



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2024-25

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

Annexure – I

CREDIT FRAMEWORK STRUCTURE

Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	7	7	-	-	-	-	-	-	14
Engineering Science Course (ESC)	6	6	-	-	-	-	-	-	12
Program Core Course (PCC)					11	9	9	-	72
Program Elective Course (PEC)					3	3	3	3	
Multidisciplinary Minor (MDM)	-	-	2	3	3	3	3	-	14
Open Elective (OE)	-	-	-	-	-	2	3	3	08
Vocations Skill Courses (VSC)	-	-	-	2	2	-	-	-	04
Ability Enhancement Course (AEC)	1	1	-	3	-	-	-	-	05
Indian Knowledge System (IKS)	2	-	-	-	-	-	-	--	02
Value Education Course (VEC)	-		3	-	-	-	-	-	03
Skill Enhancement Courses (SEC)	1	3	1	1	1	1	-	-	08
Co-curricular Courses (CC)	2	2	-	-	-	-	--	--	04
Project work, seminar and internship in industry (ELC)	-	-	1	1	-	2	2	12	18
Research Methodology	-	-	-	-	-	-	-	2	02
Total Credits (Major)	22	22	22	20	20	20	20	20	166

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SEMESTER V

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				Min Passing Marks	No of Hours for ESE
				L	T	P		Mid-Sem Examination	Continual Assessment	End Sem Examination	Total		
1.	PCC	24DS501T	Operating Systems	3	-	-	3	20	20	60	100	45	3
2.	PCC	24DS502T	Machine Learning	3	-	-	3	20	20	60	100	45	3
3.	PCC	24DS502P	Machine Learning Lab	-	-	2	1	-	25	25	50	25	-
4.	PCC	24DS503T	Software Engineering and ProjectManagement	3	-	-	3	20	20	60	100	45	3
5.	PCC	24DS503P	Software Engineering and ProjectManagement Lab	-	-	2	1	-	25	25	50	25	-
6.	PCC	24DS504P	Data Center Management and Cloud Computing Lab	-	-	2	1	-	25	25	50	25	-
7.	PCC	24DS505P	Data Science Workshop – V Lab	-	-	4	2	-	25	25	50	25	-
8.	VSC	24DS506P	Technical Skill Development - II	-	-	4	2	-	50	-	50	25	-
9.	SEC	24DS541P	Career Development - V	-	-	2	1	-	50	-	50	25	-
10.	MDM	24DS531M	MDM – III (Refer the Basket)	3	-	-	3	20	20	60	100	45	3
Total				14	-	12	20	80	280	340	700	-	-

Multidisciplinary Minor – III	
24DS531M	Data Engineering

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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS501T	Operating Systems	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended</p> <ol style="list-style-type: none"> Understand fundamental concepts of Operating Systems including evolution, types, structure, and services of OS. Learn process management and CPU scheduling techniques for efficient execution of multiple programs and data processing tasks. 	<p>Students will be able to</p> <ol style="list-style-type: none"> Explain the basic functions, structure, and services of an Operating System. Analyze process management concepts such as process states, CPU scheduling algorithms for running multiple tasks efficiently. Apply memory management techniques including paging, segmentation, virtual memory, and page replacement algorithms to optimize system performance for large datasets. Identify and solve synchronization and deadlock problems using semaphores and describe file system organization, disk scheduling.

Unit I	[9Hrs]
Introduction to Operating Systems: Definition and functions of Operating System, Evolution of Operating Systems, Types of OS: Batch OS, Time Sharing OS, Distributed OS, Real-Time OS, OS structure: Kernel, Shell, System calls, OS services.	
Unit II	[9Hrs]
Process Management: Process concept, Process states and state transition diagram, Process Control Block (PCB), Threads and multithreading, Inter-process communication (IPC): Shared memory, Message passing, CPU scheduling algorithms	
Unit III	[9Hrs]
Memory Management: Logical versus Physical memory, Contiguous and non-contiguous memory allocation, Paging and segmentation, Virtual memory, Demand paging, Page replacement algorithms: FIFO, LRU, Optimal, and Thrashing.	
Unit IV	[9Hrs]
Deadlocks and Synchronization: Critical section problem, Mutual exclusion, Semaphores and mutex, Classical synchronization problems: Producer-Consumer, Readers-Writers, Dining Philosophers, Deadlock: Conditions, Prevention, Avoidance (Banker's Algorithm), Detection and recovery.	
Unit V	[9Hrs]
File Systems : File concept and attributes, File access methods, Directory structure, File allocation methods, Free space management, Disk scheduling: FCFS, SSTF, SCAN, C-SCAN, File protection and security	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Operating System	A. Godbole	3	TMH
2	Operating System Concepts	A. Silberschatz, Peter B. Galvin, Rag Gagne	8	Wiley

S.N	Title	Authors	Edition	Publisher
1	Modern Operating Systems	Andrew S. Tanenbaum	3	PHI
2	Operating Systems: Internals and Design Principles	William Stallings	8	Pearson

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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS502T	Machine Learning	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
<p>This course is intended</p> <ol style="list-style-type: none"> To introduce the basic concepts and techniques of machine learning. To understand major machine learning algorithms. To identify machine learning techniques suitable for different problems. 	<p>Students will be able to</p> <ol style="list-style-type: none"> Demonstrate the fundamental components of machine learning Apply supervised learning techniques and explain key issues like overfitting, generalization, and regularization. Implement and evaluate probabilistic learning methods along with clustering techniques. Analyse ensemble learning techniques such as bagging, boosting, and stacking. Interpret advanced learning paradigms and critically review current research trends in machine learning.

Unit I	[10 Hrs]
Foundations for ML: ML Techniques overview, Validation Techniques (Cross-Validations), Overfitting and under-fitting, Data Normalization, Hypothesis Evaluation, Feature Reduction/Dimensionality reduction, Linear and Logistic regression. FIND-S and Candidate-Elimination algorithm.	
Unit II	[9 Hrs]
Discriminative ML Methods: Classification and its use cases, Confusion Matrix, Decision Tree, Algorithm for Decision Tree Induction, Creating a Perfect Decision Tree, , Random Forest algorithm.	
Unit III	[10 Hrs]
Bayesian learning and Bayesian networks, EM algorithm, Naive Bayes classifier, Bayesian Belief Networks, Hidden Markov Model. Clustering, Generative Models, Mixture Models, Hierarchical Clustering, K-means algorithm and complexity.	
Unit IV	[8 Hrs]
Ensemble of Machine Learning models, Boosting, Bagging, Stacking. Dimensionality Reduction and Principal Component Analysis (PCA). Support Vector Machine.	
Unit V	[8 Hrs]
Other Learning Paradigms: Introduction to Reinforcement Learning, Deep Learning, Transfer Learning, Semi-supervised Learning, and Active Learning. ML in Summary and Path Ahead - Research Survey Articles.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Machine Learning- an Artificial Intelligence Approach	Tom Mitchell	2	Morgan Kaufmann
2.	Algorithms for Clustering Data	A. K. Jain and R. C. Dubes	5	Prentice Hall PTR

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Introduction to Machine Learning	Ethem Alpaydin	2	PHI
2.	Pattern Recognition and machine learning	Christopher Bishop	5	Springer Verlag

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS502P	Machine Learning Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<p>This course is intended</p> <ol style="list-style-type: none">To implement basic machine learning algorithm for solving problem.To understand the usage of datasets in implementing machine learning problems.To learn various modern tools, packages and techniques for machine learning.	<p>Students will be able to</p> <ol style="list-style-type: none">Implement procedures for machine learning algorithms.Design python programs for various learning algorithms.Apply appropriate machine learning algorithms to various data sets.Apply machine learning algorithms to solve real world problems.

Expt. No.	Title of the experiment
1	To implement the concept of data pre-processing (Working with various data types, fixing values, handling missing values and outliers, etc.) using public dataset.
2	Perform regression on a given dataset.
3	Build a decision tree classifier for the dataset.
4	Apply a Naïve Bayes classifier to a dataset.
5	Apply a SVM on a given dataset.
6	Use the Apriori algorithm to discover frequent itemsets from a dataset.
7	Perform K-means clustering on a given dataset.
8	A micro-project based on real world problems.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Understanding Machine Learning: From Theory to Algorithms	Shalev-Shwartz, S.	2	Cambridge University Press
2.	Pattern Recognition and machine learning	Christopher Bishop	5	Springer Verlag

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Machine Learning- an Artificial Intelligence Approach	Tom Mitchell	2	Morgan Kaufmann
2.	Algorithms for Clustering Data	A. K. Jain and R. C. Dubes	5	Prentice Hall PTR
3.	Introduction to Machine Learning	Ethem Alpaydin	3	PHI

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS503T	Software Engineering and Project Management	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended <ol style="list-style-type: none">To provide understanding of software engineering principlesTo enable students to understand stages involved in the development of software projectTo get acquainted with software quality, reliability and software configuration management.	Students will be able to <ol style="list-style-type: none">Identify project types and choose suitable software development techniques accordingly.Interpret project requirements and prepare a formal software specification document.Apply design process, steps for effective UI design depending on the requirement of the project.Design test cases, apply testing strategies and demonstrate the ability to plan, estimate project.Apply Software Configuration Management practices in a software development environment.

Unit I	[9Hrs]
Introduction to Software Engineering, software, Role of Software Engineer, Software Development Phases, Process Models, Evolutionary Models, Agile Process.	
Unit II	[9Hrs]
Requirements Engineering: □ Introduction to Requirements Engineering, Initiating the Requirements Process, Requirements Elicitation Techniques, Requirements Analysis, Building the Requirements Model, Scenario-Based Analysis, Requirements Modeling Strategies, SRS.	
Unit III	[9Hrs]
Software Design and User Interface: Introduction to Software Design, Design Principles, Design Models, User Interface Design, User Interface Design Rules, User Interface Analysis and Design	
Unit IV	[9Hrs]
Software Testing: Testing Fundamentals, White Box Testing, Black Box Testing, Unit Testing, Integration Testing, Debugging. Software Projects: Project Planning objectives, Software Scope.	
Unit V	[9Hrs]
Software Quality Assurance: Concepts, Approaches, Software Quality Factor, Software Reviews, Software Reliability. Software Configuration Management	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Software Engineering, A practitioner's approach	Roger Pressman	7	Tata Mcgraw Hill
2	Object Oriented Software Engineering Using UML Patterns and Java	Bernd Bruegge & Allen H. Dutoit.	2	PHI

Reference Books

S.N	Title	Authors	Edition	Publisher
1	OOA and Design	Grady Booch	3	Ad. Wesley
2	OO Modeling and design	Rambhaugh	2	PHI

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS503P	Software Engineering and Project Management Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended <ol style="list-style-type: none">Identify Project Requirements and Develop a Formal SpecificationApply Design Principles in System Development:Implement Effective Testing Methods to Ensure Software Quality.	Students will be able to <ol style="list-style-type: none">Gather and Analyze Project Requirements, Create Formal Specifications, and Plan Development Tasks.Implement Design Principles Throughout the System Development Process.Ensure quality of software by implementing testing methods.

Expt. No.	Title of the experiment
1	Identifying the Requirements from Problem Statements
2	Estimation of Project Metrics
3	Scheduling Project
4	Modeling UML Use Case Diagrams and Capturing Use Case Scenarios
5	Modeling Data Flow Diagram & Control Flow Diagram
6	Modeling UML Class Diagrams
7	Modeling Sequence Diagrams
8	Designing Test Suites

Text Books

S.N	Title	Authors	Edition	Publisher
1	Software Engineering, A practitioner's approach	Roger Pressman	7	Tata Mcgraw Hill
2	The Art of Software Testing	Glenford J. Myers	4	John Wiley & Sons.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	OO Modeling and design	Rambhaugh	2	PHI
2	OOA and Design	Grady Booch	3	Ad. Wesly

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS504P	Data Center Management and Cloud Computing Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended 1. To provide hands-on experience with virtualization technologies. 2. To enable students to configure and manage core AWS services 3. To introduce scalable cloud architectures,. 4. To develop practical skills in DevOps tools, 5. To implement serverless computing solutions.	Students will be able to 1. Configure and manage virtual machines using industry-standard virtualization tools. 2. Deploy, secure, and manage applications on AWS. 3. Implement scalable cloud architectures using Load Balancers and Auto Scaling Groups. 4. Apply DevOps practices by using Git, GitHub, and CI/CD workflows for collaboration and automation. 5. Develop, deploy, and test serverless applications using AWS Lambda and related cloud services.

Contents- VM creation, configuration, and snapshots. User/group creation, policies, MFA, AWS CLI. Web server hosting, SSH access, security configurations. Volume creation, mounting, S3 operations, versioning. ELB configuration, ASG setup, scaling policies. Lambda creation, triggers, CloudWatch logging. Repository creation, branching, pull requests, GitHub Actions CI. Container management, Dockerfile creation, image publishing.

List of Experiments
1. Introduction to Virtualization
2. AWS IAM & Security Management
3. Deploying EC2 Instances on AWS
4. AWS Storage Management (EBS + S3)
5. Auto Scaling & Load Balancing
6. AWS Lambda – Serverless Computing
7. DevOps with Git & GitHub
8. Docker Container Deployment

Text Books

S.N	Title	Authors	Edition	Publisher
1	Mastering AWS Lambda	Ajay NS	2	Packt
2	Cloud Computing: A Hands-On Approach	Arshdeep Bahga, Vijay Madiseti	3	Universities Press

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	The DevOps Handbook	Gene Kim, Jez Humble, Patrick Debois, John Willis	3	IT Revolution Press
2.	Amazon Web Services in Action	Andreas Wittig, Michael Wittig	4	Manning

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS505P	Data Science Workshop – V	-	-	4	2	25	25	50

Course Objectives	Course Outcomes
This course is intended 1. Understand and analyze different types of clinical data including structured, image, signal, and genomic data. 2. Apply appropriate preprocessing, visualization, and data preparation techniques for clinical machine learning applications.	Students will be able to 1. Apply data analysis and preprocessing techniques on structured clinical datasets for machine learning readiness. 2. Implement image processing and data balancing techniques on clinical image datasets. 3. Apply signal processing and genomic data analysis methods for extracting meaningful clinical features. 4. Integrate multimodal clinical data and design an end-to-end data science solution for clinical applications.

Contents: Understand the structured clinical data, medical images, physiological signals, and genomic datasets using data science and machine learning techniques. The methods of visualization, preprocessing, data balancing, feature extraction, and handling of large-scale medical images such as whole slide images. Students will learn multimodal clinical data integration and develop end-to-end data science workflows for real-world clinical applications through a micro project, with emphasis on ethical handling of healthcare data.

Expt. No.	Title of the experiment
1	Analysis of Structured Clinical Data
2	Visualize and Preprocess Clinical Image Dataset
3	Data balancing for Clinical Image Dataset
4	Processing of whole slide Medical Image Dataset
5	Signal Processing Medical Image Dataset
6	Analysis of DNA / Gene Expression Dataset
7	Multimodal Clinical Data Integration
8	Micro Project on Clinical Data Science

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	2	O'Reilly Media.
2.	Machine Learning	Mitchell T.	5	McGraw-Hill

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Python for Data Analysis	Wes McKinney	2	O'Reilly
2.	Machine Learning: A Probabilistic Perspective	Kevin Murphy	2	MIT Press

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23DS506P	Technical Skill Development – II	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
This course is intended 1. Equip students with fundamentals in Java and Object-Oriented Programming. 2. Develop skills for solving real-time coding problems relevant to technical interviews. 3. Support logical thinking through structured programming and data structures. 4. Prepare students for campus recruitment drives, coding rounds, and technical interviews.	Students will be able to 1. Know and use the Java programming language with object-oriented concepts. 2. Apply control structures and data structures to solve computational problems effectively. 3. Design and develop modular, reusable programs using object-oriented principles. 4. Analyze time and space complexity of algorithms for performance evaluation. 5. Implement Java Collections Framework and basic algorithms commonly used in coding interviews.

Java Runtime Environment, core language constructs, advanced data types, wrapper classes, autoboxing and unboxing mechanisms, and input/output programming with standard coding practices. Object-oriented programming principles such as classes, objects, access specifiers, inheritance, polymorphism, abstraction, and method overloading and overriding, with design-oriented application development. Exception handling mechanisms, file input/output operations, and the Java Collections Framework with practical use cases. Multithreading concepts covering thread creation, lifecycle management, synchronization

Expt.No.	Title of the Experiment
1.	Write Java programs demonstrating wrapper classes using Scanner class.
2.	Implement matrix addition, multiplication, transpose, and search operations using 2D arrays.
3.	Develop programs for string manipulation (palindrome, frequency count, anagram check) and solve competitive-style problems using arrays and strings.
4.	Design and implement a simple Library Management or Employee Management System using classes, objects, inheritance, and polymorphism.
5.	Create a program that reads and writes student records to files while handling runtime and checked exceptions gracefully.
6.	Use ArrayList, HashMap, and Set to manage student attendance or marks data with sorting and searching operations.
7.	Implement a multithreaded program demonstrating thread creation, priorities, synchronization, and shared resource access.
8.	Analyze a Java program, find and fix errors, and test it with different inputs

Text Books

S.N	Title	Authors	Edition	Publisher
1	Programming with Java	E. Balagurusamy	2	McGraw Hill.
2	Head First Java	Kathy Sierra	2	O'Reilly Media

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Core Java Volume I – Fundamentals	Cay S. Horstmann	11	Pearson
2	Data Structures and Algorithms in Java	Robert Lafore	2	Pearson

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24DS541P	Career Development – V	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
To enhance students' aptitude, analytical reasoning, communication, teamwork, and professional presentation skills required for competitive examinations, higher education, and workplace success.	<p>CO1. Students will be able to solve problems related to time and work, pipe and cisterns, geometry, mensuration, and analytical puzzles using logical and quantitative reasoning skills.</p> <p>CO2. Students will be able to apply concepts of time, speed, and distance and solve coding-decoding and direction sense problems accurately using analytical thinking.</p> <p>CO3. Students will be able to perform SWOC analysis, set SMART goals, and deliver effective self-introductions with confidence and professional communication skills.</p> <p>CO4. Students will be able to conduct company profile presentations and participate effectively in table topic group discussions demonstrating teamwork, critical thinking, and spontaneous speaking skills.</p> <p>CO5. Students will be able to demonstrate improved verbal ability, grammar, vocabulary, reading comprehension, and active classroom participation for professional communication.</p>

Unit I (15marks)	[7Hrs]
Time and Work, Chain Rule, Pipe and Cistern, Geometry and mensuration Puzzles:- Analytical puzzle, Tabular Puzzle, Box or Floor based Puzzle, Rank based Puzzle	
Unit II (10marks)	[7Hrs]
Time Speed and Distance:- Basic Problems, Average Speed, Relative Speed, Problems on Trains, Boats and Streams, Escalators, Directions sense Problems Coding and Decoding	
Unit III (5marks)	[5Hrs]
SWOC Analysis and SMART Goal Setting - for Personal and Professional Development Self-Elevator Pitch – Self Introduction, Confidence Building, and Professional Communication Skills (5marks)	
Unit IV (10marks)	[6Hrs]
Company Profile Group Presentation – Research, Team Coordination, and Presentation Techniques (5marks) Table Topic Group Discussion – Critical Thinking, Spontaneous Speaking, and Team Interaction	
Unit V (10marks)	[3Hrs]
Verbal Ability Quiz – Grammar, Vocabulary Building, and Reading Comprehension for Professional Communication Continuous Assessment - Attendance, Individual Engagement & Team Dynamics	

Text Books

S.N	Title	Author s	Edition	Publisher
1	Quantitative Aptitude By R. S. Aggarwal	R.S. Aggarwal		
2	Quantitative Aptitude	Shripad Deo		Allied Publication
3	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude for CAT by Arun Sharma	Arun Sharma		
2	Developing Communication Skills	Krishna Mohan & Meera Banerji	2002	
3	Professional Communication Skills	Alok Jain	2006	S Chand & Company Ltd.
4	Personality Development & Soft Skills	Barun Mitra	2019	Cambridge University Oress

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24DS531M	MDM – III Data Engineering	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course is intended 1. Build a strong foundation in data structures, algorithms, and database management for data science applications. 2. Develop expertise in data preprocessing, pattern recognition, visualization, and statistical analysis for effective decision-making.	Students will be able to: 1. Apply fundamental data structures and algorithms to solve real-world problems in data science. 2. Design and implement relational databases using SQL, including advanced queries and procedures. 3. Perform data cleaning and preprocessing, including feature engineering and dimensionality reduction techniques. 4. Analyse patterns in data using clustering methods such as K-means, hierarchical clustering, and density-based clustering. 5. Visualize data effectively using charts and plots, and apply statistical hypothesis testing to extract insights from case studies.

Unit I	[9Hrs]
Data structures: Linear and nonlinear data structures, Basics of algorithm, pseudo-code, testing-debugging; Operation of Data Structures, Problems related to data science.	
Unit II	[9Hrs]
Purpose of Database System: DBMS Architecture (Three-Schema Architecture), Components of DBMS, E-R Model: Entities, Attributes, Relationships, ER Diagrams, RDBMS Basics and Introduction to SQL.	
Unit III	[9Hrs]
Data Cleaning, Transformation and Feature Engineering: EDA process, Feature Engineering, Data Encoding, Normalization, and Standardization, Dimensionality Reduction, Data Wrangling and Pipelines using Python.	
Unit IV	[9Hrs]
Data Mining and Pattern Discovery: Introduction to Data Mining and Knowledge Discovery, Classification, Clustering, and Association Rules, Clustering Techniques, Association Rule Mining, Basics of Recommendation Systems.	
Unit V	[9Hrs]
Data Analytics and Visualization: - Descriptive Statistics and Probability Distributions, Inferential Statistics, Statistical Tests, Data Visualization, Visualization Tool: Power BI (Basics).	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Fundamentals of Database Systems	Ramez Elmasri	2	Pearson Education.
2	Data Visualization: A Practical Introduction	Kieran Healy	2	Prentice-Hall
3	Introduction to the Design and Analysis of Algorithms	Anany Levitin	2	Pearson Education.

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Statistics for Data Science	James D. Miller	2	CRC press
2.	"Fundamentals of Data Visualization"	By Claus O. Wilke	3	Pearson

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