Shirpur Education Society's

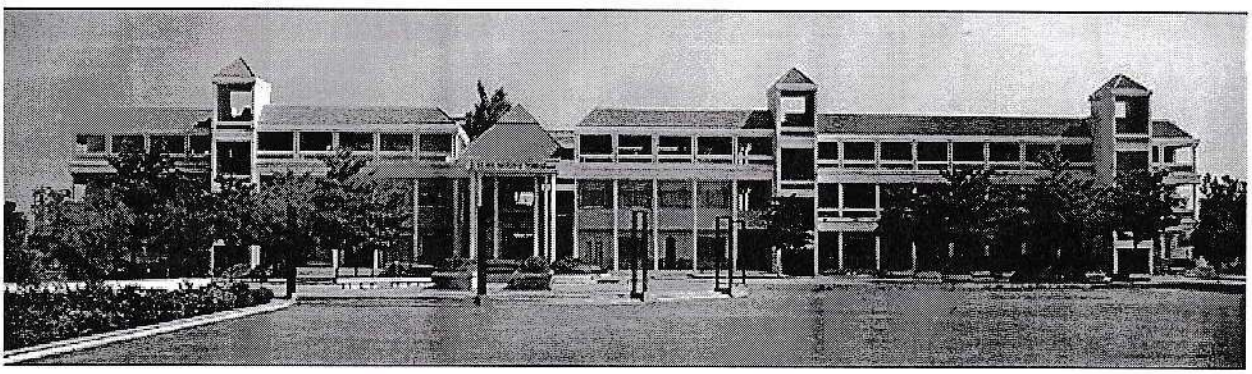
R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Second Year B. Tech (Computer Engineering)

With effect from Year 2023-24



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Semester-III (w.e.f. 2023-24)													
Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits
							Continuous Assessment (CA)				ESE		
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)			
				L	T	P	[A]			[B]	[C]	[A+B+C]	
1	BS	22BSCO3010T	Engineering Mathematics-III	3	1		20	15	15	15	65	100	4
2	PC	22PCCO3020T	Data Structures	3			20	15	15	15	65	100	3
3	PC	22PCCO3020L	Data Structures Laboratory			2	25				25	50	1
4	PC	22PCCO3030T	Discrete Structures	4			20	15	15	15	65	100	4
5	PC	22PCCO3040T	Database Management Systems	3			20	15	15	15	65	100	3
6	PC	22PCCO3040L	Database Management Systems Laboratory			2	25				25	50	1
7	ES	22ESCO3050T	Digital Electronics	3			20	15	15	15	65	100	3
8	ES	22ESCO3050L	Digital Electronics Laboratory			2	25				25	50	1
9	PC	22PCCO3060L	Programming Laboratory-I (Python)			4*	50				50	100	2
10	PJ	22PJCO3070L	Semester Project-I			2	25				25	50	1
11	MC	22MCCO3080T	Constitution of India	1									Audit Course
			Total	17	1	12	250			75	475	800	23

$ 1 hour tutorial to be taken as classwise.
* 2 hours shown as practicals to be taken classwise and other 2 hours to be taken batchwise.

Semester-IV (w.e.f. 2023-24)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credits
							Continuous Assessment (CA)				ESE		
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)			
				L	T	P	[A]			[B]	[C]	[A+B+C]	
1	BS	22BSCO4010T	Engineering Mathematics-IV	3	1		20	15	15	15	65	100	4
2	PC	22PCCO4020T	Operating System	3			20	15	15	15	65	100	3
3	PC	22PCCO4020L	Operating System Laboratory			2	25				25	50	1
4	PC	22PCCO4030T	Design and Analysis of Algorithms	3			20	15	15	15	65	100	3
5	PC	22PCCO4030L	Design and Analysis of Algorithms Laboratory			2	25				25	50	1
6	PC	22PCCO4040T	Processor Organization and Architecture	3			20	15	15	15	65	100	3
7	PC	22PCCO4040L	Processor Organization and Architecture Laboratory			2	25				25	50	1
9	PC	22PCCO4050L	Programming Laboratory-II (Web design)			4	50				50	100	2
8	HM	22HMCO4060T	Universal Human Values	2	1		20	15	15	15	65	100	3
9	PJ	22PJCO4070L	Semester Project-II			2	25				25	50	1
10	MC	22MCCO4080T	Environmental Studies	1									Audit Course
11	HM	22HMCO4090L	Employability Skill Development Program-I			2	50					50	1
			Total	15	2	14	300			75	475	850	23

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R. C. Patel Institute of Technology, Shirpur
Autonomous

Semester - III

Engineering Mathematics - III
(22BSCO3010T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 01 Hr/week
Credits : 04

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

- To introduce students with basic Integral Transform techniques. Application of these transforms techniques in solving ordinary differential equations.
- It will familiarize the students with some higher level concepts that will prepare them for future research and development projects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Use Laplace and inverse Laplace Transform to the Ordinary Differential Equations.	L3	Apply
CO2	Determine the periodic function by using Fourier series and complex form of Fourier series.	L3	Apply
CO3	Apply Fourier Transform in the future subjects like signal processing.	L3	Apply
CO4	Apply the concept of Z- transformation and its inverse of the given sequence.	L3	Apply

Course Contents

Unit-I Laplace Transform — 14 Hrs.

1.1 Introduction, Definition of Laplace transform, Laplace transform of some standard functions $1, e^{at}$, $\sin at$, $\cos at$, $\sinh at$, $\cosh at$, t^n, $erf\sqrt{t}$.

1.2 Heavi-Side unit step, Dirac-delta function, LT of Periodic Function.

1.3 Properties of Laplace Transform: Linearity, first shifting property, second shifting property,change of scale property,multiplication by t^n, division by t.

1.4 Laplace Transform of derivatives and integrals.

Inverse Laplace Transform

1.5 Inverse Laplace Transform by Partial Fraction Method, Convolution theorem.

1.6 Application to solve initial and boundary Value problem involving Ordinary differential equations and simultaneous differential equations.

Unit-II Fourier Series — 08 Hrs.

2.1 Dirichlet's conditions, Fourier series of periodic functions With period 2π and 2L.

2.2 Fourier series for even and odd functions.

2.3 Half range sine and cosine series, Parsevel's Identities (Without Proof).

2.4 Complex Form of Fourier series, Orthogonal and Orthonormal Set of Functions.

2.5 Fourier Integral Representation.

Unit-III Fourier Transform — 11 Hrs.

3.1 Definition: Introduction to Fourier Transform and Inverse Fourier Transform.

3.2 Fourier Cosine Transform and Fourier Sine Transform of Functions.

3.3 Evaluation of Fourier Transform of Various Functions.

3.4 Properties of Fourier Transform: Linearity Property and Shifting Properties of Fourier Transform, Change of Scale and Modulation Properties of Fourier Transform, Fourier Transform of Dirac Delta Function.

3.5 Fourier Transform of Derivative and Integral of a Function.

3.6 Fourier Transform of Convolution of two functions, Parseval's Identity.

3.7 Evaluation of Definite Integrals using Properties of Fourier Transform.

3.8 Finite Fourier Transform, Finite Fourier Sine Transform, Finite Fourier Cosine Transform.

Unit-IV Z-Transform — 06 Hrs.

4.1 Z-Transform of Standard Functions such as $Z(a^n)$, $Z(n^p)$.

4.2 Properties of Z-Transform :Linearity, Change of Scale, Shifting Property, Multiplication of K, Initial and final Value, Convolution Theorem (All Without Proof).

4.3 Inverse Z Transform: Binomial Expansion and Method of Partial Fraction.

Suggested Tutorials :

List of Tutorials:

1. Laplace Transform problems based on standard forms and special function.
2. Properties of Laplace Transform.
3. Inverse Laplace Transform, Convolution theorem.
4. Application of Laplace Transform.
5. Fourier Series, Half Range Series.
6. Complex form of Fourier series, Fourier Integral representation.
7. Fourier Transform, FST, FCT.
8. Properties of Fourier Transform.
9. Evaluation of integrals by FT, Finite Fourier Transform.
10. Z- Transform and its properties.
11. Inverse Z – Transform.

Minimum eight tutorials from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

1. Advanced Differential Equations by M. D. Raisinghnia, 20^{th}, S. Chand Publications.
2. Higher Engineering Mathematics by Grewal B. S.,38^{th} edition, Khanna Publication 2005.

Reference Books:

1. C. Ray Wylie & Louis Barrett, "Advanced Engineering Mathematics", 6^{th} Edition, TMH International Edition.
2. Kanti B. Datta, "Mathematical Methods of Science and Engineering", 1^{st} Edition, Cengage Learning.
3. Dr. B. B. Singh, "Integral Transforms and their Engineering Applications", 1^{st} Edition, Synergy Knowledgewar.
4. Murry R. Spieget, "Schaun's out line series, Laplace Transforms", 1^{st} Edition, Mc-Graw Hill Publication.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Data Structures (22PCCO3020T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: C Programming

Course Objective:

- To introduce and familiarize students with linear and non-linear data structures, their use in fundamental algorithms.
- To design & implement linear and non-linear data structures.
- To introduce students to the basics of algorithms and time complexity.
- To familiarize students with various sorting and searching techniques, and their performance comparison.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the concept of time complexity for algorithms.	L2	Understand
CO2	Apply various linear and non-linear data structures to solve computational problems efficiently.	L3	Apply
CO3	Illustrate the use of Non-Linear Data Structures in Various Applications.	L4	Analyze
CO4	Apply various searching, sorting, and hashing techniques to efficiently solve problems.	L3	Apply

Course Contents

Unit-I Basics of Algorithms and Data Structure 04 Hrs.

Algorithms, Characteristics of an Algorithm, Time and Space Complexities, Order of Growth Functions, Preliminary Asymptotic Notations.

Data Structures: Introduction, Need of Data Structures, Types of Data Structures, Abstract Data Types(ADT).

Unit-II Linear Data Structures – LIST 06 Hrs.

List as an ADT, Array-based Implementation, Linked List Implementation, Singly Linked Lists, Circularly Linked Lists, Doubly-Linked Lists, All Operations (Insertion, Deletion, Merge, Traversal, etc.) and their Analysis, Applications of Linked Lists - (Polynomial Addition).

Unit-III Linear Data Structure – STACK and QUEUE 08 Hrs.

Stack as an ADT, Operations, Array and Linked List Representation of Stack, Applications – Reversing Data, Conversion of Infix to Prefix and Postfix expression, Evaluation of Postfix and Prefix Expressions, Balanced Parenthesis, etc.

Linear Data Structure – QUEUE: Queue as an ADT, Operations, Implementation of Linear Queue, Circular and Priority Queue using Arrays and Linked List, Dequeue, Applications – Queue Simulation.

Unit-IV Non-Linear Data Structure – TREES 10 Hrs.

Tree Terminologies, Tree as an ADT, Binary Tree - Operations, Tree Traversals, Binary Search Tree (BST) - Operations, Expression Trees.

Height Balanced Tree: Creation of AVL Tree.

Heap- Operations on Heap.

Applications -Huffman Coding.

Unit-V Non-Linear Data Structure – GRAPHS 03 Hrs.

Graph: Graph Terminologies, Types of Graphs, Representation of Graph Using Arrays and Linked List, Breadth-First Search (BFS), Depth–First Search (DFS).

Applications of Graphs- Topological Sorting.

Unit-VI Searching, Sorting and Hashing 08 Hrs.

Searching: Linear Search, Binary Search and Fibonacci Search.

Sorting: Bubble Sort, Selection Sort, Heap Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort. Analysis of Searching and Sorting Techniques.

Hashing: Hash Functions, Overflow Handling, Collision & Collision Resolution Techniques, Linear Hashing, Hashing with Chaining, Separate Chaining, Open Addressing, Rehashing and Extendible Hashing.

Text Books:

1. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2nd Edition, Cengage Learning, 2005.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman and Company 2007.

Reference Books:

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 4th Edition, Pearson, 2014.
2. T. Goodritch, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", Wiley, 2nd Edition, 2011.
3. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2006.
4. Tenenbaum, Langsam, Augenstein, "Data Structures using C", Pearson, 1st Edition, 2019.
5. J. P. Tremblay and P. G. Sorenson, "Introduction to Data Structures and its Applications", 2nd Edition, McGraw- Hill, 1984.
6. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 1st Edition, 2010.
7. Reema Thareja, "Data Structures using C", Oxford, 2nd Edition, 2019.
8. Seymour Lipschutz, Data Structures, Schaum's Outline Series, 1st Edition, Tata McGraw-Hill, 2014.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Data Structures Laboratory (22PCCO3020L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To introduce students the concepts of various data structures, their operations and applications for solving real time complex problems.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Compare various searching techniques in terms of their efficiency.	L4	Analyze
CO2	Illustrate Various Operations on Linear Data Structures.	L3	Apply
CO3	Apply the concepts of binary trees and binary search trees to perform tree traversals and BST operations.	L3	Apply
CO4	Implement and compare different sorting algorithms.	L4	Analyze

List of Laboratory Experiments

Suggested Practical:(Any 10)

1. Implementation of Linked List using menu driven approach.
2. Implementation of different operations on Linked List –copy, concatenate, split, reverse, count no. of nodes etc.
3. Implementation of polynomials operations (addition, subtraction) using Linked List.
4. Implementation of stack using menu driven approach.
5. Implementation of Infix to Postfix conversion.
6. Implementation of Prefix and Postfix evaluation using menu driven approach.
7. Implementation of parenthesis checker using stack.
8. Implementation of Linear queue using menu driven approach.
9. Implementation of Circular queue using menu driven approach.
10. Implementation of Double ended queue using menu driven approach.
11. Implementation of Priority queue program using array and Linked list.
12. Implementation of Binary Tree using menu driven approach.
13. Implementation of Binary Tree Traversal.
14. Implementation of BST using following operations – create, delete, display.
15. Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.
16. Implementation of Graph traversal using menu driven program (DFS & BFS).
17. Implementations of Selection sort, Radix sort using menu driven.
18. Implementation of Heap & Heap Sort using menu driven program.
19. Implementation of advanced Bubble Sort and Insertion Sort using menu driven Program.
20. Implementation of searching methods (Index Sequential, Fibonacci search, Binary Search) using menu driven program.
21. Implementation of hashing functions with different collision resolution techniques.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on 22PCCO3020T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Discrete Structures(22PCCO3030T)

Teaching Scheme
Lectures : 03 Hrs./week
Tutorial : 01 Hr/week
Credits : 04

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

- To use mathematically correct terminology and notation.
- To cultivate clear thinking and creative problem solving.
- To thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies.
- To thoroughly prepare for the mathematical aspects of other Computer Engineering courses.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand discrete and fuzzy set theory.	L2	Understand
CO2	Verify the correctness of an argument using propositional and predicate logic and truth tables.	L5	Evaluate
CO3	Understand Relations, Diagraph and lattice and functions	L2	Understand
CO4	Apply principles and concepts of graph theory and trees in practical situations.	L3	Apply
CO5	Understand the different Algebraic structures and demonstrate use of groups and codes in Encoding and Decoding.	L2	Understand

Course Contents

Unit-I Sets and Logic — 08 Hrs.

Set Theory: Introduction to Set Theory, Venn diagrams, Operations on Sets, Power sets, Laws of set theory, Cartesian Product, Partitions of sets, The Principle of Inclusion and Exclusion.

Introduction to Fuzzy sets, Properties of Fuzzy sets, Fuzzy set operations, Fuzzy Cartesian product

Mathematical Logic::Propositions and Logical operations, Truth tables, Laws of Logic, Logical Equivalence, Normal Forms, Predicates, Fallacies, Quantifiers, Mathematical induction.

Introduction to First Order Predicate Logic, Inference Rules: Universal and Existential instantiation, Universal and Existential generalization, Universal Modus Ponens, Universal Modus Tollens, Multiple Quantifiers, Negation of more than one variable.

Unit-II Relations, Posets and Lattices — 10 Hrs.

Introduction: Relations and their properties, Paths and Digraphs, Types of binary relations, Operations on relations. Equivalence relations: Closures, Warshall's algorithm, Composition of relations.

Introduction to Fuzzy Relations,Properties of Fuzzy relations, Fuzzy composition of relations: Max-min composition and Max-product composition.

Posets and Lattices: Partial ordered sets, Hasse diagram, Lattice and its types, Boolean algebra.

Unit-III Functions — 05 Hrs.

Types of functions - Injective, Surjective and Bijective, Composition of functions, Identity and Inverse function, Pigeon hole principle.

Unit-IV Graphs and Trees — 06 Hrs.

Introduction to Graph Theory: Definitions, Paths and Circuits.

Types of Graphs: Eulerian and Hamiltonian, Sub Graphs, Planar Graphs, Chromatic number, Graph coloring(Welch-powell algorithm)

Functions and Graphs: Isomorphism of Graphs,Clique, Independent set, bipartite graph.

Introduction to Trees: Trees, rooted trees, path length in rooted trees, Prefix codes and optimal prefix codes (Huffman coding).

Tree Traversals: Binary search trees, tree traversals, spanning trees, Minimal spanning trees.

Application of Trees: The Max flow–Min cut theorem (transport network).

Unit-V Algebraic Structures — 05 Hrs.

Groups: Binary operations, Group, Semigroup, Monoid, Sub-group, Cyclic group, Homomorphism and Isomorphism of groups, Cosets.

Rings and Fields: Definition, Sub rings, Integral domain, Field, Integer modulo n, Ring homomor-

phism.

Unit-VI Coding theory 05 Hrs.

Group codes, Parity-check and Generator matrix, Hamming codes, Maximum likelihood technique.

Text Books:

1. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, "Discrete Mathematical Structures", 6^{th} Edition, Pearson Education, 2015.
2. C. L. Liu, D. P. Mohpatra, "Elements of Discrete Mathematics", 4^{th} Edition, McGraw-Hill, 2012.
3. Douglas B West.,"Introduction to Graph Theory", 2^{nd} Edition, Eastern Economy Edition published by PHI Learning Pvt. Ltd,2001.
4. Ralph Grimaldi, "Discrete and Combinatorial Mathematics an Applied Introduction" 5^{th} Edition, Pearson Education, 1999.
5. S.N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", 2^{nd} Edition, John Wiley & Sons, 2011.

Reference Books:

1. Y. N. Singh, "Discrete Mathematical Structures", 1^{st} Edition, Wiley-India, 2010.
2. J. L. Mott, A. Kandel, T. P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", 2^{nd} Edition, Prentice Hall of India, Private Limited,2008.
3. J. P. Trembley, R. Manohar "Discrete Mathematical Structures with Applications to Computer Science", 1^{st} Edition, McGraw-Hill, 1997.
4. Seymour Lipschutz, Marc Lipson, "Discrete Mathematics", Schaum's Outline Series, 3^{rd} Edition McGraw Hill Education, 2017.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Database Management Systems (22PCCO3040T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Computer Basics

Course Objectives:

1. To learn and practice data modelling using the Entity-Relationship and develop database designs.
2. To understand the use of Structured Query Language (SQL) and learn SQL syntax.
3. To apply normalization techniques to normalize the database.
4. To learn techniques for controlling the consequences of concurrent data access.
5. To maintain and retrieve information efficiently and effectively from a database.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Design an optimized database	L6	Create
CO2	Construct SQL queries to perform operations on the database.	L6	Create
CO3	Demonstrate appropriate transaction management and recovery techniques for a given problem	L3	Apply
CO4	Apply indexing mechanisms for efficient retrieval of information from database.	L3	Apply

Course Contents

Unit-I Introduction to Database Concepts — 03 Hrs.

Introduction, Characteristics of databases, File system v/s Database system, Users of Database system, Schema and Instance, Data Independence, DBMS system architecture, Database Administrator.

Unit-II Relationship Data Model — 09 Hrs.

The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation.

Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation.

Relational Model: Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model, Introduction to Object-Relational Databases, ORDBMS Vs Relational Databases.

Relational Algebra:Unary and Set operations, Relational Algebra Queries.

Unit-III Structured Query Language (SQL) — 09 Hrs.

Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints - key constraints, Domain Constraints, Referential integrity, check constraints, Data Control commands, Transaction Control Commands, Set and String operations, aggregate function - group by, having, Views in SQL, joins, Nested and complex queries, Triggers, Security and authorization in SQL.

Unit-IV Relational–Database Design — 05 Hrs.

Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF

Unit-V Transaction Management and Recovery — 09 Hrs.

Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Timestamp based, Validation Based, Deadlock Handling, Recovery System: Failure classification, Log based recovery, Shadow Paging, ARIES recovery algorithm.

Unit-VI Indexing Mechanism — 04 Hrs.

Hashing techniques, Types of Indexes: Single Level Ordered Indexes, Multilevel Indexes, Overview of B-Trees and B+ Trees.

Text Books:

1. Korth, Silberchatz, Sudarshan, "Database System Concepts", 7th Edition, McGraw Hill, 2019.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson education, 2016.
3. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems Design, Implementation and Management", 9th Edition, Cengage Learning, 2011.
4. G. K. Gupta, "Database Management Systems", 3rd Edition, McGraw Hill, 2018.

Reference Books:

1. Dr. P. S. Deshpande, "SQL and PL/SQL for Oracle 10g", Black Book, Dreamtech Press, 2012.
2. Sharaman Shah, "Oracle for Professional", Shroff Publishers & Distributers Private Limited, 1st Edition, 2008.
3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", Coriolis Group Publication, U.S., 11th Edition, 1997.
5. Lynn Beighley, "Head First SQL", O'Reilly Media Publication, 1st Edition, 2007.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Database Management Systems Laboratory (22PCCO3040L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model for a given application.
- To define schema by converting conceptual model to relational model.
- To understand the use of Structured Query Language (SQL) syntax for design of given application.
- To retrieve information efficiently and effectively from a database using B-trees/B+ trees.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Build ER/EER diagram for the given application.	L3	Apply
CO2	Utilize ER/EER concepts to convert into relational schema with integrity constraints for given application.	L3	Apply
CO3	Design a database for given application using DDL and DML commands.	L6	Create
CO4	Apply string, SET and Join operations, Aggregate functions and nested queries on given application database.	L3	Apply
CO5	Apply indexing algorithm on databases using B-trees/B+ trees.	L3	Apply

List of Laboratory Experiments

Suggested Experiments:

1. To draw an ER diagram for a problem statement.
2. Map the ER/EER to relational schema.
3. To implement DDL and DML commands with integrity constraints.
4. To access & modify Data using basic SQL.
5. To implement Joins and Views.
6. To implement Subqueries.
7. To implement triggers.
8. Examine the consistency of database using concurrency control technique (Locks).
9. To simulate ARIES recovery algorithm
10. To implement B-trees/B+ trees

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on 22PCCO3040T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Digital Electronics (22ESCO3050T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

- To introduce the fundamental concepts and methods for design of Digital circuits and a prerequisite for Computer Organization and Architecture, Microprocessor Systems.
- To provide the concept of designing Combinational and Sequential circuits.
- To provide basic knowledge of how digital building blocks are described in VHDL.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand different number systems and their arithmetic.	L2	Understand
CO2	Analyze and minimize logical expressions.	L4	Analyze
CO3	Design and analyze Combinational circuits and Sequential circuits.	L4	Analyze
CO4	Design and analyze Synchronous and Asynchronous Counters.	L4	Analyze
CO5	Understand Programming Logic Devices.	L2	Understand

Course Contents

Unit-I Number Systems and Codes — 06 Hrs.

Introduction to number system: Binary, Octal, Decimal and Hexadecimal Number Systems.

Binary arithmetic: addition, subtraction (1's and 2's complement), multiplication and division.

Octal and Hexadecimal Arithmetic: Addition and Subtraction (7's and 8's complement method for octal) and (15's and 16's complement method for Hexadecimal).

Codes: Gray Code, BCD Code, Excess-3 code, Error Detection and Correction: Hamming codes.

Unit-II Boolean Algebra and Logic Gates — 09 Hrs.

Boolean Algebra, Boolean functions, function reduction using Boolean laws, SOP and POS form of logic functions.

Logic simplifications using K-map method : 2-variable, 3-variables, 4-variables, Don't-Care condition.

Logic simplifications using Quine-McClusky Method,functions realization using basic gates and universal gates.

Unit-III Combinational Logic Design — 08 Hrs.

Introduction, Half and Full adder, Half subtractor, Full subtractor, 4-Bit Ripple adder, Look-Ahead carry adder, 4-bit adder subtractor, 1-digit BCD Adder, Multiplexer, Multiplexer tree, Demultiplexer, Demultiplexer tree, Encoders and decoders, Priority encoder, 1-bit, 2-bit , 4-bit Magnitude Comparator, ALU IC 74181.

Unit-IV Sequential Logic Design — 12 Hrs.

Flip-Flops: S-R, D, J-K, T, Truth Tables and Excitation Tables, Race-Around condition, Master-Slave J-K Flip Flop, Flip-flop conversions. Application of Sequential Logics.

Counters: Design of Asynchronous and Synchronous Counters, Mod Counters, UP/DOWN counter.

Shift Registers: SISO, SIPO, PIPO, PISO Bidirectional Shift Register, Universal Shift Register, Ring and Twisted-Ring/Johnson Counter, Sequence Generator.

Unit-V Programming Logic Devices — 04 Hrs.

Concepts of Programmable Array Logic (PAL) and Programming Logic Array (PLA). FPGA Arthitectures.

VHDL : Basics of VHDL, 3 models of architecture : dataflow, structural and behavioral.

Text Books:

1. R. P. Jain, "Modern Digital Electronics", 4th Edition, McGraw-Hill Education.
2. M. Morris Mano, "Digital Logic and Computer Design", 2nd Edition, PHI.
3. Norman Balabanian, "Digital Logic Design Principles", Student Edition, Wiley Publications, 2001.
4. J. Bhasker, "VHDL Primer", 3rd Edition, Pearson Education, 2015.

Reference Books:

1. Donald P. Leach and Albert Paul Malvino, "Digital Principles and Applications", 8th Edition, McGraw-Hill Education, 2014.
2. Yarbrough John M, "Digital Logic Applications and Design", 2016 Edition, Cengage Learning.
3. Douglas L. Perry, "VHDL Programming by Example", 4th Edition, McGraw-Hill Education, 2002.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Digital Electronics Laboratory(22ESCO3050L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To learn the fundamental concepts and methods for design of Digital Circuits.
- To provide basic knowledge of simplifying Boolean expressions using Logic Gates.
- To provide the concept of constructing Logic Gates using Universal Gates.
- To familiarize the students with the process of designing and implementing Combinational and Sequential circuits.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Simplify Boolean expressions using Logic Gates.	L4	Analyze
CO2	Construct basic gates using Universal Gates.	L3	Apply
CO3	Construct Binary to Gray and Gray to Binary code converter.	L3	Apply
CO4	Design and implement Combinational Logic Circuits.	L6	Create
CO5	Design and implement Sequential Logic Circuits.	L6	Create
CO6	Implement Basic Gates, Multiplexer and Counters using VHDL.	L6	Create

List of Laboratory Experiments(At Least 10)

1. To study and verify the Truth Table of various Logic Gates using IC's and realize Boolean expressions using gates.
2. To realize Basic Gates using Universal Gates.
3. To realize Binary to Gray and Gray to Binary Code converter.
4. To realize Parity Generator and Detector.
5. To realize arithmetic circuits i) Half Adder ii) Full Adder iii) Half Subtractor iv) Full Subtractor.
6. To realize 2-bit Magnitude Comparator.
7. To study Multiplexer IC and realization of Full Adder using Multiplexer IC.
8. To study Decoder IC and realization of Combinational Logic using Decoder IC.
9. To study of Flip-Flops using IC's.
10. To realize Asynchronous 3-bit UP Counter.
11. To realize Shift Registers using Flip-Flops.
12. To realize Basic Gates using VHDL.
13. To realize 4:1 Multiplexer using VHDL.
14. To realize 4-bit Counter using VHDL.
15. Case study on practical uses of Flip-Flops and Counters.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on 22ESCO3050T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Programming Laboratory-I (Python)(22PCCO3060L)

Practical Scheme
Practical : 04 Hrs./week
Credits : 02

Examination Scheme
Teacher Assessment : 50 Marks
End Sem Exam : 50 Marks
Total : 100 Marks

Prerequisite: C Programming

Course Objectives:

- To learn the basic and OOP concepts of Python.
- To study various advanced python concepts like inheritance, exception handling, modules etc.
- To develop GUI based standalone and web application.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand basic and object-oriented concepts, data structure implementation in python	L2	Understand
CO2	Apply file, directory handling and text processing concepts in python.	L3	Apply
CO3	Apply database connectivity, client-server communication using python.	L3	Apply
CO4	Develop python-based application using Tkinter.	L6	Create

Course Contents

Unit-I Python basics — 06 Hrs.

Data types in python, Operators in python, Input and Output, Control statement, Arrays in python, String and Character in python, Functions, List and Tuples, Dictionaries.

Unit-II Control Statements and Functions — 06 Hrs.

If statement, if-elif-else,if-else, Repetition using while loop, for loop, defining a Function, Checking & Setting Your Parameters, Default arguments, Variable length arguments, Defining and calling functions within a function, Layers of Functions, Lambda and Filter, Zip (), Map (), Reduce () function, recursion, Function Decorators.

Unit-III Introduction to OOP — 12 Hrs.

Creating a Class, Self-Variables, Constructors, Types of Methods, Constructors in Inheritance, Polymorphism, the super () Method, Method Resolution Order (MRO), Operator Overloading, Method Overloading & Overriding, Interfaces in Python.

Exceptions Handling: Exceptions, Exception Handling, Types of Exceptions, Except Block, assert Statement, User Defined Exceptions.

Unit-IV Advanced Python — 08 Hrs.

Building Modules, Packages: Python Collections Module, Opening and Reading Files and Folders (Python OS Module, Python Datetime Module, Python Math and Random Modules, Text Processing, Regular expression in python.

Unit-V Python Integration Primer Graphical User interface using Tkinter — 08 Hrs.

Form designing, Networking in Python: Client Server socket programming Python database connectivity: Data Definition Language (DDL), and Data Manipulation Language (DML).

Unit-VI Python advance Modules Numpy — 12 Hrs.

Working with Numpy, Constructing Numpy arrays, Printing arrays, Arithmetic Operations on matrix's, numpy zeros() Matplotlib: Matplotlib- Plot different charts, Pandas: Data Processing, Pandas-Data structure, Pandas-Series data, Data Frames, Introduction to data processing using pandas.

List of Laboratory Experiments (At least 10 Programs)

1. Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.
2. Write python programs to demonstrate applications of different decision-making statements.
3. Write a Python program to implement Basic String Operations & String Methods.
4. Write a Python program to implement functions of List, Tuples, and Dictionaries.
5. Write a Python program to implement Arrays (1D, 2D) applications.
6. Write a Python program to implement Functions and Recursion.
7. Write a Python program to implement Programs based on Lambda, Map, and Reduce Functions
8. Write a Python program to implement program to implement concept of Function decorators.
9. Write python programs to implement Classes & objects, Constructors.
10. Write python programs to implement Inheritance & Polymorphism.
11. Write python programs to implement Exception handling.
12. Write python programs to understand different File handling operations with exception handling.
13. Write python programs to implement database connectivity and DDL and DML commands in Python using SQLite.
14. Write python programs to understand GUI designing (Programs based on GUI designing using Tkinter.
15. Implement different Machine learning packages like numpy, pandas and matplotlib.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books:

1. Dr. R. Nageswara Rao, "Core Python Programming", 3rd Edition, Dreamtech Press, 2018.
2. Mark Lutz, "Learning Python", 5th Edition, Oreilly Publication, 2013.
3. E Balagurusamy, "Introduction to computing and problem-solving using Python", McGraw Hill Education, 2018.

Reference Books:

1. Zed A. Shaw, "Learn Python the Hard Way", 3rd Edition Edition, Addison–Wesley Publication, 2014.
2. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication, 2015.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA) 50 Marks:

Laboratory work will be based on 22PCCO3060L with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 10 Marks
2. Journal Submission: 10 Marks
3. Viva-voce: 10 Marks
4. Subject Specific Lab Assignment/Case Study: 20 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE) 50 Marks:

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Semester Project-I (22PJCO3070L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(Log Book Format will be as per Table 1).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details

- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintenance	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	Hardware/ Programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Constitution of India (22MCCO3080T)

Teaching Scheme
Lectures : 01 Hr/week

Audit Course

Course Objectives:

- To provide basic information about Indian constitution.
- To identify individual role and ethical responsibility towards society.
- To understand human rights and its implications.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply general knowledge and legal literacy and thereby take up competitive examinations.	L3	Apply
CO2	Understand features of the Indian Constitution.	L2	Understand
CO3	Understand Fundamental Rights and Directive principles of state policy.	L2	Understand
CO4	Understand structure of the state executive and Judiciary.	L2	Understand
CO5	Understand special provision for backward class, women and children.	L2	Understand
CO6	Understand Engineering ethics and responsibilities of Engineers.	L2	Understand

Course Contents

Unit-I Introduction to the Constitution of India — 02 Hrs.

The Making of the Constitution and Salient features of the Constitution, Preamble to the Indian Constitution, Fundamental Rights & its limitations.

Unit-II Directive Principles of State Policy — 02 Hrs.

Relevance of Directive Principles State Policy, Fundamental Duties.

Union Executives – President, Prime Minister, Parliament, Supreme Court of India.

Unit-III State Executives — 03 Hrs.

Governor, Chief Minister, State Legislature, High Court of State.

Electoral Process in India, Amendment Procedures, 42^{nd}, 44^{th}, 74^{th}, 76^{th}, 86^{th} & 91^{st} Amendments.

Unit-IV Special Provisions — 02 Hrs.

Provisions for Backward class section of society, Provision for Women, Children & Backward Classes Emergency Provisions.

Unit-V Human Rights — 02 Hrs.

Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India, Powers and functions of Municipalities, Panchayats and Co–Operative Societies.

Unit-VI Scope & Aims of Engineering Ethics — 02 Hrs.

Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.

Text Books:

1. Durga Das Basu, "Introduction to the Constitution on India", (Student Edition) Prentice-Hall EEE, 25^{th} Edition, 2021.
2. Charles E. Haries, Michael S. Pritchard and Michael J. Robins, "Engineering Ethics", Thompson Asia, 2003.
3. M. Laxmikant, "Indian Polity", 7^{th} Edition, McGraw Hill publication, 2023.

Reference Books:

1. M. V. Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. M. Govindarajan, S. Natarajan, V. S. Senthilkumar, "Engineering Ethics", Prentice-Hall of India Pvt. Ltd. New Delhi, 2004.
3. Brij Kishore Sharma, pl"Introduction to the Constitution of India", 7^{th} Edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
4. Latest Publications of Indian Institute of Human Rights, New Delhi.

Evaluation Scheme:

1. Student should submit a report on the case study declared by teacher.
2. Audit point shall be awarded subject to submission of report of the case study declared by teacher.

Semester - IV

Engineering Mathematics-IV (22BSCO4010T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Tutorial : 01 Hr/week	Teacher Assessment : 20 Marks
Credits : 04	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Prerequisite: Knowledge of

1. Calculus
2. Descriptive Statistics
3. Basics of Probability

Course Objectives:

- The objective of this course is to introduce students to the concepts of Eigen values and Eigen-vectors of Matrices, probability, test of hypothesis and correlation between data.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Discuss ability to manipulate matrices and compute Eigen values and Eigen vectors. Explain matrix algebra with its specific rules to solve the system of linear equation, using concept of Eigen value and Eigen vector to the engineering problems.	L2	Understand
CO2	Apply the concept of probability distribution to the engineering problems.	L3	Apply
CO3	Examine conclusions on population based on large and small samples taken and hence use it to understand data science.	L3	Apply
CO4	Apply the concept of Optimization, Correlation and Regression to the engineering problems.	L3	Apply

Course Contents

Unit-I Matrices — 08 Hrs.

1.1 Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof).

1.2 Similar matrices, diagonalizable of matrix.

1.3 Functions of square matrix.

1.4 Matrix decomposition, Singular Value Decomposition of a matrix (SVD).

Unit-II Probability — 08 Hrs.

2.1 Random Variables: Discrete & Continuous random variables, expectation, Variance.

2.2 Probability Density Function & Cumulative Density Function.

2.3 Moments, Moment Generating Function.

2.4 Probability distribution: Binomial distribution, Poisson distribution and Normal distribution.

Unit-III Sampling Theory and ANOVA — 12 Hrs.

3.1 Test of Hypothesis, Level of significance, Critical region, One Tailed and Two Tailed test, Interval Estimation of population parameters. Large and small sample.

3.2 Test of significant for Large Samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples.

3.3 Test of significant for small samples: Student's t-distribution and its properties. Test for significance of the difference between sample mean and population mean, Test for significance of the difference between the means of two samples, paired t-test.

3.4 Chi square test: Test of goodness of fit and independence of attributes, Contingency table. Association of attributes and Yate's correction.

3.5 Analysis of Variance(F-Test): One-way classification, Two-way classification (short-cut method).

Unit-IV Mathematical Programming — 11 Hrs.

4.1 Types of solution, Standard and Canonical form of LPP, Basic and feasible solutions.

4.2 Simplex method, Big –M method (method of penalty).

4.3 Duality of Linear Programming Problem.

4.4 Dual simplex method.

4.5 Non Linear Programming:-Problems with equality constrains and inequality constrains (No formulation, No Graphical method).

Unit-V Correlation & regression. (Flipped Classroom)

5.1 Scattered diagrams, Karl Pearson's coefficient of correlation.

5.2 Spearman's Rank correlation (non-repeated and repeated ranks).

5.3 Regression coefficient & Lines of Regression.

Tutorials :

Term work shall consist of minimum 8 Tutorials covering the entire modules.

List of Tutorials:

1. Matrices: Eigenvalues & Eigenvectors, Cayley Hamilton Theorem.
2. Matrices: Diagonalization and functions of square matrix.
3. Probability and Random variable
4. Probability Distribution
5. SSampling: Large Sample Test
6. Sampling: Small Sample Test
7. Sampling: Chi Square Test, ANOVA
8. LPP: Simplex Method, Big M Method
9. LPP: Duality and Dual Simplex Method
10. NLPP
11. Correlation and Regression

Text Books:

1. Dr. B. S. Grewal, "Higher Engineering Mathematics", 42^{th} Edition, Khanna Publication.
2. Dennis G Zill & Warren S Wright, "Advanced Engineering Mathematics", 4^{th} Edition.
3. Hira & Gupta, "Operation Research", S. Chand.
4. Dr. J Ravichandran, "Probability and Statistics for Engineering", 5^{th} Edition, Wiley-India.

Reference Books:

1. Kanti B. Datta, "Mathematical Methods of Science and Engineering", 1^{st} Edition, Cengage Learning.
2. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12^{th} Edition, 2003.
3. Kishor S. Trivedi, "Probability & Statistics with Reliability", 2^{nd} Edition, Wiley India.
4. S. D. Sharma Kedarnath, Ram Nath & Co. Meerat., "Operations Research".

5. Singiresu S. Rao, "Engineering optimization (Theory and Practice)", 3rd Edition, New Age International publication.

Evaluation Scheme:

Theory:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Operating System (22PCCO4020T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 15 Marks
Teacher Assessment : 20 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

- To introduce basic concepts and functions of different operating systems.
- To understand the concept of process, thread and resource management.
- To understand the concepts of process synchronization and deadlock.
- To understand various Memory, I/O and File management techniques.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand role of Operating System in terms of process, memory, file and I/O management.	L2	Understand
CO2	Apply appropriate process scheduling, memory mapping and disk scheduling methods.	L3	Apply
CO3	Apply appropriate method to solve the concurrency or deadlock problem.	L3	Apply
CO4	Analyze different techniques of file and I/O management.	L4	Analyze

Course Contents

Unit-I Introduction to Operating System — 04 Hrs.

Operating System Objectives, Basic Functions and Services, Evolution of Operating System, Operating System Structures(Monolithic, Microkernel), Types of Operating Systems: Batch, Multiprogramming. Multitasking, Time Sharing, Parallel, Distributed & Real-time O.S., Linux OS, Android OS, Windows OS, System calls.

Unit-II Process Management — 07 Hrs.

Process: Concept of a Process, Process States, Process Description, Process Control Block, Operations on Processes.

Threads: Definition and Types, Concept of Multithreading.

Scheduling: Types of Scheduling: Preemptive and Non-preemptive, Scheduling Algorithms and their Performance Evaluation: FCFS, SJF, SRTF, Priority based, Round Robin.

Unit-III Process Synchronization — 07 Hrs.

Concurrency: Principles of Concurrency, Inter-Process Communication, Process/Thread Synchronization.

Mutual Exclusion:Requirements, Hardware and Software Support, Semaphores and Mutex, Monitors, Classical Synchronization Problems: Producer and Consumer Problem, Readers/Writers Problem.

Unit-IV Deadlock — 07 Hrs.

Principles of Deadlock, Conditions for deadlock, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm for Single & Multiple Resources, Deadlock Detection and Recovery. Dining Philosophers Problem.

Unit-V Memory Management — 07 Hrs.

Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Next Fit, Relocation, Paging, Segmentation.

Virtual Memory: Demand Paging, Structure of Page Tables, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing.

Unit-VI File System and I/O Management — 07 Hrs.

File Management: Overview, File Organization and Access, Secondary Storage Management: File Allocation Methods.

Input/Output Management

I/O Management and Disk Scheduling: I/O Devices, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK. RAID

Text Books:

1. William Stallings, "Operating System: Internals and Design Principles", 9^{th} Edition, Prentice Hall, 2018.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10^{th} Edition, John Wiley & Sons, Inc., 2018.
3. Andrew Tannenbaum, "Operating System Design and Implementation", 3^{rd} Edition, Pearson, 2011.

Reference Books:

1. Maurice J. Bach, "Design of UNIX Operating System", 2^{nd} Edition, PHI, 2004.
2. Achyut Godbole and Atul Kahate, "Operating Systems", 3^{rd} Edition, McGraw Hill Education, 2017.
3. Remy Card, Eric Dumas, Frank Mevel, "The Linux Kernel Book", 1^{st} Edition, Wiley Publications, 2013.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Operating System Laboratory (22PCCO4020L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To understand Linux and shell script commands.
- To solve problem of process scheduling with performance evaluation.
- To explore memory allocation strategies, page replacement and disk scheduling algorithms.
- To learn throughly file allocation concepts.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Summarize the fundamental Unix commands and system calls.	L2	Understand
CO2	Illustrate an algorithm to detect and avoid deadlock.	L3	Apply
CO3	Analyze the performance of various CPU Scheduling, memory allocation and page replacement algorithms.	L4	Analyze
CO4	Evaluate the various file allocation and disk scheduling algorithms.	L5	Evaluate

List of Laboratory Experiments(At Least 08)

Suggested Experiments:

1. Explore the internal commands of linux and Write shell scripts to do the following:
   Display top 10 processes in descending order.
   Display processes with highest memory usage.
   Display current logged in user and logname.
   Display current shell, home directory, operating system type, current path setting, current working directory.
   Display OS version, release number, kernel version.
   Illustrate the use of sort, grep, awk, etc.
2. System calls for file manipulation.
3. CPU scheduling algorithms like FCFS, SJF, Round Robin etc.
4. There is a service counter which has a limited waiting queue outside it. It works as follows:
   - The counter remains open till the waiting queue is not empty.
   - If the queue is already full, the new customer simply leaves.
   - If the queue becomes empty, the outlet doors will be closed (service personnel sleep).
   - Whenever a customer arrives at the closed outlet, he/she needs to wake the person at the counter with a wake-up call.

   Implement the above-described problem using semaphores or mutuexes along with threads. Also show how it works, if there are 2 service personnel, and a single queue. Try to simulate all possible events that can take place, in the above scenario.
5. Implement Banker's Algorithm for deadlock avoidance.
6. Implement Memory management algorithms (Best, First, Worst fit).
7. Implement various page replacement policies (LRU, FIFO, Optimal).
8. Implement File allocation techniques (Sequential, Indexed, Linked).
9. Implement disk scheduling algorithm FCFS, SSTF, SCAN, CSCAN etc.
10. Using the CPU-OS simulator analyze and synthesize the following:
    - Process Scheduling algorithms.
    - Thread creation and synchronization.

- Deadlock prevention and avoidance.

11. Building a scheduler in XV6.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on 22PCCO4020T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral / Practical examination will be based on the entire syllabus including the practicals performed during laboratory sessions.

Design and Analysis of Algorithms(22PCCO4030T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Prerequisite: Computer Programming, Data structure

Course Objectives:

- The objective of the course is to introduce important algorithmic design paradigms and approaches for effective problem solving.
- To analyze the algorithm for its efficiency to show its effectiveness over the others. In addition, the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems will be introduced.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the performance of algorithms using asymptotic analysis.	L4	Analyze
CO2	Solve the problem using appropriate algorithmic design techniques.	L3	Apply
CO3	Able to Show that certain problems are NP-Complete.	L3	Apply

Course Contents

Unit-I Introduction — 08 Hrs.

Introduction to asymptotic analysis, analysis of control statements and loops, solving recurrence relations using tree, substitution, master method, analysis of quick sort and merge sort.

Problem solving using divide and conquer algorithm - Max-Min problem, Strassen's matrix multiplication.

Unit-II Greedy Method — 07 Hrs.

Introduction, control abstraction.

Problem solving using - fractional knapsack problem, activity selection problem, job sequencing with deadline, find a union, minimum spanning trees (Kruskal's algorithm, Prim's algorithm)

Graphs: Single source shortest path (Dijkstra's algorithm), coin change problem

Unit-III Dynamic Programming — 10 Hrs.

Introduction, principle of optimality, components of dynamic programming, characteristics of dynamic programming, Fibonacci problem, coin changing problem, 0/1 knapsack (table and set method), multistage graphs, all pairs shortest paths (Floyd Warshall Algorithm), single source shortest path (Bellman-Ford Algorithm), matrix chain multiplication, Optimal Binary Search Tree (OBST-successful and unsuccessful search), travelling salesperson problem, Johnson' algorithm for flow shop scheduling, Longest Common Subsequence (LCS), analysis of all algorithms.

Unit-IV Backtracking — 07 Hrs.

Introduction, basics of backtracking, N–queen problem, sum of subsets, graph coloring, Hamiltonian cycles generating permutation, analysis of all algorithms.

Branch-and-Bound: Introduction, control abstraction-LC BB, FIFO BB, LIFO BB, properties, FIFO BB, LIFO BB, LC BB, fifteen puzzle problem, 0/1 knapsack problem, travelling salesman problem, job sequencing with deadline.

Unit-V String Matching Algorithms — 03 Hrs.

Introduction, naive string-matching algorithm, Rabin Karp algorithm, string matching with finite automata, Knuth Morris Pratt algorithm.

Unit-VI Basics of Computational Complexity — 04 Hrs.

Complexity classes: class P and NP, polynomial reduction, NP completeness problem, NP-Hard problems, NP completeness problem using travelling salesman problem (TSP), approximation algorithm using TSP.

Text Books:

1. T. H. Coreman, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to algorithms", 3rd Edition, PHI publication, 2009.

2. Ellis horowitz, Sartaj Sahni, S. Rajsekaran, "Fundamentals of computer algorithms", 2nd Edition, University Press, 2007.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", 1st Edition, Tata McGraw Hill, 2006.

2. S. K. Basu, "Design Methods and Analysis of Algorithm", 2nd Edition, PHI publication.

3. John Kleinberg, Eva Tardos, "Algorithm Design", 1st Edition, Pearson, 2005.

4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design and Applications", 1st Edition, Wiley Publication, 2014.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Design and Analysis of Algorithms Laboratory (22PCCO4030L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- Design and implement efficient algorithms for a specified application.
- Strengthen the ability to identify and apply the suitable algorithm for the given real world problem.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Compare different algorithms based on Divide and Conquer approach..	L5	Evaluate
CO2	Make a use of Greedy method and Dynamic programming to solve real world problems.	L3	Apply
CO3	Demonstrate working of Backtracking method and string matching algorithms.	L3	Apply

List of Laboratory Experiments(At Least 10)

Suggested Experiments:

1. Implementation of Min Max algorithm.
2. Implementation of Strassen's Matrix Multiplication.
3. Implementation of Karatsuba algorithm for long integer multiplication.
4. Fractional Knapsack implementation using greedy approach.
5. Implementation of Activity selection using greedy approach.
6. Implementation of Kruskal's/ Prim's algorithm using greedy approach.
7. Implementation of job sequencing with deadline using greedy approach.
8. Implementation of other greedy algorithms eg: tree vertex split, subset cover, container loading, coin changing, optimal; merge patterns (Huffman tree).
9. Implementation of Single source shortest path (Dijkstra's algorithm).
10. Implementation of Bellman Ford algorithm using Dynamic programming.
11. Implementation of Longest Common Subsequence algorithm using Dynamic programming.
12. Implementation of Travelling Salesperson problem using Dynamic programming.
13. Implementation of multistage graphs/ all pair shortest path using dynamic programming.
14. Implementation of N-queen problem using Backtracking.
15. Implementation of 15 Puzzle problem using Backtracking.
16. Implementation of Knuth Morris Pratt string matching algorithm.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on 22PCCO4030T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Processor Organization and Architecture (22PCCO4040T)

Teaching Scheme	Examination Scheme
Lectures : 03 Hrs./week	Term Test : 15 Marks
Credits : 03	Teacher Assessment : 20 Marks
	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Prerequisite: Digital Electronics, Basic functional units of a computer system.

Course Objectives:

- To have a thorough understanding of the basic structure and operations of a computer system.
- To study the hierarchical memory system including cache memories and virtual memory.
- To prepare students for higher processor architectures and embedded systems.
- To apply innovative solutions and make progress in the knowledge to exploit the new paradigms of computing, particularly in distributed environments.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the arithmetic and logic algorithms for processors	L2	Understand
CO2	Understand the concepts of memory organization and mapping techniques.	L2	Understand
CO3	Explain, Interpret and implement the instructions and addressing modes of 8086 microprocessor and write assembly language programs.	L3	Apply
CO4	Understand various parameters to evaluate processor performance.	L2	Understand
CO5	Understand advanced trends and technologies in processor architectures.	L2	Understand

Course Contents

Unit-I Introduction to Computer Architecture & Organization

06 Hrs.

Introduction, Basic Organization of Computer Architecture, Von Neumann Model and Harvard Architecture, Data Representation and Arithmetic Algorithms- Addition, Subtraction, Multiplication - Unsigned Multiplication, Booth's Algorithm (Signed Multiplication), Division of Integers - Restoring Division, Non-Restoring Division.

Unit-II Memory Organization **08 Hrs.**

Types of RAM (SRAM, DRAM, SDRAM, DDR, SSD) and ROM, Characteristics of Memory, Memory Hierarchy- Cost and Performance Measurement.

Virtual Memory: Concept, Segmentation and Paging.

Address Translation Mechanism, Interleaved and Associative Memory, Cache Memory Concepts, Cache Coherency.

Unit-III Intel 8086 Architecture and Addressing Modes **05 Hrs.**

Major Features of 8086 Processor, 8086 CPU Architecture and Pipelined Operations, Programmer's Model and 8086 Pin Description, 8086 Addressing Modes.

Unit-IV 8086 Instruction set, Interrupts and Programming **08 Hrs.**

Instruction set of 8086 microprocessor, Assembler directives, Procedure and macros, Interrupts in 8086 microprocessors: Dedicated interrupts, Software interrupts, DOS interrupts (Programming examples), Assembly language programming for 8086 microprocessors.

Unit-V Introduction to Processor Performance Evaluation **06 Hrs.**

Performance metrics and benchmarks; Clock Cycle Time (CCT), Clock Rate, and Instructions Per Second (IPS), Cycles Per Instruction (CPI), Million Instructions Per Second (MIPS), Floating-Point Operations Per Second (FLOPS), Performance per Watt, Performance Evaluation with Benchmarks: Overview of popular benchmarks like SPEC, Linpack, TPC and Stream.

Unit-VI Pentium Processor Architecture **06 Hrs.**

Features of Intel Pentium processor, Pentium Superscalar architecture, Pipelining, Branch prediction, Instruction and data cache concept.

Reference Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", 11th Edition, Pearson Publication, 2018.
2. John P. Hayes, "Computer Architecture and Organization", 3rd Edition, McGraw Hill, 1988.
3. John Uffenbeck, "8086/8088 Family: Design Programming and Interfacing", 3rd Edition, PHI, 2007.
4. Douglas Hall, "Microprocessor and Interfacing", 3rd Edition, Tata McGraw Hill, 2017.
5. James L. Antonakos, "The Intel Microprocessor Family: Hardware and Software Principles and Applications", 1st Edition, Cengage Learning, 2007.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment(CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Processor Organization and Architecture Laboratory(22PCCO4040L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To understand various multiplication and division algorithms.
- To implement memory allocation and page replacement policies.
- To implement programs using 8086 instruction set and addressing modes.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement multiplication and division algorithms.	L3	Apply
CO2	Compare and apply first fit and best fit memory allocation policy.	L3	Apply
CO3	Understand and implement page replacement policies.	L3	Apply
CO4	Design and Implement assembly language programs using the instructions and addressing modes of 8086 microprocessor.	L6	Create

List of Laboratory Experiments(Atleast 10)

1. To implement shift and add method of multiplication algorithm.
2. To implement Booth's multiplication algorithm.
3. To study and implement Restoring division algorithm.
4. To study and implement Non- Restoring division algorithm.
5. To implement Memory allocation policies such as First Fit, Best Fit etc.
6. To study and implement page replacement policies such as FIFO, LRU etc.
7. Assembly program for 16-bit addition
8. Assembly Program to transfer n block of data from one segment to another segment.
9. Assembly program to sort numbers in ascending/ descending order
10. Assembly program to find minimum/ maximum no. from a given array.
11. Assembly language program using Procedures and Macros.
12. Case study to evaluate the Performance of different Processors.

Any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on 22PCCO4040T with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Programming Laboratory-II (Web Design)(22PCCO4050L)

Practical Scheme
Practical : 04 Hrs./week
Credits : 02

Examination Scheme
Teacher Assessment : 50 Marks
End Sem Exam : 50 Marks
Total : 100 Marks

Prerequisite: Basics of programming

Course Objectives:

- To get familiar with the basics of Web Programming.
- To acquire knowledge and skills for creation of web site considering both client and server-side programming.
- To gain ability to develop responsive web applications.
- To understand REST API and MongoDB for Frontend and Backend Connectivity.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement interactive web page(s) using HTML5, CSS and JavaScript.	L6	Create
CO2	Design Web Applications using opensource tool.	L6	Create
CO3	Implement a webpage using Angular, React.js and Node.js.	L6	Create
CO4	Create an application using MongoDB	L6	Create

Course Contents

Unit-I HTML5, CSS3 and Bootstrap — 08 Hrs.

HTML5: Introduction and Advantages of HTML5, Overview of New Features of HTML5, List of HTML4 elements removed from HTML5, Page Layout Semantic Elements, HTML5 Web Forms, Canvas API, SVG API, HTML5 Media (Video & Audio), Web Storage (DOM) API, Geolocation.

CSS3: Introducing CSS3, Border and Box Effects, Background Images and Other Decorative, 2D and 3D Transformations, Transitions and Animations, Tailwind CSS, CSS3-Multi Column Layout, Media Queries

Bootstrap: Introduction to Bootstrap, Bootstrap Grids, Bootstrap Themes, Bootstrap CSS, Bootstrap JS, Introduction to Apache Tomcat Server.

Unit-II JavaScript — 06 Hrs.

Introduction to JavaScript, JavaScript DOM Model, Date and Objects, Regular Expressions, Exception Handling, Validation, Built-in objects, Event Handling, DHTML with JavaScript, JSON Introduction, Syntax, Function Files, Http Request, SQL.

Unit-III TypeScript — 04 Hrs.

Overview, TypeScript Internal Architecture, TypeScript Environment Setup, TypeScript Types, variables and operators, Decision Making and loops, TypeScript Functions, TypeScript Classes and Objects, TypeScript Modules

Unit-IV Angular — 12 Hrs.

Introduction to Angular, Angular Application Architecture, what is Ng Module?, Angular Components, Angular Templates, Data Binding, Types of Data Binding Modules Component Working, Directives, Structure Directives, Template Routing, Theme Implementation in Angular Framework, Angular Forms, Services, Inject Services, Angular Server Communication with Backend Server, Working of API's (GET, POST, PUT, DELETE), Complete Web application in Angular Framework.

Unit-V Node.js and React.js — 14 Hrs.

Node.js : Introduction to Node.js, Installing Node.js, Node.js modules, File I/O. **Web development with Node.js**: Creating a basic web server, HTTP requests and responses, Handling dynamic content **Advanced Node.js**: Asynchronous programming with callbacks, promises, and async/await, Streams and buffers, Security and authentication.

React.js: Introduction to React.js, Installing React.js, React.js basics like JSX syntax, Components and props, State and lifecycle, Event handling.

Advanced React.js: Hooks (useState, useEffect, useContext, etc.), Redux for state management

Routing with React Router.

React.js and other libraries: Using third-party libraries with React.js (such as Material-UI or Bootstrap), Deploying a React.js app to a web server, Integration with CI/CD pipelines

Unit-VI MongoDB **08 Hrs.**

Understanding MongoDB, MongoDB Data Types, Administering User Accounts, Configuring Access Control, Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Accessing and Manipulating Databases, Manipulating MongoDB Documents from Node.js, Accessing MongoDB from Node.js, Using Mongoose for Structured Schema and Validation. REST API: Examining the rules of REST APIs, Evaluating API patterns, Handling typical CRUD functions (create, read, update, delete), Using Express and Mongoose to interact with MongoDB, Testing API endpoints.

List of Laboratory Experiments (At least 10 Programs)

1. Using HTML5 layout tags develop informative page with sections which include various images, links to other pages for navigation, make use of all possible formatting (for example font, color etc.).

2. Apply CSS properties, Border, margins, Padding, Navigation, dropdown list to page created in First Experiment

3. Create form in HTML5 with all form elements. Apply form validations (e.g., Email, mobile, Pin code, Password) using JavaScript.

4. Inheritance, Access Modifiers example using TypeScript.

5. Building a Simple Website with TypeScript.

6. Building a Simple to-do list app: Students can learn the basics of Angular.js by building a simple to-do list application. They can learn how to use directives, controllers, and services to create a functional app.

7. Use Angular.js to create a dynamic shopping cart that updates in real-time. They can learn how to use filters, directives, and controllers to add, remove, and update items in the cart.

8. Build a single-page application (SPA) using Angular.js. They can learn how to use Angular.js routing to create a navigation system that allows users to move between different views without the need for page reloads.

9. Building a simple web server: Students can learn the basics of Node.js by building a simple web server that serves static content. They can learn how to use the http module to create a server, and how to handle requests and responses.

10. Creating a real-time dashboard: Students can learn how to use Node.js to create a real-time dashboard that displays data in real-time. They can learn how to use websockets to create a two-way communication channel between the client and the server, and how to create interactive visualizations using libraries like D3.js.

11. Building a simple Blog App which has features like articles list based on most commented or most liked, author profile page and article page with comment section and reaction button. Basically, this app must have 3 different filters, based on filter chosen, the listing component must render 3 different pages. Develop using React Hooks, React Routing, Pagination and other sorting techniques.

12. Build a RESTful API using MongoDB.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Mini Project: Develop website using any CMS tool which falls into one of the categories blog, social networking, News updates, Wikipedia, E-commerce store. Website must include home page, and at least 3 forms (with Validation), use at least HTML5, CSS/Bootstrap, JavaScript, Angular.js, React.js web technologies. Database support is needed. Deploy website on live webserver and access through URL.

Text Books:

1. John Dean, "Web Programming with HTML5, CSS3 and JavaScript", Jones & Bartlett Learning, 2019 Edition.
2. Boris Cherny, "Programming TypeScript- Making Your Javascript Application Scale", O'Reilly Media Inc., 2019 Edition..
3. Adam Bretz and Colin J. Ihrig, "Full Stack JavaScript Development with MEAN", SitePoint Pty. Ltd., 2015 Edition.
4. Simon Holmes Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Manning Publications, 2019 Edition.

Reference Books:

1. Glenn Johnson, "Programming in HTML5 with JavaScript and CSS3", Microsoft Press, 2013 Edition.
2. Yakov Fain and Anton Moiseev, "TypeScript Quickly", Manning Publications, 2020 Edition.
3. Steve Fenton, "Pro TypeScript: Application - Scale Javascript Development", Apress, 2014 Edition.
4. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications", 2nd Edition, AddisonWesley Professional, 2018 Edition.

Online Resources:

1. https://www.w3schools.com/
2. https://www.tutorialspoint.com/index.htm

3. https://www.udemy.com/course/crash-course-html-and-css/
4. https://nptel.ac.in/courses/106106156
5. https://www.udemy.com/course/reactjs-training/
6. https://www.udemy.com/course/mern-stack-course-mongodb-express-react-and-nodejs/
7. https://www.classcentral.com/course/skillshare-create-a-web-app-with-react-mongodb-express-and-nodejs-84146

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA) 50 Marks:

Laboratory work will be based on 22PCCO4050L with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 10 Marks
2. Journal Submission: 10 Marks
3. Viva-voce: 10 Marks
4. Subject Specific Lab Assignment/Case Study: 20 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (ESE) 50 Marks:

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Universal Human Values (22HMCO4060T)

Teaching Scheme	Examination Scheme
Lectures : 02 Hrs./week	Term Test : 15 Marks
Tutorial : 01 Hr/week	Teacher Assessment : 20 Marks
Credits : 03	End Sem Exam : 65 Marks
	Total Marks : 100 Marks

Course Objectives:

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- To understand the harmony in the human being, family, society and nature/existence.
- To Strengthen Self-Reflection.
- To develop the commitment and courage to act.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand and analyse the essentials of human values and skills, self exploration, happiness and prosperity.	L2	Understand
CO2	Identify the role of harmony in family, society and universal order.	L4	Analyze
CO3	Apply holistic understanding of harmony on professional ethics.	L3	Apply

Course Contents

Unit-I Introduction 05 Hrs.

Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.

Continuous 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.

Unit-II Understanding Harmony in the Human Being 05 Hrs.

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 am 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.

Unit-III Understanding Harmony in the Family 03 Hrs.

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

Unit-IV Understanding the harmony in society (society being an extension of family) 03 Hrs.

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.

Unit-V Understanding Harmony in Nature and Existence 05 Hrs.

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.

Unit-VI Implications of the above Holistic Understanding of Harmony on Professional Ethics 05 Hrs.

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. Strategy for transition from the present state to Universal Human Order:

a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers,

b. At the level of society: as mutually enriching institutions and organizations.

Tutorials(Term work):

Term work shall consist of minimum 5 activities based on activities conducted. The tutorials could be conducted as per the following topics: -

1. 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.

2. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

3. 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' lives.

4. 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.

5. 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.

Text Books:

1. R. R. Gaur, R. Sangal, G. P. Bagaria, "Human Values and Professional Ethics", 1st Edition, Excel Books, New Delhi, 2010.

Reference Books:

1. A Nagaraj, "Jeevan Vidya: EkParichaya", Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathi, "Human Values", New Age International Publishers, New Delhi, 2004.
3. Annie Leonard, "The Story of Stuff" (Book), 2010.
4. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth",2012.
5. E. F. Schumacher, "Small is Beautiful", 2011.
6. Cecile Andrews, "Slow is Beautiful", New Society Publishers, 2006.
7. J. C. Kumarappa, "Economy of Permanence".
8. Pandit Sunderlal, "Bharat Mein Angreji Raj", 1929.
9. Dharampal, "Rediscovering India", 2012.
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule", 2014.
11. Maulana Abdul Kalam Azad, "India Wins Freedom", 2017.
12. Romain Rolland, "Vivekananda"(English).
13. Romain Rolland, "Gandhi"(English), 2022.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

Conduction of Term Test

The two Term Tests of 15 marks will be conducted under Continuous Assessment (CA) out of which best performance among the two Term Tests will be considered.

Term Test (TT) (for 15 Marks)

Best of Two (TT-1/ TT-2)

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Semester Project-II (22PJCO4070L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of introducing semester project at second year level is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Second Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(Log Book Format will be as per Table 4).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details

- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 5.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 6.

Table 4: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 5: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintenance	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 6: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	Hardware/ Programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Environmental Studies (22MCCO4080T)

Teaching Scheme
Lecture : 01 Hr/week

Audit Course

Prerequisite: Interest in Environment and its impact on Human.

Course Objectives:

- Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
- Familiarise environment related legislation.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand how human activities affect environment.	L2	Understand
CO2	Understand the various technology options that can make a difference.	L2	Understand

Course Contents

Unit-I Social Issues and Environment 04 Hrs.

Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests, Carbon emissions and Global Warming.

Unit-II Technological Growth for Sustainable Development 04 Hrs.

Social, Economical and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board.

Unit-III Green Technology 05 Hrs.

History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency.

Text Books:

1. R. Rajagopalan, "Environmental Studies From Crisis to Cure", 2012.
2. Erach Bharucha, "Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education".
3. Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, Morgan and Kaufman, "Green Information Technology: A Sustainable Approach", Elsevier, 2015.

Reference Books:

1. Paulina Golinska, Marek Fortsch, Jorge Marx-Gómez, "Information Technologies in Environmental Engineering: New Trends and Challenges", Springer, 2011.

Evaluation Scheme:

1. Student should submit a report on the case study declared by teacher.
2. Audit point shall be awarded subject to submission of report of the case study declared by teacher.

Employability Skill Development Program-I (22HMCO4090L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 50 Marks
Total : 50 Marks

Course Objectives:

- To enhance the problem solving skills.
- To improve the basic mathematical skills for solving real life examples.
- Able to implement the algorithms and draw flowcharts for solving Mathematical and Engineering problems.
- Demonstrate an understanding of computer programming language concepts.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basic concepts of Quantitative Ability i.e. profit, loss, time, work and geometry.	L2	Understand
CO2	Apply the concepts of Quantitative Ability for the problem solving.	L3	Apply
CO3	Illustrate the concept of Variables and Functions.	L3	Apply
CO4	Illustrate the concept of Multithreading and string handling	L3	Apply
CO5	Understand and describe the fundamental of object-oriented programming	L2	Understand
CO6	Understand the concepts of distributed database.	L2	Understand

Course Contents

Unit-I Aptitude

Quantitative Aptitude : Algebra, Profit and Loss, Average & Allegation / Mixture, Time and Work, Geometry Mensuration, Numbers , Percentage, Permutation and Combination, Probability, Ratios & Proportion, Time and Distance. Reasoning : Analytical, Puzzles, Blood relationship, Data Interpretation, Data sufficiency

Unit-II Fundamental of Programming

Variables: Local variables, Global variables, 'global' keyword, Rules of Identities, **Functions**: Introduction, Prototype, Classification of functions, No arguments and No return values, With arguments and With return values.

No arguments and With return values: With arguments and No return values, Recursion, Argument type functions, Default arguments functions, Required arguments functions, Keyword arguments functions, Variable arguments function.

Operators: Arithmetic Operators, Relational operators, Logical operators, Bitwise operators, Shift operators.

Control Statements: Conditional Control Statements, if, if-else, if-elif-else, nested-if, Loop Control Statements, While, For.

Branching Statements: Break, Continue, pass, return, exit.

Exception Handling: Introduction, The need of exception handling, Getting exceptions, Default exception handler, Handling exception, Try, Except, Try with multiple except blocks Handling exceptions using Exception class, Finally, block, Releasing resources using Finally block, Raise, Creating a user exception class., Raise exception manually, Exceptions based application.

Multithreading: Introduction, Multitasking, Multi tasking v/s Multithreading, threading module, Thread class introduction, Creating thread, The life cycle of a thread, Single-threaded application, Multi-threaded application, Sleep() method. Sleep() v/s run(), Join() v/s Sleep(), Multiple custom threads creation, The execution time of single-threaded application, The execution time of multi-threaded application, Synchronization of threads. Inner classes basic syntax of inner class, Advantages of Inner classes, Access class level members of inner classes, Access object level members of inner classes, Local inner classes, Complex inner classes, Accessing data of inner classes.

Regular expressions:'re' module, Match(), Search(), find() etc, and actual projects web scrapping Mail extraction Date extraction, Mobile number extraction, Vehicle number extraction, zoom chat analysis, Expressions using operators and symbols: Split string into characters, Split string into words, Lambda expressions.

String handling using regex: Introduction to Strings, Indexing and Slicing, Special operators in String handling, Old style String formatting, String library methods, Quotes and Escape characters

in a String representation, String Immutability, Logical programs using Strings.

Object Oriented Programming: Introduction to OOPs, Classes, Objects, Structure to OOP application, Contexts of OOP application, Class level members, Object level members, self variable, Constructor and Initialization of object. Access modifiers : Private, Protected, Public, Program codes. Encapsulation Rules, Implementation, Abstraction, Polymorphism Inheritance Introduction, Types of Inheritance, Single inheritance, Multi-Level inheritance, Method overriding, Object initialization using constructor, Multiple inheritances, Hierarchical inheritance, Method overriding in Multi level inheritance.

Reference Books:

1. Dr. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. Chand Publication.
2. M. G. Venkateshmurthy, "Programming Techniques through C", Pearson Publication.
3. Behrouz Forouzan, "A Computer Science Structure Programming Approaches using C", Cengage Learning.
4. Yashwant Kanetkar, "Let Us C", BPB Publication.

Evaluation Scheme:

1. The Teacher Assessment is based on the following criteria defined in autonomous rules and regulation R 9.3
2. For Laboratory courses, 100% assessment shall be based on CA.

Teacher Assessment(TA): For Laboratory courses the CA shall have one component i.e. Teacher Assessment (TA), Completion of experiment, Viva- voce, Journal submission, Assignments, Experiments performance, and any other component recommended by BOS and approved by Dean Academics. The distribution of marks for term work shall be as follows:

1. MCQ Test based on Aptitude: 20 Marks
2. MCQ Test based on Programming skills: 30 Marks
3. Total Marks: 50 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.