Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

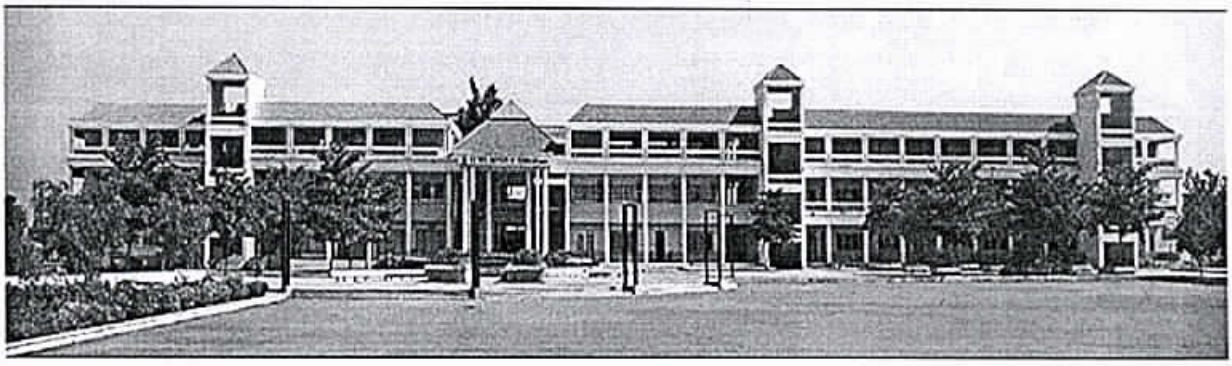
(An Autonomous Institute)

Course Structure and Syllabus

Second Year B. Tech

Artificial Intelligence and Machine Learning

With effect from Year 2023-24



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Semester-III(w.e.f. 2023-24)														
Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	BS	22BSAI3010T	Engineering Mathematics-III	4	1		20	15	15	15	65	100	5	5
2	PC	22PCAI3020T	Data Structures	3			20	15	15	15	65	100	3	4
	PC	22PCAI3020L	Data Structures Laboratory			2	25				25	50	1	
3	PC	22PCAI3030T	Database Management Systems	3			20	15	15	15	65	100	3	4
	PC	22PCAI3030L	Database Management Systems Laboratory			2	25				25	50	1	
4	PC	22PCAI3040T	Operating Systems	3			20	15	15	15	65	100	3	4
	PC	22PCAI3040L	Operating Systems Laboratory			2	25				25	50	1	
5	PC	22PCAI3050L	Programming Laboratory-I(Python Programming)			2	25				25	50	1	1
6	PJ	22PJAI3060L	Semester Project-I			2	25				25	50	1	1
7	MC	22MCAI3070T	Constitution of India	1									Audit Course	
			Total	14	1	10	205			60	385	650	19	

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

of Technology, Shirpur
Autonomous

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

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Best of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	22PCAI4010T	Statistics for Engineers	4			20	15	15	15	65	100	4	5
	PC	22PCAI4010L	Statistics for Engineers Laboratory			2	25					25	1	
2	PC	22PCAI4020T	Artificial Intelligence	3			20	15	15	15	65	100	3	4
	PC	22PCAI4020L	Artificial Intelligence Laboratory			2	25				25	50	1	
3	PC	22PCAI4030T	Machine Learning-I	3			20	15	15	15	65	100	3	4
	PC	22PCAI4030L	Machine Learning-I Laboratory			2	25				25	50	1	
4	PC	22PCAI4040T	Computer Networks and Security	3			20	15	15	15	65	100	3	4
	PC	22PCAI4040L	Computer Networks and Security Laboratory			2	25				25	50	1	
5	PC	22PCAI4050L	Programming Laboratory-II (Java and Advanced Java Programming)			4	25				25	50	2	2
6	HM	22HMAI4060T	Universal Human Values	2	1		20	15	15	15	65	100	3	3
7	PJ	22PJAI4070L	Semester Project-II			2	25				25	50	1	1
8	HM	22HMAI4080L	Employability Skill Development Program-I			2	50					50	1	1
			Total	15	1	16	300			75	450	825	24	

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...itute of Technology, Shirpur
SES
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Engineering Mathematics - III (22BSAI3010T)

Teaching Scheme
Lectures : 04 Hrs./week
Tutorial : 01 Hr/week
Credits : 05

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

Prerequisite: Knowledge of

1. Solving a simultaneous linear equation using concept of matrices.
2. Calculus

Course Objectives:

1. Understanding basic concepts of linear algebra.
2. Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. To understand the concept of Fourier Series, its complex form and enhance the problem solving skill and Optimization techniques.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Learn the basic notation of vector spaces and subspaces.	L3	Apply
CO2	Apply the concept of vector spaces using linear transformations which is used in computer graphics and inner product spaces.	L3	Apply
CO3	Apply the concepts of eigenvalue, eigenvectors and diagonalization in linear systems.	L3	Apply
CO4	Expand the periodic function by using Fourier series and complex form of Fourier series.	L3	Apply
CO5	Apply the concept of Linear &Non-Linear Programming Problem to the engineering problems.	L3	Apply

Course Contents

Unit-I Vector Space and Inner Product Spaces — 12 Hrs.

Vector Space and Inner Product Spaces: Definition of vector space over R, Subspaces. Linear combinations, Linearly dependent and independent vectors, Basis, Dimension.

Inner Product Spaces: Dot product in R^n , Definition of general inner product on a vector space over R. Norm of a vector in an inner product space. Cauchy-Schwarz inequality.

Orthogonal sets and orthonormal sets in an inner product space. Orthogonal and orthonormal bases. Gram-Schmidt orthogonalization process simple examples in R^2, R^3.

Unit-II Linear Transformations — 10 Hrs.

Definition and properties.

Kernel and image of a linear transformation, Rank-Nullity Theorem.

Invertible Linear Transformation, Relation between matrices and Linear Transformations, Change of bases.

Unit-III Matrices — 08 Hrs.

Eigen values, Eigen vectors and their properties.

Cayley-Hamilton theorem (without proof) and its application.

Similar matrices, diagonalization of matrix.

Functions of square matrix.

Singular value decomposition.

Unit-IV Calculus — 04 Hrs.

Gradient, directional derivatives, Jacobian, Hessian, convex sets, convex functions, and its properties.

Unit-V Optimization — 10 Hrs.

Unconstrained and Constrained optimization.

Unconstrained optimization techniques: Newtons method, Quasi Newton method.

Constrained optimization techniques: Gradient descent, stochastic gradient descent, Penalty function method, Lagrange multiplier method, KarushKuhnTucker method, Simplex method, Penalty and Duality, Dual simplex method, Downhill simplex method.

Unit-VI Fourier series — 08 Hrs.

Dirichlets conditions, Fourier series of periodic functions with period 2Π and Rule of Fourier series for even and odd functions.

Half range sine and cosine Fourier series, Parsevals identities (without proof).

Complex form of Fourier series, Orthogonal and Orthonormal set of functions.

Tutorials :

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

List of Tutorials:

1. Vector Space.
2. Inner Product Space.
3. Linear Transformation.
4. Eigen Value and Eigen Vector and Similarity of Matrices.
5. Cayley-Hamilton Theorem, Functions of square matrix.
6. Singular value decomposition.
7. Calculus.
8. Unconstrained Optimization Techniques.
9. Constrained Optimization Techniques.
10. Fourier Series.
11. Half-Range Fourier Series
12. Complex Form of Fourier Series.

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

Text Books:

1. Jin Ho Kwak and Sungpyo Hong, "Linear Algebra", 2nd Edition, Springer, 2004.
2. Bernard Kolman and David, R. Hill, "Introductory Linear Algebra- An applied first course", 9th Edition, Pearson Education, 2011.
3. Hira and Gupta, "Operation Research", S Chand.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley India, 2015.

Reference Books:

1. Stephen Andrilli and David Hecker, "Elementary Linear Algebra", 5th Edition, Academic Press, 2016.
2. Rudolf Lidl, Guter Pilz,"Applied Abstract Algebra", 2nd Edition, Springer 2004.

3. Howard Anton, Robert C Busby, "Contemporary linear algebra", Wiley 2003.

4. Gilbert Strang, "Introduction to Linear Algebra", 5th Edition, Cengage Learning, 2015.

5. S.D. Sharma Kedar Nath, Ram Nath & Co. Meerat, "Operations Research".

6. Singiresu S.Rao, "Engineering optimization (Theory and Practice)", New Age International publication.

7. B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, India, 2015.

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 (22PCAI3020T)

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

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

Prerequisite: C Programming

Course Objectives:

The objective of the course is 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 with various sorting and searching techniques, and their performance comparison.

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

03 Hrs.

Non-Linear Data Structure GRAPHS: Graph Terminologies, Types of Graphs, Representation of Graph using arrays and Linked List, Breadth-First Search (BFS), DepthFirst 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. Goodritch, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", Wiley, 2nd Edition, 2011.
3. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2013.
4. Tenenbaum, Langsam, Augenstein, "Data Structures using C", 2nd Edition Pearson, 2015.
5. J. P. Tremblay and P. G. Sorenson, "Introduction to Data Structures and its Applications", 2nd Edition, McGraw-Hill, 1984.
6. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 2010.
7. Reema Tharcja, "Data Structures using C", Oxford, 2017.
8. Seymour Lipschutz, "Data Structures, Schaum's Outline Series", 1st Edition, Tata McGraw-Hill, 2014.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

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

Continuous Assessment (B):

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 (22PCAI3020L)

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 10)

Suggested Experiments:

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

A minimum of 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI3020T 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):

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

Database Management Systems (22PCAI3030T)

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:

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.	L6	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 Introduction to Database Concepts — 03 Hrs.

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

Unit-II Relational Data Model — 09 Hrs.

The Entity-Relationship (ER) Model: Entity Types: Weak and Strong Entity Sets, Entity Sets, Types of Attributes, Keys, Relationship Constraints: Cardinality and Participation.

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

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

Relational Algebra: Unary and Set operations, Relational Algebra Queries

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

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

Unit-IV Relational Database Design — 05 Hrs.

Pitfalls in Relational-Database Designs, Concept of Normalization, Functional Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF

Unit-V Transaction Management and Recovery — 09 Hrs.

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

Unit-VI Indexing Mechanism — 04 Hrs.

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

Text Books:

1. Korth, Silberchatz, Sudarshan, "Database System Concepts", 7th Edition, McGraw Hill, 2019.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.
3. Peter Rob and Carlos Coronel, "Database Systems Design", Implementation and Management, 5th Edition, Thomson Learning, 2002.
4. G. K. Gupta, "Database Management Systems", 3rd Edition, McGraw Hill, 2018.

Reference Books:

1. Dr. P.S. Deshpande, "SQL and PL/SQL for Oracle 10g", Black Book, Dreamtech Press, 2012.
2. Sharaman Shah, "Oracle for Professional", Shroff Publishers & Distributers Private Limited, 1st Edition, 2008
3. Raghu Ramkrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", Coriolis Group,U.S., 11th Edition, 1 July 1997
5. Lynn Beighley, "Head First SQL", O'Reilly Media, 1st Edition (28 August 2007)

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 (22PCAI3030L)

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. Define the basics of Database Management Systems.
2. Understand the key concepts of DBMS.
3. Understand the fundamentals and essentials of SQL.
4. Construct a relational database and retrieve information from the database by formulating SQL queries.
5. Explain the concepts of transaction, concurrency and recovery
6. Understand the Advance Concepts of ADBMS.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Build ER diagram for the given Application.	L3	Apply
CO2	Utilize ER/EER Concepts to Convert into Relational Schema Model.	L3	Apply
CO3	Design & Create Database for given application using DDL & DML Commands and apply various integrity Constraints.	L6	Create
CO4	Apply string, Join operation, nested queries on given application database.	L3	Apply
CO5	Examine the consistency of database using concurrency control technique (Locks).	L4	Analyze

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.

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

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI3030T 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.

Operating Systems (22PCAI3040T)

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: Programming Language C and Basics of Hardware, i.e., ALU, RAM, ROM, HDD, etc

Course Objectives:

The objective of this course is to familiarize students with the functionality of an Operating System, its basic components & interaction among them. The course will also expose students to analyze and evaluate different policies for scheduling, deadlocks, memory management, synchronization, file management & I/O and implement these policies using a suitable programming language.

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

Course Contents

Unit-I Introduction to Operating System — 08 Hrs.

Operating System Objectives, basic functions and services, Evolution of operating system, Operating System structures (monolithic, microkernel), Types of Operating Systems: Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real-time O.S., Linux OS, Mobile OS, System calls.

Unit-II Process Management — 08 Hrs.

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

Threads: Definition and Types, Concept of Multithreading

Scheduling: Types of Scheduling: Preemptive and, Non-preemptive, Scheduling algorithms and their performance evaluation: FCFS, SJF, SRTF, Priority based, Round Robin.

Unit-III Process Synchronization — 08 Hrs.

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

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

Unit-IV Deadlock — 07 Hrs.

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

Unit-V Memory Management — 04 Hrs.

Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Next Fit, Relocation, Paging, Segmentation. Virtual Memory: Demand Paging, Structure of Page Tables, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing.

Unit-VI File and I/O management — 04 Hrs.

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

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

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 8th Edition, John Wiley & Sons, Inc., 2018.
2. Tanenbaum, "Modern Operating System", 4th Edition, Pearson Education, 2014.
3. William Stallings, "Operating System: Internals and Design Principles", 8th Edition, Prentice Hall, 2014. ISBN-10: 0133805913 ISBN-13: 9780133805918
4. Andrew Tannenbaum, "Operating System Design and Implementation", 3rd Edition, Pearson, 2015.
5. Randal. K. Michael, "Mastering Shell Scripting", 2nd Edition, Wiley Publication, 2008.

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.
4. Phillip A. Laplante, Seppo J. Ovaska, "Real Time Systems Design and Analysis", 4th Edition, Wiley-IEEE Press,Dec 2011.
5. Naresh Chauhan, "Principles of Operating Systems", 1st Edition, Oxford University Press, 2014. Prepared

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.

Operating System Laboratory (22PCAI3040L)

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 implement CPU scheduling algorithms and memory management strategies and demonstrate working through simulation.
2. To demonstrate working of deadlock handling mechanism through simulation.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate basic operating system commands.	L1,L2	Remember, Understand
CO2	Implement and analyze different process scheduling algorithms.	L3	Apply
CO3	Implement and analyze different memory management algorithms and disk scheduling.	L4	Analyze
CO4	Evaluate process management techniques and deadlock handling using simulator.	L5	Evaluate

List of Laboratory Experiments(At Least 08)

Suggested Experiments:

1. Explore the internal commands of linux and Write shell scripts to do the following: Display top 10 processes in descending order Display processes with highest memory usage. Display current logged in user and logname. Display current shell, home directory, operating system type, current path setting, current working directory. Display OS version, release number, kernel version. Illustrate the use of sort, grep, awk, etc.
2. System calls for file manipulation.
3. CPU scheduling algorithms like FCFS, SJF, Round Robin etc.
4. There is a service counter which has a limited waiting queue outside it. It works as follows:
   - The counter remains open till the waiting queue is not empty.
   - If the queue is already full, the new customer simply leaves.
   - If the queue becomes empty, the outlet doors will be closed (service personnel sleep) item 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 mutexes along with threads. Also show how it works, if there are 2 service personnel, and a single queue. Try to simulate all possible events that can take place, in the above scenario.
5. Implement Bankers Algorithm for deadlock avoidance.
6. Implement Placement algorithms (Best, First, Worst fit).
7. Implement various page replacement policies (LRU, FIFO, Optimal).
8. Implement File allocation techniques (Sequential, Indexed, Linked).
9. Implement disk scheduling algorithm FCFS, SSTF, SCAN, CSCAN etc.
10. Using the CPU-OS simulator analyze and synthesize the following:
    - Process Scheduling algorithms.
    - Thread creation and synchronization.
    - Deadlock prevention and avoidance.
11. Building a scheduler in XV6
12. Building own file system.

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

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI3040T 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.

Programming Laboratory-I (Python Programming)(22PCAI3050L)

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

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

Prerequisite: C Programming

Course Objectives:

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

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

Course Contents

Unit-I Python basics — 04 Hrs.

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

Unit-II Control Statements and Functions — 04 Hrs.

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

Unit-III Introduction to OOP — 06 Hrs.

Creating a Class, Self-Variables, Constructors, Types of Methods, Constructors in Inheritance. Polymorphism, the super () Method, Method Resolution Order (MRO), Operator Overloading, Method Overloading & Overriding, Interfaces in Python. **Exceptions Handling:** Exceptions, Exception Handling, Types of Exceptions, Except Block, assert Statement, User Defined Exceptions.

Unit-IV Advanced Python — 03 Hrs.

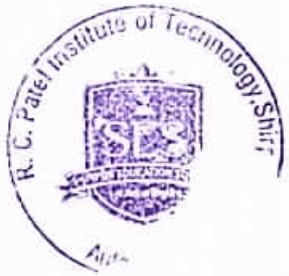
Building Modules, Packages: Python Collections Module, Opening and Reading Files and Folders, Python OS Module, Python Datetime Module, Python Math and Random Modules, Text Processing, Regular expression in python.

Unit-V Python Integration Primer Graphical User interface using Tkinter — 03 Hrs.

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

Unit-VI Python advance Modules — 06 Hrs.

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



List of Laboratory Experiments

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

Minimum 08 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

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

Reference Books:

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

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI3050L 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.

Semester Project-I (22PJAI3060L)

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 semester project 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 (22MCAI3070T)

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	Have general knowledge and legal literacy and thereby to take up competitive examinations.	L2	Understand
CO2	Understand state and central policies, fundamental duties.	L2	Understand
CO3	Understand Electoral Process, special provisions.	L2	Understand
CO4	Understand powers and functions of Municipalities, Panchayats and Co-Operative Societies.	L2	Understand
CO5	Understand Engineering ethics and responsibilities of Engineers.	L2	Understand
CO6	Understand Engineering Integrity & Reliability	L2	Understand

Course Contents

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

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

Unit-II Directive Principles of State Policy — 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, 2003-08-05.

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.