Shirpur Education Society's

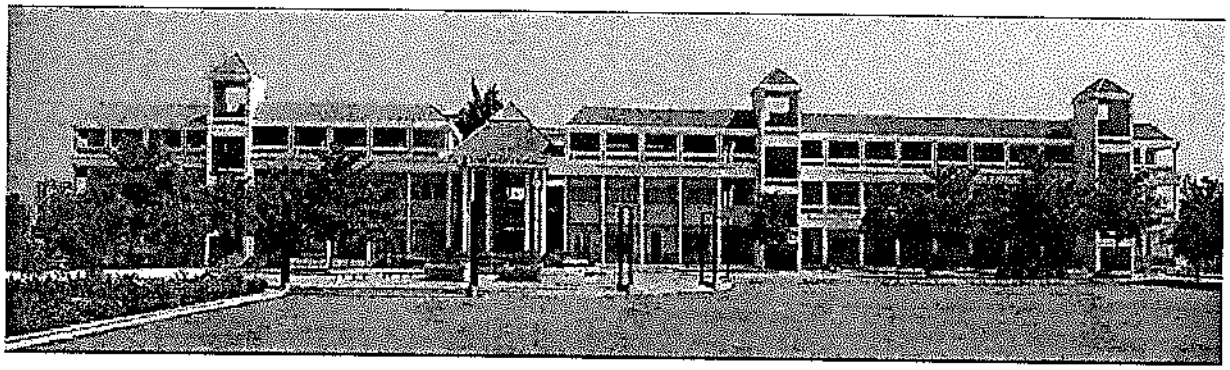
R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Second Year B. Tech (Computer Engineering)

With effect from Year 2021-22



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Semester-III (w.e.f. 2021-22)													
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	BSCO3010T	Engineering Mathematics-III	3	1		20	15	15	15	65	100	4
2	PC	PCCO3020T	Data Structures	3			20	15	15	15	65	100	3
3	PC	PCCO3020L	Data Structures Laboratory			2	25				25	50	1
4	PC	PCCO3030T	Discrete Structures	3	1$		20	15	15	15	65	100	4
5	PC	PCCO3040T	Database Management Systems	3			20	15	15	15	65	100	3
6	PC	PCCO3040L	Database Management Systems Laboratory			2	25				25	50	1
7	ES	ESCO3050T	Digital Electronics	3			20	15	15	15	65	100	3
8	ES	ESCO3050L	Digital Electronics Laboratory			2	25				25	50	1
9	PC	PCCO3060L	Programming Laboratory-I (Java)			4*	50				50	100	2
10	PJ	PJCO3070L	Semester Project-I			2	25				25	50	1
11	MC	MCCO3080T	Constitution of India	1									Audit Course
			Total	16	2	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. 2021-22)

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	BSCO4010T	Engineering Mathematics-IV	3	1		20	15	15	15	65	100	4
2	PC	PCCO4020T	Formal Language and Automata Theory	3	1		20	15	15	15	65	100	4
3	PC	PCCO4030T	Operating System	3			20	15	15	15	65	100	3
4	PC	PCCO4030L	Operating System Laboratory			2	25				25	50	1
5	PC	PCCO4040T	Analysis of Algorithms	3			20	15	15	15	65	100	3
5	PC	PCCO4040L	Analysis of Algorithms Laboratory			2	25				25	50	1
6	PC	PCCO4050T	Computer Networks	3			20	15	15	15	65	100	3
7	PC	PCCO4050L	Computer Networks Laboratory			2	25				25	50	1
8	HM	HMCO4060T	Universal Human Values	2			20	15	15	15	65	100	2
9	PJ	PJCO4070L	Semester Project-II			2	25				25	50	1
10	HM	HMCO4080	Employability Skill Development Program-I			2	50					50	1
			Total	17	2	10	270			90	490	850	24

Prepared by:
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Director

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Semester - III

Engineering Mathematics - III (BSCO3010T)

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:

The objective of this course is 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.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Use Laplace and inverse Laplace Transform to the Ordinary Differential Equations.	L3	Apply
CO2	Expand 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

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Course Contents

Unit-I Laplace Transform — 14 Hrs.

Introduction, Definition of Laplace Transform, Laplace Transform of Some Standard Functions $1, e^{at}$, sin at, cos at, sinhat, cosh at, t^n, $erf\sqrt{t}$ Heavi-Side Unit Step, Dirac-Delta Function, LT of Periodic Function. Properties of Laplace Transform: Linearity, First Shifting Property, Second Shifting Property, Multiplication by t^n Division by t, Laplace Transform of Derivatives and Integrals, Change of Scale Property (Without Proof).

Inverse Laplace Transform

Inverse Laplace Transform by Partial Fraction Method, Convolution Theorem Application to Solve Initial and Boundary Value Problem Involving Ordinary Differential Equations and Simultaneous Differential Equations.

Unit-II Fourier series — 10 Hrs.

Dirichlet's Conditions, Fourier Series of Periodic Functions With Period 2π and 2L, Fourier Series for Even and Odd Functions, Half Range Sine and Cosine Fourier Series, Parsevel's Identities (Without Proof), Complex Form of Fourier Series, Orthogonal and Orthonormal Set of Functions. Fourier Integral Representation.

Unit-III Fourier Transform — 12 Hrs.

Definition: Introduction to Fourier Transform and Inverse Fourier Transform, Fourier Cosine Transform and Fourier Sine Transform of Functions, Evaluation of Fourier Transform of Various Functions. Properties: Linearity Property and Shifting Properties of Fourier Transform, Change of Scale and Modulation Properties of Fourier Transform, Fourier Transform of Derivative and Integral of a Function, Fourier Transform of Convolution of Two Functions, Parseval's Identity, Evaluation of Definite Integrals using Properties of Fourier Transform, Fourier Transform of Dirac Delta Function, Finite Fourier Transform, Finite Fourier Sine Transformm, Finite Fourier Cosine Transform.

Unit-IV Z-Transform — 12 Hrs.

Z-Transform of Standard Functions such as $Z(a^n)$, $Z(n^p)$. Properties of Z-Transform :Linearity, Change of Scale, Shifting Property, Multiplication of K, Initial and Final Value, Convolution Theorem (All Without Proof) Inverse Z Transform: Binomial Expansion and Method of Partial Fraction.

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Tutorials :

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

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

Text Books:

1. Grewal B. S., "Higher Engineering Mathematics", 38^{th} Edition, Khanna Publication 2005.
2. Kreyszig E., "Advanced Engineering Mathematics", 9^{th} Edition, John Wiley.

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", Mc-Graw Hill Publication.

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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 3 hrs.

Data Structures (PCCO3020T)

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 Programming (C Programming)

Course Objective:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To Demonstrate Different Searching and Sorting Techniques.	L2	Understand
CO2	To Perform Various Operations on Linear and Non-Linear Data Structures.	L3	Apply
CO3	To Implement Linear Data Structures for Different Applications.	L3	Apply
CO4	To Illustrate Use of Non-Linear Data Structures in Various Applications.	L2	Understand
CO5	To Explain and Construct Various Hashing Techniques.	L2, L3	Understand, Apply

Course Contents

Unit-I Introduction — 06 Hrs.

Types: Primitive, Non Primitive, Linear, Non Linear Data structures, Single and Multidimensional Arrays, Memory Representation, Introduction to Time and Space Complexity. Searching: Search Techniques, Sequential Search, Variant of Sequential Search: Sentinel Search, Binary Search, Fibonacci Search. Sorting: Types of Sorting - Internal and External Sorting, Sorting Methods: Insertion Sort, Selection Sort, Quick Sort.

Unit-II Linked Lists — 08 Hrs.

Comparison of Sequential and Linked Organizations, Dynamic Memory Management, Linked List Abstract Data Type, Linked List Operations, Types of Linked List: Linear and Circular Linked Lists, Doubly Linked List and Operations, Circular Linked List, Singly Circular Linked List, Doubly Circular Linked List, Polynomial Manipulations: Polynomial Addition and Subtraction.

Unit-III Stacks — 06 Hrs.

Stacks: Concept, Primitive Operations, Stack as Abstract Data Type, Representation of Stacks using Sequential Organization, Stack Operations, Multiple Stacks, Applications of Stack: Expression Evaluation and Conversion, Polish Notation and Expression Conversion, Postfix Expression Evaluation, Parenthesis Correctness, Linked Stack and Operations.

Unit-IV Queues — 06 Hrs.

Concept, Queue as Abstract Data Type, Realization of Queues using Arrays, Circular Queue, Advantages of using Circular Queues, Multi Queues, Deques, Priority Queue, Array Implementation of Priority Queue, Linked Queue and Operations.

Unit-V Trees and Graphs — 11 Hrs.

Trees: Basic Terminology, Representation using Array and Linked List, Operations on Binary Tree: Finding Height, Leaf Nodes, Counting Number of Nodes etc., Tree Traversals: Preorder, Inorder, Postorder, Binary Search Trees(BST), Operations on BST: Insertion, Deletion of a Node from BST, Threaded Binary Tree(TBT), Height Balanced Tree(AVL): Rotations on AVL Tree, Expression Trees.
Graphs: Terminology and Representation, Graph Traversals: Breadth First Search and Depth First Search, Topological Sort.

Unit-VI Hashing Techniques — 05 Hrs.

Hash Table, Hash Functions and Collision, Dynamic Hashing: Motivation for Dynamic Hashing, Dynamic Hashing using Directories, Directory Less Dynamic Hashing, Bloom Filters, Bloom Filter

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Designs, Count Min Sketch.

Text Books:

1. Reema Thareja, "Data Structures using C", 2nd Edition, Oxford.
2. Rajesh K. Shukla, "Data Structures using C and C++", Edition 2019, Wiley – India.
3. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, "Data Structures Using C", 1st Edition, Pearson.
4. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition.
5. Jean-Paul Tremblay, Paul G. Sorenson, "Introduction to Data Structure and Its Applications", 2nd Edition.

Reference Books:

1. Prof. P. S. Deshpande, Prof. O. G. Kakde, "C and Data Structures", Edition 2003, Dreamtech Press.
2. E. Balagurusamy, "Data Structure using C", Edition 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 3 hrs.

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Data Structures Laboratory (PCCO3020L)

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.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To Implement Different Searching and Sorting Operations.	L3	Apply
CO2	To Perform Different Operations on Stack and Queue Data Structure.	L3	Apply
CO3	To Implement Single Linked List and Perform various Operations.	L3	Apply
CO4	To Explain and Construct various Hashing Techniques.	L2, L3	Understand, Apply
CO5	To Implement Tree Data Structure.	L3	Apply

List of Laboratory Experiments(At Least 12)

Suggested Experiments:

Note: Students are required to complete 12 experiments. At least one experiments is mandatory from each topic .

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

1. Sorting
   (a) Implementation of Insertion Sort, Selection Sort Menu Driven Program.
   (b) Implementation of Quick Sort.
2. Searching
   (a) Implementation of Searching Methods: Sequential Search.
   (b) Implementing variant of sequential search: Sentinel Search, Binary Search, Fibonacci Search.
3. Linked List
   (a) Implementation of Linked List Menu Driven Program.
   (b) Implementation of different operations on Linked List: Copy, Concatenate, Split, Reverse, Count number of nodes etc.
   (c) Implementation of Polynomial Operations (Addition, Subtraction) using Linked List.
   (d) Implementations of Linked Lists Menu Driven Program (Stack and Queue).
   (e) Implementations of Double Ended Queue using Linked List.
   (f) Implementation of Priority Queue Program using Linked List.
4. Stack
   (a) Implementation of Infix to Postfix Transformation and its Evaluation Program.
   (b) Implementation of Infix to Prefix Transformation and its Evaluation Program.
5. Queue
   (a) Implementation of Double Ended Queue Menu Driven Program.
   (b) Implementation of Queue Menu Driven Program.
   (c) Implementation of Priority Queue Program using Array.

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6. Tree

   (a) Implementation of BST Program.

   (b) 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.

7. Graph

   (a) Implementation of Graph Menu Driven Program (DFS and BFS).

   (b) Implementation of Topological Sort.

8. Hashing

   (a) 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 PCCO3020T with minimum 12 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(PCCO3030T)

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:

1. To cultivate clear thinking and creative problem solving.
2. To thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies.
3. To thoroughly prepare for the mathematical aspects of other Computer Engineering courses.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Verify the correctness of an argument using propositional and predicate logic and truth tables.	L5	Evaluate
CO2	Solve problems using counting techniques and combinatorics in the context of discrete probability.	L3	Apply
CO3	Solve problems involving recurrence relations and generating functions.	L3	Apply
CO4	Summarize relations, diagraph, lattice, and functions.	L2	Understand
CO5	Explain and differentiate graphs and trees.	L2	Understand
CO6	Distinguish the different Algebraic structures and demonstrate use of groups and codes in Encoding-Decoding.	L2, L4	Understand, Analyze

Course Contents

Unit-I Sets and Logic — 06 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 Propositional Logic: Propositions and Logical Operations, Truth Tables, Laws of Logic, Equivalence, Implications, Normal Forms, Predicates, Quantifiers.

Unit-II Relations and Functions — 14 Hrs.

Introduction: Relations and their Properties, Paths and Digraphs, Types of Binary Relations, Operations on Relations.

Equivalence Relations: Closures, Warshall's Algorithm.

Posets: Partial Ordered Relations, Poset, Hasse Diagram, Lattice and It's Types: Distributive, Complimentary.

Functions: Types of Functions: Injective, Surjective and Bijective, Composition of Functions, Iden tity and Inverse function.

Unit-III Combinatorics and Probability — 06 Hrs.

Combinatorics: Mathematical Induction, Basics of Counting: Pigeon-Hole Principle, Permutations and Combinations, Recurrence Relations, Solving Recurrence Relations, Generating Functions.

Probability: Basic Probability, Conditional Probability, Bayes Theorem.

Unit-IV Graphs and Trees — 08 Hrs.

Introduction to Graph Theory: Definitions, Paths and Circuits.

Types of Graphs: Eulerian and Hamiltonian, Sub Graphs, Planar Graphs, Coloring Graphs.

Functions and Graphs: Isomorphism of Graphs.

Introduction to Trees: Trees, Rooted Trees, Path Length in Rooted Trees, Prefix Codes and Optimal Prefix Codes.

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 Generating Function and Recurrence Relation — 08 Hrs.

Function of Sequences, Calculating Coefficient of Generating Function, Recurrence Relations, Solving Recurrence Relation by Substitution and Generating Functions, Characteristics Roots Solution, In Homogeneous Recurrence Relation.

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Tutorials:

1. Students need to solve minimum eight tutorials.
2. All tutorials to be taken as prescribed in Course: Discrete Structure (Course Code:PCCO3030T).

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.

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, 2008.
3. J. P. Trembley, R. Manohar "Discrete Mathematical Structures with Applications to Computer Science", 2^{nd} Edition, McGraw-Hill, 2017.
4. Seymour Lipschutz, MarcLipson," 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 3 hrs.

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Database Management Systems (PCCO3040T)

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:

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 understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.
5. To introduce principles and foundations of distributed databases, design issues, query processing and optimization.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Illustrate the fundamentals of a database systems.	L2	Understand
CO2	Design and draw ER and EER diagram for the real-life problem.	L6	Create
CO3	Build relational model from conceptual model and formulate relational algebra queries.	L6	Create
CO4	Design and query database using SQL.	L6	Create
CO5	Analyze and apply concepts of normalization to relational database design and explain the concept of transaction, concurrency and recovery.	L3, L4, L2	Apply, Analyze, Understand
CO6	Summarize the concepts of distributed database.	L2	Understand

Course Contents

Unit-I Introduction to Database Concepts — 03 Hrs.

Introduction, Characteristics of Databases, File System v/s Database System, Users of Database System, Data Independence, DBMS System Architecture, Database Administrator.

Unit-II Entity–Relationship Data Model — 08 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.

Unit-III Relational Model and Relational Algebra — 08 Hrs.

Introduction to the Relational Model, Relational Schema and Concept of Keys, Mapping the ER and EER Model to the Relational Model.

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

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

Overview of SQL, Data Definition Commands, Data Manipulation Commands, Data Control Commands, Transaction Control Commands.

Integrity Constraints: Key Constraints, Domain Constraints, Referential Integrity, Check Constraints, Set and String Operations, Aggregate Function, Group By Clause, Having Clause.

Views in SQL, Joins, Nested and Complex Queries.

Introduction to PL/SQL

Unit-V Relational Database Design — 10 Hrs.

Pitfalls in Relational-Database Designs, Concept of Normalization, Functional Dependencies, First Normal Form, 2NF, 3NF, BCNF.

Transactions Management and Concurrency:

Transaction Concept, Transaction States, ACID Properties, Concurrent Executions, Serializability – Conflict and View, Concurrency Control: Lock-Based, Timestamp-Based Protocols.

Recovery System: Introduction to Recovery System.

Unit-VI Distributed Database — 04 Hrs.

Introduction to Distributed Database, Features of DDBS, Design Issues in DDBS, Distributed Database Design Concept, Objectives, Data Fragmentation, Transparencies in Distributed Database Design.

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Text Books:

1. Korth, Silberchatz, Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education.
3. Peter Rob and Carlos Coronel, "Database Systems Design, Implementation and Management", 5th Edition, Thomson Learning.
4. Chhanda Ray, "Distributed Database System", Pearson Education India.
5. G. K. Gupta, "Database Management Systems", McGraw-Hill.

Reference Books:

1. Dr. P. S. Deshpande, "SQL and PL/SQL for Oracle 10g", Black Book, Dreamtech Press.
2. Gillenson, Paulraj Ponniah, "Introduction to Database Management", Wiley Publication.
3. Sharaman Shah, "Oracle for Professional", SPD.
4. Raghu Ramkrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw-Hill.
5. M. Tamer Ozsu, Patrick Valduriez, "Principles of Distributed Database", 2nd Edition, Pearson Education India.

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 3 hrs.

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Database Management Systems Laboratory (PCCO3040L)

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

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

Course Objectives:

1. To design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model for a given application.
2. To define schema by converting conceptual model to relational model.
3. To understand the use of Structured Query Language (SQL) syntax for design of given application.
4. To retrieve information from database using different SQL operations.

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	Identify, analyze and evaluate the project developed for an application.	L3, L4, L5	Apply, Analyze, Evaluate

List of Laboratory Experiments(At Least 10)

Suggested Experiments:

Description:

- The below suggested experiments need to be performed by a group of 3/4 students.
- Select any database management system and conduct all experiments based on the same topic.

1. Identify the case study and detailed statement of problem. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.
2. Mapping ER/EER to Relational schema model.
3. Create and populate database using Data Definition Language (DDL) and DML Commands.
4. Apply various Integrity Constraints on given database.
5. To perform Simple queries, string manipulation operations on given database.
6. To perform Nested queries and Complex queries on given database.
7. To demonstrate use of different types of Join operations.
8. To demonstrate Views and Triggers.
9. Write a Procedures in PL/SQL to perform various operations on database.
10. Examine the consistency of database using concurrency control technique (Locks).
11. Case study on Fragmentation (PHF, DHF, VF, and HF) in DDBMS design.
12. Case study on recent databases and applications.

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 PCCO3040T 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

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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 (ESCO3050T)

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:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain different Number Systems and their conversions.	L2	Understand
CO2	Examine and minimize Boolean expressions.	L4, L6	Analyze, Create
CO3	Design and analyze Combinational circuits.	L6, L4	Create, Analyze
CO4	Design and analyze Sequential circuits.	L6, L4	Create, Analyze
CO5	Design and analyze Counters and Registers.	L6, L4	Create, Analyze
CO6	Explain concept of Programming Logic Devices.	L2	Understand

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Course Contents

Unit-I Number Systems and Codes — 07 Hrs.

Introduction to Number System and Conversions: 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 — 08 Hrs.

Theorems and Properties of Boolean Algebra, Boolean Functions, Boolean Function Reduction using Boolean Laws, Canonical Forms, Standard SOP and POS Form. Basic Digital Gates: NOT, AND, OR, NAND, NOR, EX-OR, EX-NOR, Positive and Negative Logic, K-Map Method: 2-variable, 3-variable, 4-variable, Don't-Care Conditions, Quine-McCluskey Method, NAND-NOR Realization.

Unit-III Combinational Logic Design — 08 Hrs.

Introduction: Half and Full Adder, Half and Full Subtractor, 4-bit Ripple Adder, Look-Ahead Carry Adder, 4-bit Adder and Subtractor, 1- digit BCD Adder, Multiplexers, Multiplexer Tree, Demultiplexers, Demultiplexer Tree, Encoders, Priority Encoder, Decoders. Comparators: 1-bit, 2-bit, 4-bit Magnitude Comparators, ALU IC 74181.

Unit-IV Sequential Logic Design — 09 Hrs.

Application of Sequential Logic, Introduction: S-R Latch, S-R, D, J-K, T Flip-Flops, Truth Tables and Excitation Tables of all Types, Race-Around Condition, Master-Slave J-K Flip-Flops, Flip-Flop Conversion.

Unit-V Counters — 07 Hrs.

Design of Asynchronous and Synchronous Counters, Modulus of the Counters, UP/DOWN Counter, Shift Registers: SISO, SIPO, PIPO, PISO Bi-directional Shift Register, Universal Shift Register, Ring and Twisted-Ring/Johnson Counter, Sequence Generator.

Unit-VI Programming Logic Devices — 03 Hrs.

Concepts of Programmable Array Logic (PAL) and Programming Logic Array (PLA). Introduction to Sensors.

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Text Books:

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

Reference Books:

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

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 3 hrs.

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Digital Electronics Laboratory(ESCO3050L)

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

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

Course Objectives:

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

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

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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 ESCO3050T 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

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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 (Java)(PCCO3060L)

Teaching Scheme
Lectures : 02 Hrs./week
Practical : 02 Hrs/week
Credits : 02

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

Course Objectives:

1. To learn the object oriented programming concepts.
2. To study various java programming concept like multithreading, exception handling, packages etc.
3. To explain components of GUI based programming.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Make use of fundamental programming constructs.	L3	Apply
CO2	Illustrate the concept of packages, classes and objects.	L3	Apply
CO3	Explain the concept of strings, arrays and vectors.	L2	Understand
CO4	Implement the concept of inheritance and interfaces.	L3	Apply
CO5	Implement the notion of exception handling and multi-threading.	L3	Apply
CO6	Develop GUI based application.	L6	Create

Course Contents

Unit-I Introduction to Object Oriented Programming 02 Hrs.

OOP Concepts: Object, Class, Encapsulation, Abstraction, Inheritance, Polymorphism. Features of Java, JVM.

Basic Constructs/Notions: Constants, Variables and Data Types, Operators and Expressions, Revision of Branching and Looping.

Unit-II Classes, Object and Packages 05 Hrs.

Class, Object, Method.

Constructor, Static Members and Methods. Passing and Returning Objects.

Method Overloading.

Packages in Java, Creating User Defined Packages, Access Specifiers.

Unit-III Array, String and Vector 04 Hrs.

Arrays, Strings, String Buffer. Wrapper Classes, Vector.

Unit-IV Inheritance and Interface 04 Hrs.

Types of Inheritance, Super Keyword, Method Overriding, Abstract Class and Abstract Method, Fi nal Keyword, Access Modifiers, Static and Dynamic Binding in Java.

Implementing Interfaces, Extending Interfaces.

Unit-V Exception Handling and Multithreading 04 Hrs.

Error vs Exception, Try, Catch, Finally, Throw, Throws, Creating Own Exception. Thread Lifecycle, Thread Class Methods, Creating Threads, Synchronization.

Unit-VI GUI Programming in JAVA 09 Hrs.

SWING Programming: Swing Components, Containers, JLabel, JButton, JCheckBox, JRadio. Buttons, JTextField etc., Event Handling.

Web Java GUI: Introduction to Java Web Frameworks, SPRING Framework.

Programming Using JDBC: Introduction to JDBC, JDBC Drivers and Architecture.

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List of Laboratory Experiments (At least 16-18 Programs and Mini Project) :

1. Program on various ways to accept data through keyboard and unsigned right shift operator.
2. Program on branching, looping, labelled break and labelled continue.
3. Program to create class with members and methods, accept and display details for single object.
4. Program on constructor and constructor overloading.
5. Program on method overloading.
6. Program on passing object as argument and returning object.
7. Program on creating user defined package.
8. Program on 1D array.
9. Program on 2D array.
10. Program on String.
11. Program on String Buffer.
12. Program on Vector.
13. Program on single and multilevel inheritance (Use super keyword).
14. Program on abstract class.
15. Program on interface demonstrating concept of multiple inheritance.
16. Program on dynamic method dispatch using base class and interface reference.
17. Program to demonstrate try, catch, throw, throws and finally. Also, implement user defined exception.
18. Program to demonstrate concept of multithreading.
19. Program to demonstrate concept of synchronization.
20. Program to create GUI application with event handling using SWING.
21. Program to create application using SPRING Framework.
22. Subject Specific Lab Assignments/Case Study. (Group of 2-3 students) [Real life Applications/problems]

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

Text Books:

1. Herbert Schildt, "JAVA: The Complete Reference", 9th Edition, Oracle Press.
2. Sachin Malhotra and Saurabh Chaudhary, "Programming in Java", 1st Edition, 2010, Oxford University Press.

Reference Books:

1. Ivor Horton, "Beginning JAVA", Wiley India.
2. Deitel and Deitel, "Java: How to Program",8th Edition, PHI.
3. "JAVA 8 Programming", Black Book, Dreamtech Press.
4. "Learn to Master Java programming", Staredusolutions.

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA) 50 Marks:

Laboratory work will be based on PCCO3060L with minimum 16 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.

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Semester Project-I (PJCO3070L)

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.

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

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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.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine before end of the semester.

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 (MCCO3080T)

Teaching Scheme
Lectures : 01 Hr/week

Audit Course

Course Objectives:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Why general knowledge and legal literacy thereby to take up competitive examinations.	L1	Remember
CO2	Explain state and central policies, fundamental duties.	L2	Understand
CO3	Identify Electoral Process, special provisions.	L3	Apply
CO4	Relate powers and functions of Municipalities, Panchayat's and Co- operative Societies.	L1	Remember
CO5	Develop Engineering ethics and responsibilities of Engineers.	L3	Apply
CO6	Classify Engineering Integrity & Reliability.	L4	Analyze

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 — 03 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 — 03 Hrs.

For SC & ST Special Provision for Women, Children & Backward Classes, Emergency Provisions.

Human Rights:

Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Cooperative Societies.

Unit-V Scope & Aims of Engineering Ethics — 03 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, 19^{th}/ 20^{th} Edition, 2001.
2. Charles E. Haries, Michael S. Pritchard and Michael J. Robins, "Engineering Ethics", Thompson Asia, 2003.

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,"Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.

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4. Latest Publications of Indian Institute of Human Rights, New Delhi.

Web Resources

1. www.nptel.ac.in
2. www.hnlu.ac.in
3. www.nspe.org
4. www.preservearticles.com

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.

Engineering Mathematics-IV (BSCO4010T)

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

Pre-requisite: Engineering Mathematics - I & Engineering Mathematics - II

Course Objectives:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate ability to manipulate matrices and compute Eigen values and Eigen vectors. Use 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	Draw 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

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Course Contents

Unit-I Matrices — 08 Hrs.

Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem (Without Proof), Similar Matrices, Diagonalizable of Matrix. Functions of Square Matrix.

Unit-II Probability — 09 Hrs.

Baye's Theorem, Random Variables: Discrete & Continuous Random Variables, Expectation, Variance, Probability Density Function & Cumulative Density Function, Moments, Moment Generating Function.

Probability Distribution: Binomial Distribution, Poisson & Normal Distribution (For Detail Study).

Unit-III Sampling Theory and ANOVA — 13 Hrs.

Sampling Distribution, Test of Hypothesis, Level of Significance, Critical Region, One Tailed and Two Tailed Test, Interval Estimation of Population Parameters, Large and Small Sample. 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.

Test of Significant for Small Samples: Student's T-Distribution and Its Properties.

Test of Significance of Small 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, Paired T-Test.

Chi Square Test: Test of Goodness of Fit and Independence of Attributes, Contingency table, Association of Attributes and Yate's Correction. Analysis of Variance(F-Test): One Way Classification, Two-Way Classification(Short-Cut Method).

Unit-IV Mathematical Programming — 12 Hrs.

Types of Solution, Standard and Canonical form of LPP, Basic and Feasible Solutions, Simplex Method.Artificial Variables, Big–M Method (Method of Penalty), Duality, Dual Simplex Method.

Non Linear Programming:-Problems with Equality Constrains and Inequality Constrains (No Formulation, No Graphical Method).

Unit-V Correlation & regression, Curve Fitting (Flipped Classroom)

Scattered Diagrams, Karl Pearson's Coefficient of Correlation, Covariance, Spearman's Rank Correlation (Non-Repeated and Repeated Ranks) Regression Coefficient & Lines of Regression.

Fitting of Curves: Least Square Method. Fitting of the Straight Line $y=a+bx$, Parabolic Curve $y=a+bx+cx^2$ & Exponential Curve $y=ab^x$.

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Tutorials :

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

List of Tutorials:

1. Matrices
2. Probability and Random variable
3. Probability Distribution
4. Sampling: Large Sample Test
5. Sampling: Small Sample Test
6. Sampling: Chi Square Test, ANOVA
7. LPP: Simplex Method, Big M Method
8. LPP: Duality and Dual Simplex Method
9. NLPP
10. Correlation
11. Regression and Curve Fitting

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", Wiley-India.

Reference Books:

1. Kreyszig E., "Advanced Engineering Mathematics", 9^{th} Edition, John Wiley.
2. C. Ray Wylie & Louis Barrett., "Advanced Engineering Mathematics", TMH International Edition.
3. Kanti B. Datta, "Mathematical Methods of Science and Engineering", Cengage Learning.
4. S. C. Gupta, V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons -2003.
5. Kishor S. Trivedi, "Probability & Statistics with Reliability", Wiley India.

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6. S. D. Sharma Kedarnath, Ram Nath & Co. Meerat., "Operations Research".

7. Singiresu S. Rao, "Engineering optimization (Theory and Practice)", 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 3 hrs.

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Semester - IV

Formal Language and Automata Theory (PCCO4020T)

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 provide a theoretical foundation for the process of computation and to impart an understanding of the notions of automata, formal languages and computability.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain basic concepts in automata theory and theory of computation.	L2	Understand
CO2	Identify different formal language classes and their relationships.	L3	Apply
CO3	Design grammars and recognizers for different formal languages.	L6	Create
CO4	Prove or disprove theorems in automata theory using its properties.	L5	Evaluate
CO5	Determine the decidability and intractability of computational problems.	L5	Evaluate

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Formal Language and Automata Theory (PCCO4020T)

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 provide a theoretical foundation for the process of computation and to impart an understanding of the notions of automata, formal languages and computability.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain basic concepts in automata theory and theory of computation.	L2	Understand
CO2	Identify different formal language classes and their relationships.	L3	Apply
CO3	Design grammars and recognizers for different formal languages.	L6	Create
CO4	Prove or disprove theorems in automata theory using its properties.	L5	Evaluate
CO5	Determine the decidability and intractability of computational problems.	L5	Evaluate

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Course Contents

Unit-I Fundamentals — 05 Hrs.

Strings, Alphabet, Language, Operations, Finite State Machine, Definitions, Finite Automaton Model, Acceptance of Strings and Languages, Deterministic Finite Automaton and Non Deterministic Finite Automaton, Transition Diagrams and Language Recognizers.

Unit-II Finite Automata — 06 Hrs.

NFA with ε transitions: Significance, Acceptance of Languages.

Conversions and Equivalence: Equivalence between NFA with and without ε Transitions, NFA to DFA Conversion, Minimisation of FSM, Equivalence between Two FSM's.

Finite Automata with output: Moore and Mealy Machines.

Applications: For the Designing of Lexical Analysis Phase of a Compiler.

Unit-III Regular Languages — 03 Hrs.

Regular Sets, Regular Expressions, Identity Rules, Constructing Finite Automata for a Given Regular Expressions, Conversion of Finite Automata to Regular Expressions, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets (proofs not required).

Unit-IV Grammars — 12 Hrs.

Grammars: Regular Grammars- Right Linear and Left Linear Grammars, Equivalence between Regular Linear Grammar and FA, Inter Conversion, Context Free Grammar, Derivation Trees, and Sentential Forms. Right Most and Leftmost Derivation of Strings.

Context Free Grammars: Ambiguity in Context Free Grammars, Minimisation of Context Free Grammars, Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for Context Free Languages, Enumeration of Properties of CFL (Proofs Omitted), Chomsky Hierarchy of Languages, Linear Bounded Automata and Context Sensitive Language, LR(0) Grammar.

Unit-V Push Down Automata — 08 Hrs.

Push Down Automata, Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty State and Its Equivalence, Equivalence of CFL and PDA, Interconversion (Proofs Not Required), Introduction to DCFL and DPDA.

Applications:

1. For Designing the Parsing Phase of a Compiler (Syntax Analysis).
2. For Evaluating the Arithmetic Expressions.

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Unit-VI Turing Machine 08 Hrs.

Turing Machine, Definition, Model, Design of TM, Computable Functions, Recursively Enumerable Languages, Church's Hypothesis, Counter Machine, Types of Turing Machines, Universal Turing Machine, Halting Problem.

Tutorials:

1. Finite State Machine and NFA with and without Epsilon.
2. NFA to DFA, DFA Minimization (Myhill-Nerode Theorem), Moore and Mealy Machines.
3. Regular Expressions, Arden's Theorem.
4. Derivation, Parse Tree, Ambiguity, Right and Left Linear Grammar.
5. CNF and GNF.
6. Push Down Automata.
7. Pumping Lemma: RL and CFL, CFG to PDA.
8. Turing Machine.
9. Implement any 1 Application of Finite Automata.
10. Implement any 1 Application of Push Down Automata.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education.
2. J.C.Martin, "Introduction to languages and the Theory of Computation", 4th Edition, Mc-Graw Hill.
3. Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, Cengage Learning.

Reference Books:

1. Dr. O. G. Kakde, "Theory of Computation", 1st Edition, Laxmi Publication.
2. Krishnamurthy E.V., S. K. Sen., "Introductory Theory of Computer Science", 2nd Edition, East-West press.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

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

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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 3 hrs.

Operating System (PCCO4030T)

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:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Summarize basic functions of Operating System.	L2	Understand
CO2	Compare and evaluate process scheduling algorithms and IPC.	L4	Analyze
CO3	Illustrate various memory management techniques.	L2	Understand
CO4	Explain and interpret File and I/O management techniques.	L5	Evaluate
CO5	Discover functionalities of different operating systems.	L4	Analyze

Course Contents

Unit-I Introduction to Operating System — 04 Hrs.

Operating System Objectives and Functions, Evolution of Operating System, OS Design, Considerations for Multiprocessor Architectures, Operating System Structures, 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, Multi core Processors and Threads. **Scheduling**: Types of Scheduling: Preemptive and Non-preemptive, Scheduling Algorithms and their Performance Evaluation: FCFS, SJF, SRTN, Priority Based, Round Robin, Introduction to Thread Scheduling.

Unit-III Process Synchronization and Deadlocks — 10 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**: Readers/Writers Problem, Producer and Consumer Problem.

Principles of Deadlock: Conditions and Resource Allocation Graphs, Deadlock Prevention.

Deadlock Avoidance: Banker's Algorithm for Single & Multiple Resources, Deadlock Detection and Recovery, Dining Philosophers Problem.

Unit-IV Memory Management — 08 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-V File System and I/O Management — 08 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**.

Unit-VI Case Studies — 05 Hrs.

XV6 OS, Distributed OS, Real Time OS, Mobile OS.

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Text Books:

1. William Stallings, "Operating System: Internals and Design Principles", 8th Edition, Prentice Hall, 2014.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley & Sons, Inc., 2016.
3. Andrew Tannenbaum, "Operating System Design and Implementation", 3rd Edition, Pearson, 2015.

Reference Books:

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

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Operating System Laboratory (PCCO4030L)

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

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

Course Objectives:

1. To understand commands of Linux and shell script.
2. To learn thoroughly process and thread concepts.
3. To solve problem of process/thread scheduling and synchronization.
4. To explore memory allocation strategies, page replacement and disk scheduling algorithms.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate the fundamental Unix commands and system calls.	L2	Understand
CO2	Solve the scheduling algorithms for given problems.	L3	Apply
CO3	Explain the synchronous concept using process and threads.	L2	Understand
CO4	Illustrate an algorithm to detect and avoid deadlock.	L2	Understand
CO5	Identify the performance of various memory allocation and page replacement algorithms.	L3	Apply
CO6	Demonstrate the various disk scheduling algorithms.	L2	Understand

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List of Laboratory Experiments(At Least 10)

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. Building multi-threaded and multi-process applications.
4. CPU scheduling algorithms like FCFS, SJF, Round Robin etc.
5. Process and Thread Synchronisation using client server mechanism.
6. 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.
7. Implement order scheduling in supply chain using Banker's Algorithm.
8. Using the CPU-OS simulator analyze and synthesize the following:
   - Process Scheduling algorithms.
   - Thread creation and synchronization.
   - Deadlock prevention and avoidance.
9. Implement various page replacement policies.
10. Implement disk scheduling algorithm FCFS, SSTF, SCAN, CSCAN etc.

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11. Building a scheduler in XV6.

12. Building own file system.

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 PCCO4030T 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.

Analysis of Algorithms (PCCO4040T)

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 Programming (C Programming)

Course Objectives:

1. To provide mathematical approach for Analysis of Algorithms.
2. To solve problems using various strategies.
3. To analyze strategies for solving problems.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze time and space complexity of an algorithm.	L4	Analyze
CO2	Solve problems using divide and conquer techniques.	L3	Apply
CO3	Solve problems using the concept of dynamic programming and greedy method.	L3	Apply
CO4	Explain the concepts of backtracking and string-matching algorithms.	L2	Understand
CO5	Make use of linear programming to optimize the solution.	L3	Apply

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Course Contents

Unit-I Introduction to Analysis of Algorithms — 08 Hrs.

Introduction, Asymptotic Notations (Big-Oh, Small-Oh, Big Omega, Theta Notations), Analysis of Selection Sort, Insertion Sort, Recurrences: Recursion Tree Method, Substitution Method, Master's Theorem.

Unit-II Divide and Conquer — 08 Hrs.

Analysis of Quick Sort, Merge Sort, Min-Max Algorithm, Finding Median, Efficient Algorithms for Integer Arithmetic (Euclid's Algorithm, Karatsuba's Algorithm for Integer Multiplication, Fast Exponentiation).

Unit-III Dynamic Programming — 08 Hrs.

General Strategy, 0/1 Knapsack, Multistage Graph, Single Source Shortest Path, All Pair Shortest Path, Travelling Salesman Problem, Longest Common Subsequence Problem.

Unit-IV Greedy Approach — 05 Hrs.

General Strategy, Knapsack Problem, Single Source Shortest Path, Minimum Spanning Tree (Prims and Kruskal Algorithm), Job Sequencing with Deadline.

Unit-V Backtracking Strategy and Linear Programming — 09 Hrs.

Backtracking Strategy: General Strategy, N queen Problem, Graph Coloring, Sum of Subset Problem.

Linear Programming: Introduction to Linear Programming, Geometric Interpretation, LP Duality, Simplex Algorithm, Linear Optimization Problems and their LP Formulation.

Unit-VI String Matching Algorithms — 04 Hrs.

The Naive String Matching Algorithms, The Rabin Karp Algorithm, String Matching with Finite Automata, The Knuth Morris Pratt Algorithm.

Text Books:

1. T. H. Coreman, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to algorithms", 3rd Edition, PHI publication.
2. Ellis horowitz, Sartaj Sahni, S. Rajsekaran, "Fundamentals of computer algorithms", 2nd Edition, University Press.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", 1st Edition, Tata McGraw- Hill.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", 2nd Edition, PHI publication.
3. John Kleinberg, Eva Tardos, "Algorithm Design", 1st Edition, Pearson.
4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design and Applications", 1st Edition, Wiley 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 3 hrs.

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Analysis of Algorithms Laboratory (PCCO4040L)

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

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

Course Objectives:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Compare different algorithms based on divide and conquer approach.	L4	Analyze
CO2	Solve different real world problems using dynamic programming technique.	L3	Apply
CO3	Make use of Greedy method to find minimum cost path in graph.	L3	Apply
CO4	Solve different problems using string matching algorithms and Backtracking algorithms.	L3	Apply

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List of Laboratory Experiments(At Least 08)

Suggested Experiments:

1. Introduction to analysis of algorithm Divide and Conquer Approach:
   - Selection sort, Insertion sort.
   - Merge sort, Quick sort, and Binary search.
2. Dynamic Programming Approach:
   - Multistage graphs, single source shortest path, all pair shortest path, 0/1 knapsack, Travelling salesman problem, Longest common subsequence.
3. Greedy Approach:
   - Single source shortest path, Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees-Kruskal and Prim's algorithm, Optimal storage on tapes.
4. Backtracking and String Matching Algorithms:
   - 8 queen problem (N-queen problem), Sum of subsets, Graph coloring, Any String matching algorithm

Evaluation Scheme:

Laboratory:

Continuous Assessment (TA):

Laboratory work will be based on PCCO4040T 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.

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Computer Networks (PCCO4050T)

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 get familiar with contemporary issues and challenges of various protocol designing in layered architecture and performance analysis of routing and transport layer protocols for various applications.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate the concepts of data communication at physical layer and compare ISO - OSI model & TCP/IP model.	L2	Understand
CO2	Demonstrate the working of networking protocols at data link layer.	L2	Understand
CO3	Design of network using given IP addressing and subnetting / supernetting schemes.	L6	Create
CO4	Compare and Analyze the performance of various routing protocols.	L2, L4	Understand, Analyze
CO5	Compare and Analyze the transport layer protocols and various congestion control algorithms.	L2, L4	Understand, Analyze
CO6	Explore various protocols at application layer.	L4	Analyze

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Course Contents

Unit-I Introduction to Networking — 04 Hrs.

Introduction to Computer Network, Network Application, Network Software and Hardware Components, Network Topology, Design Issues for the Layers. Reference Models: Layer Details of OSI, TCP/IP Models.

Unit-II Physical Layer — 06 Hrs.

Introduction to Digital Communication System, Guided Transmission Media: Twisted Pair, Coaxial, Fiber Optics. Unguided Media (Wireless Transmission): Radio Waves, Microwave, Bluetooth.

Unit-III Data Link Layer — 10 Hrs.

Design Issues: Framing, Error Control: Error Detection and Correction (Hamming Code, CRC, Checksum). **Flow Control**: Stop and Wait, Sliding Window (Go-Back-N, Selective Repeat), Elementary Data Link Protocols, HDLC, PPP. **Medium Access Control Sublayer**: Channel Allocation Problem, Multiple Access Protocols (ALOHA, Carrier Sense Multiple Access (CSMA/CA, CSMA/CD), Wired LANS: Ethernet, Ethernet Standards, Virtual LANS.

Unit-IV Network Layer — 10 Hrs.

Network Layer Design Issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (Classful and Classless), Subnetting, Supernetting Design Problems, IPv4 Protocol, Network Address Translation (NAT), Routing Algorithms: Shortest Path (Dijkastra's), Link State Routing, Distance Vector Routing Protocols, ARP, RARP, ICMP, IGMP, Congestion Control Algorithms: Open Loop Congestion Control, Closed Loop Congestion Control, QoS Parameters, Token and Leaky Bucket Algorithms.

Unit-V Transport Layer — 06 Hrs.

The Transport Service: Port Addressing, Transport Service Primitives, Berkeley Sockets, Connection Management (Handshake, Teardown), UDP, TCP, TCP State Transition, TCP Timers, TCP Flow Control (Sliding Window), TCP Congestion Control: Slow Start.

Unit-VI Application Layer — 06 Hrs.

DNS: Name Space, Resource Record and Types of Name Server. HTTP, HTTPS, SMTP, Telnet, FTP, DHCP.

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Text Books:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5^{th} Edition, Pearson Education.
2. Behrouz A. Forouzan, "Data Communications and Networking", 5^{th} Edition, TMH.
3. Oliver C Ibe, "Fundamentals of Data Communication Networks", 1^{st} Edition, Wiley Publications.
4. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6^{th} Edition, Pearson Education.

Reference Books:

1. S.Keshav, "An Engineering Approach To Computer Networking", 3^{rd} Edition, Pearson Education.
2. Natalia Olifer & Victor Olifer, "Computer Networks: Principles, Technologies & Protocols for Network Design", Wiley India, 2011.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 2^{nd} Edition, (The Morgan Kaufmann Series in Networking).

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 3 hrs.

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Computer Networks Laboratory (PCCO4050L)

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 the working of various communication protocols and simulate the various topologies and protocols using Network Simulator-NS2.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain various LAN topologies and Network devices.	L2	Understand
CO2	Design wired & wireless topology using NS2.	L6	Create
CO3	Write programs to implement Error Detection and Correction, Framing, Sliding Window Protocols.	L6	Create
CO4	Create Stop and Wait, TCP and UDP scenarios in NS2.	L6	Create
CO5	Design various Classful Networks.	L6	Create
CO6	Write programs for Routing protocols and congestion control algorithms.	L6	Create

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List of Laboratory Experiments(At Least 10)

1. (a) Study of LAN topology.

   (b) Study of various Network devices.

2. Installation & Configuration of Network Simulator (NS2) in Linux environment. Study of different topologies and create duplex link in NS2.

3. Building of wired & wireless topology using NS2.

4. Write a program to implement-

   (a) Error Detection and Correction

   (b) Framing

5. Implement Stop and Wait protocol in NS2.

6. Write a program to implement Sliding Window Protocols- Selective Repeat, Go-Back-N.

7. Build Class A & Class B Network using router and Implement subnetting concept.

8. Write a program to implement any one Routing Protocol.

9. Write a program to find out class of a given IP address, subnet mask & first & last IP address of that block.

10. Write a program to implement Congestion Control algorithms.

11. Write a program to build client-server model on different computers. Implement TCP, UDP scenario in NS2/NS3.

12. Install and configure Network Management/ Monitoring Tools.

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 PCCO4050T 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.

Universal Human Values (HMCO4060T)

Teaching Scheme
Lectures : 02 Hrs./week
Credits : 02

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

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Define the concepts, need, basic guidelines, content and process for value education.	L1	Remember
CO2	Identify the harmony in the human being - harmony in myself.	L3	Apply
CO3	Make use of harmony in the family and society.	L3	Apply
CO4	Relate the nature and existence as coexistence.	L2	Understand
CO5	Explain holistic understanding of harmony on professional ethics.	L2	Understand

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Course Contents

Unit-I Introduction: Need, Basic Guidelines, Content and Process for Value Education — 05 Hrs.

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 Fulfillment of Aspirations of Every Human Being with their Correct Priority. Understanding Happiness and Prosperity Correctly- A Critical Appraisal of the Current Scenario. Method to Fulfill the Above Human Aspirations: Understanding and Living in Harmony at Various Levels.

Unit-II Understanding Harmony in the Human Being - Harmony in Myself! — 06 Hrs.

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 and Society: Harmony in Human-Human Relationship — 06 Hrs.

Understanding Values in Human-Human Relationship; Meaning of Justice (Nine Universal Values in Relationships) and Program for its Fulfillment to Ensure Mutual Happiness; Trust and Respect as the Foundational Values of Relationship.

Understanding the Meaning of Trust; Difference Between Intention and Competence.

Understanding the Meaning of Respect, Difference Between Respect and Differentiation, the Other Salient Values in Relationship.

Understanding the Harmony in the Society (Society Being an Extension of Family): Resolution, Prosperity, Fearlessness (Trust) and Co-Existence as Comprehensive Human Goals.

Visualizing a Universal Harmonious Order in Society- Undivided Society, Universal Order from Family to World Family.

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Unit-IV Understanding Harmony in the Nature and Existence: Whole Existence as Coexistence 05 Hrs.

Understanding the Harmony in the Nature 19. Interconnectedness and Mutual Fulfillment Among the Four Orders of Nature Recyclability and Self-Regulation in Nature.

Understanding Existence as Coexistence of Mutually Interacting Units in All Pervasive Space.

Holistic Perception of Harmony at All Levels of Existence.

Unit-V Implications of the Above Holistic Understanding of Harmony on Professional Ethics 06 Hrs.

Natural Acceptance of Human Values 23. 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.

Text Books:

1. R. R. Gaur, R. Sangal, G. P. Bagaria, "Human Values and Professional Ethics", 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. "The Story of Stuff" (Book).
4. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth".
5. E. F. Schumacher, "Small is Beautiful".
6. Cecile Andrews, "Slow is Beautiful".
7. J. C. Kumarappa, "Economy of Permanence".

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8. Pandit Sunderlal, "Bharat Mein Angreji Raj".

9. Dharampal, "Rediscovering India".

10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule".

11. Maulana Abdul Kalam Azad, "India Wins Freedom".

12. Romain Rolland, "Vivekananda"(English).

13. Romain Rolland, "Gandhi"(English).

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 3 hrs.

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Semester Project-II (PJCO4070L)

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.

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

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- 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.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine before end of the semester.

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

Employability Skill Development Program-I (HMCO4080)

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

Examination Scheme
Teacher Assessment : 50 Marks
Total : 50 Marks

Course Objectives:

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

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

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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

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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: 30 Marks
2. MCQ Test based on Programming skills: 20 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.

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