Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

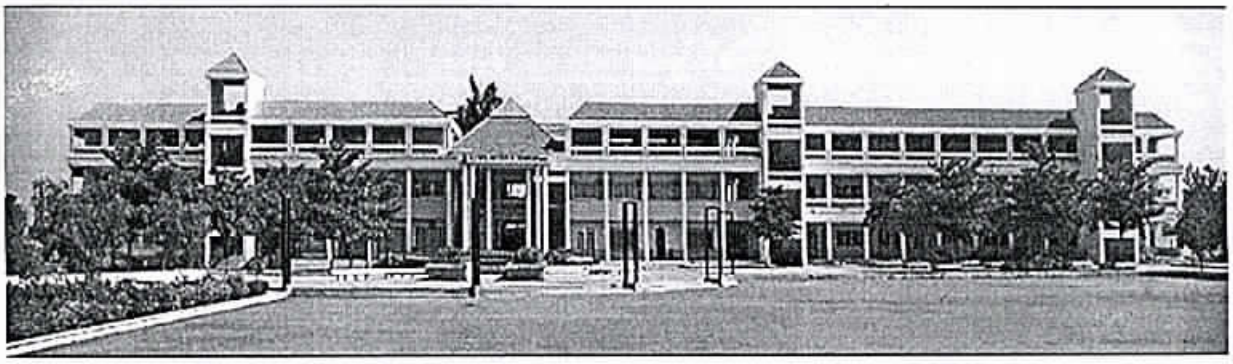
(An Autonomous Institute)

Course Structure and Syllabus

Second Year B. Tech

Computer Science and Engineering(Data Science)

With effect from Year 2023-24



Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
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Semester-III(w.e.f. 2023-24)

Sr	Course Category	Course Code	Course Title	Teaching Scheme				Evaluation Scheme					Total		
								Continuous Assessment (CA)				ESE			
								TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of(TT1 & TT2)				
				L	T	P	Credits	[A]			[B]	[C]	[A+B+C]	Credits	
1	BS	22BSCS3010T	Mathematics for Intelligent Systems	3	1		4	20	15	15	15	65	100	4	4
2	PC	22PCCS3020T	Data Structures	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS3020L	Data Structures Laboratory			2	1	25				25	50	1	
3	PC	22PCCS3030T	System Fundamentals	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS3030L	System Fundamentals Laboratory			2	1	25				25	50	1	
4	PC	22PCCS3040T	Database Management Systems	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS3040L	Database Management Systems Laboratory			2	1	25					25	1	
5	PC	22PCCS3050L	Python Laboratory	1		2	2	25				25	50	2	2
6	PC	22PCCS3060L	Web Engineering Laboratory			4	2	50					50	2	2
7	PJ	22PJCS3070L	Semester Project-I			2	1	25				25	50	1	1
8	MC	22MCCS3080T	Constitution of India	1										Audit Course	
			Total	14	1	14	21	255			60	360	675	21	21

Prepared by:
Prof. Dr. P. S. Sanjekar

Checked by:
Prof. S. M. Pardeshi

Prof. Dr. R. B. Wagh
BOS Chairman

Prof. S. P. Shukla
C.O.E.

Prof. Dr. P. J. Deore
Dean Academics/Dy. Director

Prof. Dr. J. B. Patil
Director

R. C. Patel Institute of Technology, Shirpur
Autonomous

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

Sr	Course Category	Course Code	Course Title	Teaching Scheme				Evaluation Scheme					Total	Credits	
								Continuous Assessment (CA)				ESE			
								TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)				
				L	T	P	Credits	[A]			[B]	[C]	[A+B+C]	Credits	
1	PC	22PCCS4010T	Programming Language Principles	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS4010L	Programming Language Principles Laboratory			2	1	25				25	50	1	
2	PC	22PCCS4020T	Machine Learning - I	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS4020L	Machine Learning - I Laboratory			2	1	25				25	50	1	
3	PC	22PCCS4030T	Foundations of Data Analysis	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS4030L	Foundations of Data Analysis Laboratory			2	1	25				25	50	1	
4	PC	22PCCS4040T	Design and Analysis of Algorithms	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS4040L	Design and Analysis of Algorithms Laboratory			2	1	25				25	50	1	
5	PC	22PCCS4050T	Statistics for Data Science	3			3	20	15	15	15	65	100	3	4
	PC	22PCCS4050L	Statistics for Data Science Laboratory			2	1	25				25	50	1	
6	HM	22HMCS4060T	Universal Human Values	2			2	20	15	15	15	65	100	2	2
7	PJ	22PJCS4070L	Semester Project-II			2	1	25				25	50	1	1
8	HM	22HMCS4080L	Employability Skill Development Program-I			2	1	50					50	1	1
			Total	17		14	24	320			90	540	950	24	24

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Director

K. C. Pae Institute of Technology, Shirpur

Mathematics for Intelligent Systems (22BSCS3010T)

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-requisites: Concepts of basic matrices, partial derivatives and basic probability.

Course Objectives:

To build the strong foundation in learners of mathematics needed for building concepts of machine learning.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze probability of random variables and probability distributions.	L4	Analyze
CO2	Demonstrate knowledge of linear algebra.	L2	Understand
CO3	Apply concepts of matrix theory.	L3	Apply
CO4	Demonstrate concepts of calculus.	L2	Understand
CO5	Analyze different optimization techniques.	L4	Analyze

Course Contents

Unit-I Probability, Random Variables and Probability Distributions 10 Hrs.

Probability: Conditional Probability, Mutually and Pair Wise Independent Events, Bayes' Theorem

Random Variables: Discrete Random Variable, Probability Mass Function, Discrete Distribution Function, Continuous Random Variable, Probability Density Function, Continuous Distribution Function, Mathematical Expectation, Moment Generating Function, Two-Dimensional Random Variable and its Joint Probability Mass and Density Function, Marginal Distribution Function, Conditional Distribution Functions, Covariance, Joint Moments.

Probability Distributions: Discrete Probability Distribution: Binomial Distribution, Poisson Distribution, Hypergeometric Distribution.

Continuous Probability Distribution: Uniform Distribution, Exponential Distribution, Normal Distribution, Beta Distribution, Gamma Distribution, Central Limit Theorem.

Unit-II Linear Algebra 08 Hrs.

Vectors in N-Dimensional Vector Space, Properties, Dot Product. Cross Product, Norm and Distance,Vector Spaces over Real Field, Properties of Vector Spaces over Real Field, Subspaces, Linear Independence and Dependence of Vectors, Span of Vectors, Basis of a Vector Space, Dimension of a Vector Space, Cauchy Schwarz Inequality, Linear Transformation, Norms and Spaces, Orthogonal Compliments and Projection Operator, Kernel Hilbert Spaces.

Unit-III Matrix Theory 08 Hrs.

Characteristic Equation, Eigen Values and Eigen Vectors, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem, Examples Based on Verification of Cayley Hamilton Theorem, Similarity of Matrices, Diagonalization of Matrices, Functions of Square Matrix, Derogatory and Non-derogatory Matrices, Least Squared and Minimum Normed Solutions.

Unit-IV Calculus 04 Hrs.

Gradient, Directional Derivatives, Jacobian, Hessian, Convex Sets, Convex Functions and its Properties.

Unit-V Optimization 12 Hrs.

Unconstrained and Constrained Optimization, Convergence.

Unconstrained Optimization Techniques: Newton's Method, Quasi Newton Method,

Constrained Optimization Techniques: Gradient Descent, Stochastic Gradient Descent, Penalty Function Method, Lagrange Multiplier Method, Karush–Kuhn–Tucker Method, Simplex Method,

Penalty and Duality, Dual Simplex Method, Downhill Simplex Method.

List of tutorials: (any 8)

1. To solve numerical on discrete probability distributions.
2. To solve numerical on continuous probability distributions.
3. To solve numerical on vector spaces (basis and dimension).
4. To solve numerical on cauchy-schwarz inequality and linear transformation.
5. To solve numerical on diagonalizability using eigenvalues and eigenvectors.
6. To solve numerical on minimal polynomial and functions of a matrix.
7. To solve numerical on calculus.
8. To solve numerical on Gradient descent and Lagrange's multiplier method.
9. To solve numerical on KKT method.
10. To solve numerical on all forms of simplex method.

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

Text Books:

1. Dr. B. S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publication, 1965.
2. Kanti B. Datta, "Mathematical Methods in Science and Engineering", 1st Edition, Cengage Learning India, 2011.
3. Hamdy A. Taha, "Operations Research - An Introduction", Pearson, 10th Edition, 2010.
4. P. K. Gupta, Mohan Man, "Operations Research", 1st Edition, S. Chand Publication, 2005.

Reference Books:

1. W. Cheney, "Analysis for Applied Mathematics", 1st Edition, New York: Springer Science Business Media, 2001.
2. S. Axler, "Linear Algebra Done Right", 3rd Edition, Springer International Publishing, 2015.
3. J. Nocedal and S. J. Wright, "Numerical Optimization", 2nd Edition, New York: Springer Science+Business Media, 2006.
4. J. S. Rosenthal, "A First Look at Rigorous Probability Theory", 2nd Edition, Singapore: World Scientific Publishing, 2006.

5. Seymour Lipschutz and Marc Lipson, "Linear Algebra Schaum's outline series", 4th Edition, Mc-Graw Hill Publication, 2009.

6. Erwin Kreysizg, John Wiley & Sons, Inc, "Advanced Engineering Mathematics", 10th Edition, 2000.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

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

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Best of the marks scored in both the tests will be considered for final grading.

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 (22PCCS3020T)

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:

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

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the concept of time and space complexity for algorithms.	L2	Understand
CO2	Assimilate the concept of various linear and non-linear data structures.	L6	Create
CO3	Solve the problem using appropriate data structure.	L3	Apply
CO4	Implement appropriate searching and sorting technique for a given problem.	L3	Apply

Course Contents

Unit-I

04 Hrs.

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

Data Structures: Introduction, need of Data Structures, Types of Data Structures, Abstract Data Types (ADT)

Unit-II

06 Hrs.

Linear Data Structures – LIST: List as an ADT, Array-based implementation, Linked List implementation, singly linked lists, circularly linked lists, doubly-linked lists, All operations (Insertion, Deletion, Merge, Traversal, etc.) and their analysis, Applications of linked lists - (Polynomial Addition).

Unit-III

04 Hrs.

Linear Data Structure – STACK: Stack as an ADT, Operations, Array and Linked List representation of Stack, Applications – Reversing data, Conversion of Infix to prefix and postfix expression, Evaluation of postfix and prefix expressions, balanced parenthesis, etc.

Unit-IV

04 Hrs.

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

Unit-V

10 Hrs.

Non-Linear Data Structure – TREES: Tree Terminologies, Tree as an ADT, Binary Tree - Operations, Tree Traversals, Binary Search Tree (BST) - Operations, Expression Trees

Height Balanced Tree: Creation of AVL Tree

Heap: Operations on heap

Applications: Huffman coding

Unit-VI

06 Hrs.

Non Linear Data Structure – GRAPHS: Graph Terminologies, Types of Graphs, Representation of Graph using arrays and Linked List, Breadth-First Search (BFS), Depth–First Search (DFS)

Applications of Graphs: Topological sorting.

Unit-VII

08 Hrs.

Searching- Linear Search, Binary Search and Fibonacci search.

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

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

Text Books:

1. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2nd Edition,Cengage Learning, 2005.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman and Company, 2008.

Reference Books:

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", 4th Edition, Pearson, 2014.
2. M. T. Goodrich, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", 2nd Edition, Wiley, 2011.
3. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2013.
4. Tenenbaum, Langsam, Augenstein, "Data Structures using C", 2nd Edition, Pearson, 2015.
5. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 2010.
6. Reema Thareja, "Data Structures using C", Oxford, 2017.
7. Seymour Lipschutz, "Data Structures, Schaum's Outline Series", Tata McGraw-Hill, 1st Edition, 2014.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

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

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Best of the marks scored in both the tests will be considered for final grading.

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 Laboratory (22PCCS3020L)

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

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

Course Objectives:

The course intends to introduce and familiarize students with data structures, their use in solving real time complex problems and implementation of these data structures. The course also aims to provide mathematical approach for analyzing algorithms using asymptotic notation and for measuring efficiency of algorithms. Finally, the course intends to make students learn various sorting and searching techniques and choose efficient one based on their efficiency.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand of stack and Demonstrate its operations.	L2	Understand
CO2	Demonstrate different types of queue and its operations.	L2	Understand
CO3	Demonstrate various Linked list types and its operations.	L2	Understand
CO4	Demonstrate heap-sort and compare Hashing techniques	L2, L4	Understand, Analyze
CO5	Understand and compare various searching and sorting techniques.	L2, L4	Understand, Analyze

List of Laboratory Experiments(At Least 08)

Suggested Experiments:

- Implementations of Linked List using menu driven approach.
- Implementation of different operations on linked list –copy, concatenate, split, reverse, count no. of nodes etc.
- Implementation of polynomials operations (addition, subtraction) using Linked List.
- Implementations of stack using menu driven approach.
- Implementations of Infix to Postfix conversion.
- Implementation of prefix and postfix evaluation using menu driven approach.
- Implementation of parenthesis checker using stack.
- Implementations of Linear queue using menu driven approach.
- Implementations of circular queue using menu driven approach.
- Implementations of double ended queue using menu driven approach.
- Implementation of Priority queue program using array and Linked list.
- Implementations of Binary Tree using menu driven approach.
- Implementation of Binary Tree Traversal.
- Implementations of BST.
- 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.
- Implementations of Graph traversal using menu driven program (DFS & BSF).
- Implementations of Selection sort, Radix sort using menu driven.
- Implementations of Heap & Heap Sort using menu driven program.
- Implementations of Advanced Bubble Sort and Insertion Sort using menu driven Program.
- Implementations of searching methods (Index Sequential, Fibonacci search, Binary Search) using menu driven program.
- Implementation of hashing functions with different collision resolution techniques.

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

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCCS3020T 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 (C):

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

System Fundamentals(22PCCS3030T)

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: Basic Mathematics

Course Objectives:

To understand the structure, functions and characteristics of computer system and operating systems.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the fundamental organization of a computer system.	L1	Remember
CO2	Apply appropriate memory mapping, process scheduling and disk scheduling methods.	L3	Apply
CO3	Identify the need of concurrency and apply appropriate method to solve the concurrency or deadlock problem.	L3	Apply
CO4	Differentiate between various processor architecture.	L4	Analyze

Course Contents

Unit-I

08 Hrs.

Introduction to System Fundamentals: Realization of half adder and full adder using Logic Gates, Von Neumann model, Fixed point representation, Register Transfer and Micro-operations: Floating point representation, Arithmetic Micro- Operations, Arithmetic logical shift unit. Addition and subtraction, Multiplication Algorithms (Booth Multiplication Algorithm), Division Algorithms, Floating Point Arithmetic operations, Instruction Cycle with interrupt and DMA.

Operating System Architecture: Basic functions and services, System calls, Types of Operating Systems: Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real-time OS.

Unit-II

06 Hrs.

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction format, Addressing Modes, data transfer and manipulation, Program Control, Reduced Instruction Set Computer (RISC).

Process Management: Process Concept, Process states, Process control Block, Threads, Uniprocessor Scheduling: Types of scheduling: Pre-emptive, Non pre-emptive, Scheduling algorithms: FCFS, SJF, RR, Priority. Comparative study of process management in Windows, Linux and Android OS.

Unit-III

08 Hrs.

Memory Organization: Memory Hierarchy, Main Memory, Cache Memory, Memory Mapping, cache coherence, Pentium IV cache organization, ARM cache organization.

Memory Management: Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, Virtual Memory, Paging. Segmentation, Demand paging and Page replacement policies. Comparative study of memory management in Windows, Linux and Android OS.

Unit-IV

10 Hrs

Concurrency control

Concurrency: Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Monitors, Classical Problems of Synchronization: Readers-Writers and Producer Consumer problems and solutions.

Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher problem. Comparative study of concurrency control in Windows, Linux and Android OS.

Unit-V

04 Hrs.

File and I/O management: File access methods, I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache, Arbitration methods, Comparative study of file and I/O management in Windows, Linux and Android OS.

Unit-VI

06 Hrs.

Advance Computer Architecture: Characteristics of Multiprocessors, Flynn's taxonomy, Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Introduction to Multiprocessor network topologies.

Text Books:

1. William Stallings, "Computer Organisation and Architecture", 11^{th} Edition, 2018.
2. Greg Gagne, Abraham Silberschatz, Peter B. Galvin ,"Operating System Concepts", 10^{th} Edition, John Wiley & Sons, 2018.

Reference Books:

1. John Hayes, "Computer Architecture and Organization", 3^{rd} Edition, McGrawHill, 2017.
2. M. Morris Mano, "Computer System Architecture", 3^{rd} Edition, Pearson.
3. Andrew S. Tanenbaum and Todd Austin, "Structured Computer Organization", 6^{th} Edition, PHI, 2016.
4. M. Murdocca and V. Heuring, "Computer Architecture and Organization", 1^{st} Edition, WILEY, 2017.
5. Andrew S. Tanenbaum, "Modern Operating Systems", 4^{th} Edition, PHI, 2009.
6. G. Meike, Lawrence Schiefer, "Inside the Android OS: Building, Customizing, Managing and Operating Android System Services (Android Deep Dive)", 2021.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

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

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Best of the marks scored in both the tests will be considered for final grading.

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.

System Fundamentals Laboratory (22PCCS3030L)

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 Booth's, Restoring, and Non-Restoring algorithm.
3. To solve problem of process/thread scheduling and synchronization.
4. To explore memory allocation strategies and disk scheduling algorithms.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate the fundamental Unix commands, system calls and shell scripting.	L2	Understand
CO2	Solve the scheduling algorithms for given problems.	L3	Apply
CO3	Identify the performance of Booth's, Restoring, and Non-Restoring algorithm.	L3	Apply
CO4	Illustrate an algorithm to detect and avoid deadlock.	L2	Understand
CO5	Demonstrate the various page replacement and disk scheduling algorithms.	L2	Understand

List of Laboratory Experiments

Suggested Experiments:

- Implement Booth's multiplication algorithm.
- Implement CPU Non-Preemptive scheduling algorithms like FCFS, SJF, Priority etc.
- Implement CPU Preemptive scheduling algorithms like SRTF, Round Robin, Preemptive priority etc.
- Explore the internal commands of Linux.
- Write shell scripts handling File, Directory, Networking and security aspects.
- Implement Best Fit, First Fit and Worst Fit Memory allocation policy.
- Implement Fully associative and set associative cache memory mapping.
- Implement various cache/page replacement policies.
- Implement order scheduling in supply chain using Banker's Algorithm.
- Implement Disk Scheduling Algorithms.

  Study Experiments:

  - Implement Restoring and Non-Restoring division algorithm.
  - Implement Solution to Producer Consumer Problem of Process Synchronization.
  - Implement Solution to Reader Writer Problem of Process Synchronization.
  - Implement Solution to Dinning Philosopher Problem of Process Synchronization.
  - Implementation of Multithreading using parent process and child process using UNIX calls like fork, exec and wait.

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

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCCS3030T 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 (C):

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

Database Management Systems
(22PCCS3040T)

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

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

Prerequisite: Computer Basics

Course Objectives:

The course intends to introduce the students to the management of database systems, with an emphasis on how to design, organize, maintain and retrieve information efficiently and effectively from a database.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Design an optimized database.	L6	Create
CO2	Construct SQL queries to perform operations on the database.	L5, L6	Evaluate, Create
CO3	Demonstrate appropriate transaction management and recovery techniques for a given problem.	L2	Understand
CO4	Apply indexing mechanisms for efficient retrieval of information from database.	L3	Apply

Course Contents

Unit-I

03 Hrs.

Introduction Database Concepts: Introduction, Characteristics of Databases, File System v/s Database System, Users of Database System, Schema and Instance Data Independence, DBMS System Architecture, Database Administrator.

Unit-II

09 Hrs.

Relational Data Model: Entity-Relationship Model: The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation.

Relational Model: Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model.

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

Unit-III

09 Hrs.

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

Unit-IV

05 Hrs.

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

Unit-V

09 Hrs.

Transaction Management and Recovery: Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Timestamp based, Validation Based, Deadlock Handling.

Recovery System: Failure classification, Log based recovery, Shadow Paging, ARIES recovery algorithm.

Unit-VI

04 Hrs.

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

Text Books:

1. Korth, Silberchatz, Sudarshan, "Database System Concepts", 7th Edition, McGraw – Hill, 2019.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2021.
3. G. K. Gupta, "Database Management Systems", 3rd Edition, McGraw – Hill.

Reference Books:

1. Raghu Ramkrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw – Hill.
2. Sharnam Shah, "Oracle for Professional", SPD.
3. Dr. P.S. Deshpande, "SQL and PL/SQL for Oracle 10g", Black Book, Dreamtech Press.
4. Patrick Dalton, "Microsoft SQL Server Black Book", Coriolis Group, U.S.
5. Lynn Beighley, "Head First SQL", O'Reilly Media.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

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

Continuous Assessment (B):

1. Two term tests of 15 marks each will be conducted during the semester.
2. Best of the marks scored in both the tests will be considered for final grading.

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.

Database Management Systems Laboratory (22PCCS3040L)

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

Examination Scheme
Teacher Assessment : 25 Marks
Total : 25 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

List of Laboratory Experiments(At Least 08)

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

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

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCCS3040T 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.

Python Laboratory (22PCCS3050L)

Practical Scheme
Lecture : 01 Hrs./week
Practical : 02 Hrs./week
Credits : 02

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

Prerequisite: Programming Fundamental

Course Objectives:

1. To learn the basic and OOP concepts of Python.
2. To study various advance python concept like inheritance, exception handling, modules etc.
3. To learn to develop GUI based standalone and web application.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate basic data types, data structures and the concepts of Object-oriented programming in python.	L2	Understand
CO2	Implement file handling and text processing concepts in python.	L3	Apply
CO3	Develop an application using Tkinter, database connectivity and client-server communication using python.	L3	Apply
CO4	Apply various advance modules of Python for data analysis.	L3, L4	Apply, Analyze

Course Contents

Unit-I — 02 Hrs.

Python Basics: Operators, Input and Output, Control statements, Arrays, String and Character.

Unit-II — 04 Hrs.

Functions and Collections in Python: Functions in python, Calling a Function, Arguments, Arbitrary Arguments, *args, Keyword Arguments, Arbitrary Keyword Arguments, **kwargs, The pass Statement, Recursion, Collections in Python, List, Tuples and Dictionaries

Unit-III — 04 Hrs.

Introduction to OOP: Classes, Objects, and Constructor, Methods and Abstraction, Inheritance, Magic Methods.

Unit-IV — 02 Hrs.

Exception Handling in Python: Exception Handling, Try and Except Statement for Catching Exceptions, Try with Else Clause, Try, Except and Finally Statement for Catching Exception.

Unit-V — 04 Hrs.

Advanced Python Concepts: Modules, Packages, Python Collections Module for Opening and Reading Files and Folders, Python OS Module, Python Date Time Module, Python Math and Random Modules, Text Processing & Regular expression.

Unit-VI — 03 Hrs.

Python Integration Primer: GUI (Graphical User Interface) using Tkinter, Client Server architecture using socket programming.

Unit-VII — 03 Hrs.

Python database Connectivity: Database connectivity using SQLite, CRUD (create, read, update and delete) operations on database (SQLite/ MySQL)

Unit-VIII — 03 Hrs.

Python Numpy Module: Construct Numpy arrays, Printing arrays, Arithmetic Operations on matrix's using Numpy Module, numpy zeros ()

Unit-IX 03 Hrs.

Python Pandas Module: Data Processing using Pandas, Data structure using Pandas, Data Frame using Pandas and perform basic operations

Unit-X 02 Hrs.

Python Matplotlib Module: Install Matplolib module, Perform basic visualization.

Text Books:

1. Zed Shaw, "Learn Python the Hard Way", Addison-Wesley, 3rd Edition, 2013.
2. Laura Cassell, Alan Gauld, "Python Projects", 1st Edition, Wiley, 2015.

Digital Resources:

1. The Python Tutorial: http://docs.python.org/release/3.0.1/tutorial/
2. http://spoken-tutorial.org
3. www.staredusolutions.org

Evaluation Scheme:

Laboratory:

Continuous Assessment (A): 25 Marks:

Laboratory work will be based on 22PCCS3050L 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 (C): 25 Marks:

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

Web Engineering Laboratory (22PCCS3060L)

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

Examination Scheme
Teacher Assessment : 50 Marks
Total : 50 Marks

Prerequisite: Programming Fundamentals.

Course Objective:

The objective of this lab is to provide the basic framework of web development (MERN Stack) and cloud computing.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Develop a website as per the requirements.	L6	Create
CO2	Apply the concepts of cloud computing to improve the efficiency of web development.	L3	Apply
CO3	Evaluate the requirement of the problem and select appropriate method of web development.	L5	Evaluate

List of Laboratory Experiments

- HTML — 02Hrs
  - Create a static web page using HTML.
  - Create a class timetable using HTML.
  - Create a registration form using HTML.
  - Create a web page using HTML5 tags.
- CSS — 04Hrs
  - Design a web page using External or Embedded Style Sheet.
  - Design a responsive web page using media queries and CSS3.
  - Design a web page using Bootstrap.
  - Design a resume using Bootstrap.
  - Design the admission form using Bootstrap.
- Client-Side Scripting — 04Hrs
  - Programs based on objects in JavaScript.
  - Program to design a calculator using JavaScript.
  - Programs based on form validation.
- React JS — 08Hrs
  - Create an application using React.
  - Introduction to Git and GitHub
  - Introduction to Version Control
  - Using Git Locally and Remotely
  - Collaboration
- Server-Side Scripting — 04Hrs
  - Installation and Configuration of Node.js server
  - Program based on inbuilt functions in Node.js
- Express and MongoDB — 06Hrs
  - Using Mongoose to make schemas in MongoDB.

- Making API end points using Express and testing using postman.
- Develop a website and integrate it with pre-defined API.
- Develop a website to consume user defined API.
- Doing CRUD on database MongoDB using Express.
- Writing tests using mocha and chai.

- XML and XSL — 04Hrs
  - Design XML using XML DTD and schema.
  - Implementing XSL elements in XML.
  - Validating XML data through DTD and storing in database.
- Concepts of Cloud Computing — 04Hrs
  - Introduction to cloud computing.
  - NIST model
  - Service and Deployment models.
- Networking and Security — 04Hrs
  - Identity and Access Management
  - Networking basics
  - VPC networking and security
  - Design a VPC
  - Build your own VPC and Launch a Web Server
- Compute Service — 04Hrs
  - Compute Services overview
  - Elastic Computing
  - Serverless Compute service
  - Deploying and scaling web applications
- Storage Service — 04Hrs
  - Cloud object storage
  - Cloud block storage
  - Elastic file system
- Database Service — 04Hrs

- Cloud Relational database services
- Cloud NoSQL Databases
- Elastic load balancing

Text Books:

1. Vasan Subramanian,"Pro MERN Stack", 2nd Edition, Apress Publication, 2019.
2. Shama Hoque, "Full-Stack React Projects", 2nd Edition, Packt Publication, 2020.
3. Rajkumar Buyya, James Broberg, Goscinki,"Cloud Computing: Principles and Paradigms", Wiley, 2013.
4. Shalabh Aggarwal, "Flask Framework Cookbook: Over 80 proven recipes and techniques for Python web development with Flask", Packt publication, 2nd Edition, 2019

Reference Books:

1. Benjamin LaGrone, "HTML5 and CSS3 Responsive Web Design Cookbook", 1st Edition, Packt Publishing, 2013.
2. DT Editorial Services, "Web Technologies: Black Book", 1st Edition, Dreamtech Press, 2018.
3. Christopher Schmitt, Kyle Simpson, "HTML5 Cookbook", 1st Edition, O'Reilly Media Inc., 2011.
4. Uttam K. Roy, "Web Technologies", 1st Edition, Oxford University Press, 2010.
5. Greg Sidelnikov, "React. Js Book: Learning React JavaScript Library from Scratch", 1st Edition, Independently Published, 2017.
6. DT Editorial Services, "HTML5 Black Book", 2nd Edition, Dreamtech Press, 2016.
7. Ben Frain, "Responsive Web Design with HTML5 and CSS3", 2nd Edition, Packt Publishing, 2015.
8. Steve Suehring, "JavaScript Step by Step", 3rd Edition, Pearson Education, 2013.
9. Stoyan Stefanov, "React Up Running Building Web Applications", 1st Edition, O'Reilly Media Inc., 2016.
10. Velte, "Cloud Computing a Practical Approach", Tata McGraw-Hill Education.
11. Sandip Bhowmik, "Cloud Computing", Cambridge University Press, 2017.
12. Miguel Grinberg, "Flask Web Development", O'Reilly publication,2018
13. Sack Stouffer Daniel Gaspar, "Mastering Flask Web Development" Packt Publication, 2018

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Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCCS3060L with minimum 10 experiments to be incorporated.

The distribution of marks for term work shall be as follows:

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

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

Semester Project-I (22PJCS3070L)

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 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 (22MCCS3080T)

Teaching Scheme
Lecture : 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	Have 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 — 2 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 — 3 Hrs.

Relevance of Directive Principles State Policy Fundamental Duties.

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

Unit-III State Executives — 3 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 — 3 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 — 3 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.

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.