interface.
CO5	Implement python programming to solve real-world problems using appropriate data structures and problem-solving approaches.

List of Activities for Future Skills Lab

S.No.	Activity Title
1	To categorize students into grade ranges and compute overall statistics from a list of marks.
2	To verify whether a given string is a palindrome and compute character frequencies ignoring spaces and case.
3	To find all Armstrong numbers within a user-specified integer range.
4	To perform basic operations on a 2D matrix: transpose and diagonal sum (for square matrices).
5	To analyse a text file and compute basic statistics such as line count, word count, character count, and longest word.
6	To design a menu driven calculator using modular programming (functions) and control structures.
7	To maintain and query student records using dictionary data structure.
8	To implement Caesar cipher encryption and decryption for text messages.
9	To compute electricity bills based on tiered slab rates and additional charges.
10	To analyse word frequencies in a text file, excluding stopwords, and find top N frequent words.
11	WAP to explore the numpy library in python.
12	WAP to explore the matplotlib library in python.
13	WAP to implement linear regression in python.
14	WAP in python to implement logistic regression.
15	Write a program to implement K-Nearest Neighbors using python.
16	WAP in python to implement the concept of SVM using an appropriate

	example/dataset.
17	WAP to implement k-means clustering algorithm in python.
18	WAP to implement DBSCAN algorithm in python.
19	WAP to implement digit/Character recognition system by applying Neural Network concepts in python.

Mini Projects

1.	Design a Library Record Management System using dictionary data structures to store, search, and manage book or student records.
2.	Develop an Electricity Billing Management System that calculates bills based on slab rates, additional charges, and generates customer billing summaries.

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1NCU-301	Constitution of India	NCC	S/NS	2	0	0	0	-	0

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Summarize the emergence, evolution, structure, and composition of the Indian Constitution.
CO2	Analyze the concept and functioning of federalism in the India as provided in the Constitution.
CO3	Classify the Panchayati Raj institutions as instruments of decentralization and the roles of the three organs of the state in the contemporary scenario.
CO4	Explain the Indian political scenario in the context of emerging challenges.
CO5	Elaborate Indian foreign relations under the cold war and post-cold war era.

Detailed Syllabus

Unit 1: Introduction to Indian Constitution: Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Composition of the Constituent Assembly, Functions of the Constituent Assembly, Various Committees of the Constituent Assembly, Enforcement of the Constitution, Indian Constitution and its Salient Features**.** **(8 Hrs.)**

Unit 2: The role of B R Ambedkar in the making of the Indian Constitution, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Gandhian Principles, Liberal Principles, Socialistic Principles. **(8 Hrs.)**

Unit 3: Indian Federalism: Meaning and Definition of Federalism, Structure and Features of Indian Federalism, Difference between Indian and Federation of other states, Difference between federal and unitary features, Critical Evaluation of the Indian Federal System, Decentralization of Powers, Centre-State Relations, 73rd Amendment, Panchayath Raj Institutions. **(8 Hrs.)**

Unit 4: Union Government: Powers of Indian Parliament, Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister. **(8 Hrs.**)

Unit 5: India's External Relations - Cold War and Post-Cold War era: What is Foreign Policy? Basic Determinants of Foreign Policy, Indian and its Neighbours, India's Extended Neighbourhood in West Asia and South-East Asia, India's relations with the United States and Russia, India and the World Organisations, India in the 21st century. **(8 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Constitution of India	The Constitution of India, 1950 (Bare Act)	Government Publication.	-
2	Working of a Democratic Constitution of India.	Granville Austin	Oxford University Press, New Delhi	1st(2003)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Contemporary India: Economy, Society, Politics	N. Chandhoke& Priyadarshini	Pearson Education India	1st (2009)
2	Understanding Contemporary India: Critical Perspectives	A. Vanaik& R. Bhargava	Orient Blackswan	1st (2010)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1RAIU-311	Future Skills Lab (RAI)	Professional Core	1	0	0	2	30	20	50

Course Outcomes

At the end of the course; the student will be able to	
CO1	Demonstrate fundamental python programming concepts to solve computational problems.
CO2	Apply python looping and control statements to develop efficient program solutions.
CO3	Implement file handling and exception handling techniques in python programs.
CO4	Recall fundamental concepts of number systems, basic PLC hardware components and ladder logic symbols.
CO5	Explain the working principles of PLC systems, ladder logic programming and HMI interfacing.

List of Activities for Future Skills Lab

S. No.	Activity Title
1	**Student Data Analysis** Grade categorization, statistics, and student record management using dictionaries.
2	**String & File Processing** Palindrome check, character frequency, file analysis (word/line count, top words).
3	**Number & Mathematical Programs** Armstrong numbers, electricity bill calculation, basic numerical problems.
4	**Matrix & Calculator Programs** 2D matrix operations (transpose, diagonal sum) and menu-driven calculator.
5	**Encryption & Logic Building** Caesar cipher implementation and pattern-based problem solving.
6	**Python Libraries & ML Basics** Introduction to NumPy, Matplotlib, and implementation of ML algorithms
7	**Understand Number Systems** Learn types of number systems and perform basic conversions for digital applications.
8	**Basic PLC Setup** Identify PLC components and set up a simple control system.
9	**Ladder Logic Basics** Recognize common symbols and write simple ladder logic programs.
10	**PLC with HMI** Understand how to connect PLC with HMI and monitor basic operations.

11	**Motor Control Fundamentals** Control speed and direction of a motor using an inverter.
12	**Servo Control using PLC** Use PLC signals to control basic movement and positioning of a servo motor.

Mini Projects

Every individual student is required design and build one Lab Project under the supervision of course teacher. Topic of the project may be any from the theory contents and not limited to following list:

1	Design a Library Record Management System using dictionary data structures to store, search, and manage book or student records.
2	Develop an Electricity Billing Management System that calculates bills based on slab rates, additional charges, and generates customer billing summaries.
3	USB Powered LED Night Lamp
4	Smart traffic control using PLC

4th

Semester

Syllabus

Course Code	Course Title	ategory	Cd	L	T	P	Marks		
							Internal Marks	Exter al Mar s	Total
25C1CSU-401	Discrete Mathematics	PCC	3	3	0	0	40	60	100

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Identify and apply operations on discrete structures such as sets, relations and functions in different areas of computing.
CO2	Analyze counting techniques to solve real world problems.
CO3	Utilize the concept of graph theory for solving computing problems
CO4	Apply propositional logic concepts to analyze the validity and satisfiability of logical statements.
CO5	Classify the algebraic structures and Boolean algebra by identifying their properties

Detailed Syllabus

Unit 1: Sets, Relation and Function: Introduction, Types, Operations and Laws of Sets, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Functions and its types, Sum and Product of Functions, Bijective functions, Inverse and Composite Function. **(12Hrs.)**

Unit 2: Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination, Recurrence relations, Generating Function, Application. **(10Hrs.)**

Unit 3: Graphs and Trees:Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, and Planar Graphs, definition properties and Example, Biconnected component and Articulation Points, Shortest distances, rooted trees, trees and sorting, weighted trees and prefix codes, Spanning tree.**(10Hrs.)**

Unit 4: Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **(8Hrs.)**

Unit 5: Algebraic Structures and Morphism: Algebraic Structures with one Bi ary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Cyclic Groups, Permutation Groups, Subgroup, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form. **(12Hrs.)**

Recent Trends in Discrete Mathematics

Graph Theory and Network Analysis,Applications in Cryptography,Recursion in Programming.

Text Books

S. No	Name of the Books	Author	Publisher	E ition (Public tion Year)
1	Discrete Mathematics and its Applications	Kenneth H. Rosen	Tata McGraw – Hill	8th(2022)
2	Discrete Mathematics with Applications	Susanna S. Epp	Wadsworth Publishing Co. Inc.	4th(2021)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Discrete Mathematical Structure and Its Application to Computer Science	J.P. Tremblay and R. Manohar	Tata Mcgraw-Hill	1st(2020)
2	Discrete Mathematics	Norman L. Biggs	Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson	2nd(2021)

Course Code	Course Title	Category	Cd	L	T	P	Marks		
							Internal Marks	Exte nal Mar s	Total
25C1CSU-402	Operating System	PCC	3	3	0	0	40	60	100

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Summarize the concept , architecture and design of operating system.
CO2	Implement the various scheduling algorithms of processes such as fcfs, sjf, round robin, and priority scheduling.
CO3	Explain about process synchronization, deadlock handling methods and security challenges.
CO4	Apply memory management techniques, virtual memory and page replacement algorithms.
CO5	Examine and implement file systems and secondary storage management and scheduling.

Detailed Syllabus

Unit 1: Introduction**:** Characteristics of Modern Operating system. Operating system functions, batch, multi-programmed, time-sharing, real-time, Distributed OS, Embedded system. Parts of OS: Kernel and Shell. **(6 Hrs.)**

Unit 2: Processes and Scheduling**:** Concept of processes, process states type of Schedulers, Process Scheduling and algorithms, scheduling criteria. **(8 Hrs.)**

Unit 3: Process Synchronization and OS Security: Concurrent Processes, Critical section problem, Semaphores, Bounded- Buffer Problem, Readers-writers Problem. Deadlocks: Characterization, Prevention, Avoidance, Detection and Recovery, Combined approach to Deadlock Handling, OS Security Threats and Protection Mechanisms. **(10Hrs.)**

Unit 4: Memory Management*:* Need of Memory management, Introduction to Persistent memory, Characteristics of contiguous and non-contiguous allocation techniques, Paging, segmentation, concept of fragmentation, Virtual memory management, Introduction to page replacement, page-replacement techniques, Thrashing**.** **6 Hrs.)**

Unit 5: File Systems & disk storage: Files: file and directory structure, types of files, access methods, allocation methods (contiguous, linked, and indexed), free-space management (bit vector, linked list, grouping), Distributed File Systems (HDFS, Google File System) Disk Structure, Disk Scheduling, Disk Management, Storage Optimization. **(6 Hrs.)**

Recent Trends in Operating system

AI-enabled Operating Systems, Distributed Operating Systems, Security and Energy Efficient OS.

Text Books

S. No	Name of the Books	Author	Publisher	dition (Publication Year)
1.	Operating System Concepts	Abraham (Avi) Silberschatz, Peter B. Galvin, Greg Gagne	Wiley.	10th(2018)
2.	Modern Operating Systems	Andrew S. Tanenbaum & Herbert Bos	Pearson	5th(2022)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1.	Operating Systems: Internals and Design Principles	William Stallings	Pearson / Prentice Hall	9th(2025)
2.	Modern Operating Systems	Tanenbaum & Bos	Pearson	5th(2024)

Course Code	Course Title	Category	Cd	L	T	P	Ma ks		
							Internal Marks	External Marks	Total
25C1CSU-411	Operating System Lab	PCC	1	0	0	2	30	20	50

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Demonstrate basic services and functionalities of the operating system.
CO2	Construct CPU scheduling programs such as FCFS, Round Robin, SJF, and Priority.
CO3	Apply operating system commands to manage files and directories.
CO4	Develop shell programs using fundamental shell scripting concepts.
CO5	Design solutions for handling deadlocks and apply different file organization techniques.

List of Activities for Operating Systems Lab

S. No.	Activity Title
1.	Write a program to demonstrate the installation steps of Windows/Linux Operating System.
2.	Implementation and calculation of waiting time and turnaround time using CPU-Scheduling First Come First Serve (FCFS), Shortest Job First (SJF) and Round Robin (Pre-emptive) scheduling.
3.	Write a program to implement Priority Scheduling algorithm (pre-emptive and non-pre-emptive).
4.	Write a program to implement the Producer–Consumer problem using semaphores.
5.	Write a program to implement the Dining Philosophers problem.
6.	Perform installation of Virtual Machine software (VMware/Virtual Box) and study the concept of virtualization.
7.	Create a Virtual Machine using a hypervisor and configure system resources.
8.	Install Linux/Windows operating system on a Virtual Machine and test resource allocation.
9.	Implement Linux directory commands such as cd, ls, cp, mv, rm, mkdir, rmdir, and create/view files using cat.
10.	Write a shell script using basic Linux commands.
11.	Write a program to demonstrate parent–child process creation using the fork() system call.
12.	Perform file handling operations and comparison using commands such as cmp, touch, file, sort, cut, and disk space checking commands.

13.	Demonstrate process creation and monitoring in Linux using commands such as ps, who, sleep, kill, background processing, and process priority.
14.	Implement Linux utilities for pipes and process communication using commands such as grep, egrep, find, cal, banner, and demonstrate printing and filtering outputs.
15.	Write bash scripts using shell programming concepts including conditional statements, loops, case statements, shell variables, parameters, and arguments.
16.	Write a program to implement Banker's Algorithm for deadlock avoidance.
17.	Write a program to implement contiguous memory allocation techniques such as First Fit, Best Fit, and Worst Fit.
18.	Write a program to implement Page Replacement algorithms such as (i) First In First Out (FIFO) (ii) Least Recently Used (LRU) (iii) Optimal.

Mini Projects

1.	Develop a REST API that accepts process details and simulates CPU scheduling algorithms such as FCFS, SJF, Round Robin, and Priority, returning waiting time and turnaround time results.
2.	Design a cloud computing environment in CloudSim to analyze virtual machine allocation and resource utilization under different workload conditions.

Course Code	Course Title	Category	Cd	L	T	P	Ma ks		
							Internal Marks	External Marks	Total
25C1CSU-403	Computer Organization & Architecture	ESC	3	3	0	0	40	60	100

Course Outcomes

At the end of the course, the student will be able to:	
CO1	Explain the functional units and internal architecture of a microprocessor.
CO2	Illustrate the data representation and perform the arithmetic and logical o erations on binary data.
CO3	Categorize the design approaches of control unit and I/O data transfer approaches
CO4	Analyze the composition and working of pipelined and parallel processors.
CO5	Explain the functions and role of memory systems in processors.

Detailed Syllabus

Unit 1: Basics of computer architecture**:** Introduction to basic architecture and pin diagram of microprocessor 8085 and their description, instruction format, execution cycle, RTL interpretation of instructions, Instruction set, addressing modes, and basic programming in assembly language. **(9 Hrs.)**

Unit 2: Data representation & Computer Arithmetic: Signed number representation, fixed- and floating-point representations, character representation. Computer arithmetic – integer addition and subtraction, multiplication – shift-and add, Booth multiplier etc. Division - restoring and non-restoring techniques. **(7 Hrs.)**

Unit 3: Control Unit Design and I/O Organization**:** CPU control unit design: Hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged Instructions, software interrupts and exceptions. Programs and processes –role of interrupts in process state transitions, I/O device interfaces – SCII, USB. **(9 Hrs.)**

Unit 4: Introduction to Pipelining and Parallel Processors: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and Cache coherency. **(7 Hrs.)**

Unit 5: Memory Organization: Memory system design: semiconductor memory technologies, memory organization, Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies. **(7 Hrs.)**

Recent Trends in Computing

Introduction to Arduino Uno and Raspberry Pi Boards and basic programming to execute projects like LED blinking, Temperature Monitoringetc.

Text Books

S. No.	Name of the Books	Author	Publisher	Edition (ublication Year)
1	Computer Organization and Architecture	Morris Mano	Pearson Education	3rd(2017)
2	Microprocessor Architecture, Programming and Applications of the 8085	Ramesh S. Gaonkar	Tata McGraw–Hill	5th (2002)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (ublication Year)
1	Computer Architecture and Organization	John P. Hayes	WCB/McGraw-Hill	3rd(2002)
2	Computer Organization and Architecture: Designing for Performance	William Stallings	Pearson Education	10th(2019)

Course Code	Course Title	Category	Cd	L	T	P	arks		
							Internal Marks	External Marks	Total
25C1CSU-412	Computer Organization and Architecture Lab	ESC	1	0	0	2	30	20	50

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Identify the computer an atomy-Memory, Ports, Motherboardetc.
CO2	Examine the functional units of the microprocessor and various ICs available on its trainer board.
CO3	Analyze the instruction set of a microprocessor 8085 and perform the arithmetic and logical operations on binary data.
CO4	Analyze the instruction set of a microprocessor 8086 and perform the arithmetic and logical operations on binary data.
CO5	Evaluate the operation of microprocessor for I/O based interfacing devices.

List of Activities for Computer Organization and Architecture Lab

S. No.	Activity Title
1	Computer Anatomy- Memory, Ports, Motherboard and add-on cards.
2	Dismantling and assembling PC.
3	Introduction to 8085 kit.
4	Addition of two 8 bit numbers, sum 8 bit.
5	Subtraction of two 8 bit numbers.
6	Find 1’s and 2’s complement of 8-bit number.
7	Multiplication of 8 bit numbers.
8	Shift an 8-bit no. by one bit.
9	Find Largest among an array of ten numbers.
10	Find smallest among an array of ten numbers (8 bit).
11	Sum of series of 8 bit numbers.
12	Introduction to 8086 kit.
13	Addition and subtraction of two 16 bit numbers, sum 16 bit.
14	Implement of Booth’s algorithm for arithmetic operations.
15	Find 1’s and 2’s complement of 16-bit number.
16	Implement simple programs using I/O based interface.

Mini Projects

1	Introduction to Arduino Uno and various sensors, Monitoring etc.
2	Execution of simple projects like LED blinking, temperature and moisture monitoring etc.

Course Code	Course Title	Category	Cd	L	T	P	Ma ks		
							Internal Marks	External Marks	Total
25C1CSU-404	**Design and Analysis of Algorithms**	**PCC**	**3**	**3**	**0**	**0**	**40**	**60**	**100**

Course Outcomes:

At the end of the course, the student will be able to	
CO1	Illustrate algorithm performance using asymptotic complexity and recurrence relations.
CO2	Apply brute-force and divide-and-conquer strategies to solve problems and analyze their efficiency.
CO3	Make use of greedy strategies to solve optimization problems such as Fractional Knapsack, Job Sequencing with Deadlines, and Activity Selection.
CO4	Design dynamic programming approaches for solving complex problems while examining advanced graph optimization algorithms.
CO5	Compare problem classes (P, NP, NP-Complete) along with backtracking, branch & bound, heuristic techniques for solving intractable problems.

Detailed Syllabus

Unit 1: Introduction Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem. **(8 Hrs.)**

Unit 2: Fundamental Algorithmic Strategies: Brute-Force-String Matching, Selection Sort, Sequential Searching. Divide and Conquer: Binary search, Finding the maximum and minimum, Merge sort, Quick sort and its analysis, Strassen's matrix multiplication. **(10 Hrs.**)

Unit 3: Greedy Algorithms- Fractional Knapsack Problem, Job Sequencing with deadlines, Activity Selection Problem, Huffman Coding, Bin packing, Minimum Cost Spanning Tree-

Prim's Algorithm, Kruskal's Algorithm, Single source shortest paths- Dijkstra's algorithm. **(10 Hrs.)**

Unit 4: Dynamic Programming- General Method with Examples, Transitive Closure, All Pairs Shortest Paths- Floyd's Warshall Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem, Network Flow Algorithm. **(10 Hrs.**)

Unit 5: Backtracking- General method, N-Queens problem, Sum of subsets problem, Graph colouring, Hamiltonian cycles. Branch and Bound-Travelling Sales Person problem, 0/1 Knapsack problem, FIFO Branch and Bound solution. Problem Classes: P, NP, NP-Hard and NP-Complete, Randomized algorithm, Approximation algorithm, Heuristic algorithm. **(10Hrs.)**

Recent trends in Design and Analysis of algorithm: Approximation and Randomized Algorithms**,** Streaming and Dynamic Algorithms**,** Machine Learning & AI-Based Algorithms

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT Press / Pearson.	3rd / 4th Edition(2022)
2	Design and Analysis of Algorithms	Jon Kleinberg, Éva Tardos	Pearson India	2nd Edition (2024)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	The Algorithm Design Manual	Steven S. Skiena	Springer	3rd Edition, (2020)
2	Design and Analysis of Algorithms	Aho, Hopcroft, Ullman	Pearson	1st Edition (2002)

Course Code	Course Name	Category	Cd	L	T	P	Marks		
							Internal Marks	External M rks	Total
25C1CSU -413	Design and Analysis of Algorithm Lab	PCC	2	0	0	4	30	20	50

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Illustrate asymptotic notations and relate master's theorem for recurrence relations.
CO2	Apply greedy and dynamic programming techniques to solve optimization problems.
CO3	Implement dfs and bfs algorithms for graph applications.
CO4	Experiment with shortest path algorithms with different edge weight conditions.
CO5	Apply minimum spanning tree algorithms and analyze their performance for different graph structures.
CO6	Develop efficient algorithmic solutions for complex and np-complete problems.

List of Activities for Design and Analysis of Algorithm Lab

S. No.	Activity Title
1	Write a program to implement recurrence relation using binary search.
2	Write a program to implement quick sort using Master's theorem.
3	Write a program to apply Knap Sack using greedy approach.
4	Write a program to implement Job Sequencing with deadlines using Greedy Approach.
5	Write a program to find an optimal solution to Travelling Salesman Problem using dynamic programming.
6	Write a program to find an optimal solution for optimal binary search tree using dynamic programming.
7	Write a program to find an optimal solution to matrix chain multiplication using dynamic programming.
8.	Write a program to implement N-Queens problem using Backtracking method.
9	Write a program of Subset Sum NP-Complete Problem using Branch and Bound Technique.
10	Write a program to find a path from the source to the goal in a maze using DFS.
11	Write a program to find the topological sort of a directed acyclic graph using DFS.
12	Write a program to find connected components of an undirected graph using BFS.
13	Write a program to check whether a given graph is bipartite using BFS.
14	Write a program to find shortest paths in a graph with positive edge weights using Dijkstra's algorithm.

15	Write a program to find shortest paths in a graph with arbitrary edge weights using Bellman-Ford algorithm.
16	Write a program to find shortest paths in a graph with arbitrary edge weights using Floyds' algorithm.
17	Write a program to find the minimum spanning tree in a weighted, undirected graph using Prims' algorithm.
18	Write a program to find the minimum spanning tree in a weighted, undirected graph using Kruskals' algorithm.
19	Write a program to implement Network Flow using Ford-Fulkerson Algorithm.
20	Write a program to match the string using the Rabin-Karp method.
21	Write a program for real-world problem or TSP algorithm using any heuristic technique.
22	Write a program to implement Vertex Cover using Approximation Algorithm.
23	Write a program to implement Randomized Quick Sort Algorithm.

Projects Based

1.	Write a program to build a route optimization system for a map or network. Given a network of cities or nodes, the system finds shortest paths, alternative routes, and connectivity between locations.
2.	Write a program to design an optimal communication or transportation network. This constructs minimum cost networks and determines efficient routes for visiting multiple nodes.

Course Code	Course Name	Category	Cd	L	T	P	Marks		
							Internal Marks	External M rks	Total
25C1HS U-401	Universal Human Values	HSS	3	3	0	0	40	60	100

Course Outcomes:

At the end of the course, the student will be able to:	
CO1	Explain the need and process of value education in understanding basic human aspirations for happiness and harmony.
CO2	Apply the understanding of harmony between the self ('I') and body to romote health and prosperity.
CO3	Make use of human values such as trust, respect and justice to build harmony in family and society.
CO4	Differentiate the interco nectedness and mutual harmony among different orders of nature to understand co-existence in the whole existence.
CO5	Justify the role of human values and holistic understanding in promoting professional ethics and socially responsible practices.

Detailed Syllabus

Unit 1: Course Introduction – Need, Basic Guidelines, Content and Process for Value Education**:** Self-Exploration–what is it? 'Natural Acceptance' and Experiential Validation- as the process for self-exploration; Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority; Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario; Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co- existence) rather than as arbitrariness in choice based on liking-disliking. **(6 Hrs.)**

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself**!:** Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer); Understanding the characteristics and activities of 'I' and harmony in 'I' ; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Health.
Include practice sessions to discuss the role others have played in making available material goods to me. Identifying from one's own life. Differentiate between accumulation. prosperity and Discuss program for ensuring health vs dealing with disease. **(5 Hrs.)**

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human

Relationship: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship; Understanding the meaning of Trust; Difference between intention and competence; Understanding the meaning of Respect,

Difference between respect and differentiation; the other salient values in relationship; Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' live **.**

(5 Hrs.)

Unit 4: Understanding Harmony in the Nature and Existence -Whole existence as Coexistence: Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all- pervasive space; Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. **(4 Hrs.)**

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order ; Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco - friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems; Case studies of typical holistic technologies, management models and production systems. The level; Strategy for transition from the present state to Universal Human Order: a. At of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations; Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. to discuss the conduct as an engineer or scientist etc. **(7 Hrs.)**

Text Books

S. No	Name of the Book	Author	Publisher	Edition (Publication Year)
1.	A foundation course in Human Values and Professional Ethics	R. R. Gaur, R. Asthana, G. P. Bagaria	UHV Publications	3rd (2023)
2.	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi	3rd (2023)

Reference Books

S.No	Name of the Book	Author(s)	Publisher	dition (Publication Year)
1.	Professional Ethics and Human Values (JNTU-Kakinada, Anantpur)	B.S. Raghavan	Scitech Publications	2nd (2021)
2.	Indian Ethos and Modern Management	B L Bajpai	New Royal Book Co., Lucknow	3rd (2004)

Course Code	Course Name	C urse Type	Cd	L	T	P	Marks		
							Internal Marks	External Marks	Total
25C1SEU -401	Career and Placement Planning -2	Value Added	1	0	0	2	50	0	50

Pre-requisite: Basic English communication, grammar, vocabulary, and teamwork skills needed for professional communication and placement preparation.

Course Outcomes

At the end of the course, students will be able to:	
CO1	Demonstrate improved group communication and workplace interaction skills.
CO2	Apply verbal ability concepts in grammar, vocabulary, and reading tasks relevant to employability.
CO3	Participate effectively in group discussions, case-based conversations, and structured speaking tasks.
CO4	Develop foundational professional documents and workplace communication habits.
CO5	Analyse communication situations and respond with clarity, logic, and confidence.

Detailed Syllabus

Unit 1: Professional Communication in Group Contexts: Transition from academic to professional communication, speaking with purpose, body language in professional settings, listening in teams, collaboration skills, discussion etiquette, communication in formal vs informal contexts. Activity: Icebreaker with role-based speaking, body language observation task. **(6 Hrs.)**

Unit 2: Verbal Ability for Employability: Advanced sentence correction, error detection, commonly confused words, sentence completion, para jumbles basics, contextual vocabulary, reading comprehension with inference and tone-based questions. Activity: Timed verbal drills, RC strategy practice, sentence completion tasks. **(6 Hrs.)**

Unit 3: Group Discussion & Analytical Communication: Introduction to group discussion, types of GDs, initiating and concluding a GD, agreeing and disagreeing politely, idea structuring, speaking with relevance, handling interruptions, current-affairs-based discussion approach. Activity: Mock GDs, topic analysis sheet, role rotation in GD. **(6 Hrs.)**

Unit 4: Case Study & Problem-Solving Communication: Introduction to case study approach, identifying problem statement, brainstorming techniques, solution framing, presenting practical recommendations, collaborative problem solving, structured speaking under pressure. Activity: Short case analysis, group solution presentation, business scenario discussion. **(6 Hrs.)**

Unit 5: Resume Basics, Digital Communication & Professional Presence: Introduction to resume writing, components of an effective resume, academic achievements and projects presentation, introduction to LinkedIn awareness, email etiquette basics, digital professionalism, online communication manners. Activity**:** Drafting first resume, email writing practice, profile headline exercise. **(6 Hrs.)**

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Verbal Ability book	TPP Dept.	TPP	6th
2	Interviews and Group Discussions	T. S. Jain & Gupta	Upkar Publications	2nd(2008)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Publication Year)
1	Word Power Made Easy	Norman Lewis	Goyal Publishers	4th (2012)
2	Communication Skills for Engineers	Sunita Mishra &C.Muralikrishna	Pearson Education	1st(2011)