BONAM VENKATA CHALAMAYYA ENGINEERING COLLEGE:ODALAREVU
(AUTONOMOUS)
B. Tech., CSE (AI & DS) (BR23) COURSE STRUCTURE & SYLLABUS
(Applicable from the academic year 2023-24 and onwards)
B. Tech.– III Year II Semester

S.No.	Course Code	Category	Title	L	T	P	Credits
1	23AD6T04	PCC	Big Data Analytics	3	0	0	3
2	23AD6T05	PCC	Machine Learning	3	0	0	3
3	23AD6T06	PCC	Data Visualization	3	0	0	3
4	23CS6D05 23AD6D05 23AD6D06 23AD6D07 23AD6D08	PE-II	1. Software Testing Methodology 2. Cryptography & Network Security 3. Recommender Systems 4. NoSQL databases 5. Computer Vision	3	0	0	3
5	23CS6D08 23ML6D02 23CS6D04 23AM6D05	PE-III	1. Software Project Management 2. Cloud Computing 3. Quantum Computing 4. Social Network Analysis 5. 12-Week SWAYAM /NPTEL Course recommended by the BoS	3	0	0	3
6		OE – II		3	0	0	3
7	23AD6L03	PCC	Data Visualization and Machine Learning Lab	0	0	3	1.5
8	23AD6L04	PCC	Big Data Analytics Lab	0	0	3	1.5
9	23HM6S02	SEC	Soft skills	0	1	2	2
10	23AC6T02	Audit Course	Technical Paper Writing & IPR	2	0	0	-
		Total		20	01	08	23
		*Mandatory Industry Internship/ Mini Project of 08 weeks duration during summer vacation					

Under Industry Internship interested students can pursue SWAYAM Plus courses viz., Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World Application

Dr. N Ramakrishnaiah, Professor and HOD–CSE, UCEK, JNTUK Kakinada	Dr. U.S.N. Raju, Associate Professor, Dept. of CSE, NIT, Warangal	Dr. V. Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr.B. Jnaneswara Rao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S. Rao Chintalapudi, Professor and HOD–CSE (AIML), CMR Technical Campus, Hyderabad	Dr.A. Ramakrishna, Professor and HOD of CSE(AI&ML), AIML, CSE(AI&DS)
University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairperson-BOS.

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BONAM VENKATA CHALAMAYYA ENGINERING COLLEGE
ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6T04	L	T	P	C
		3	0	0	3

BIG DATA ANALYTICS
Common to CSE(AI&DS)/AIML

Course Objectives:

The main objectives of the course is to

- Optimize business decisions and create competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefit from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
- To introduce programming tools PIG & HIVE in Hadoop echo system.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze the implementation and usage of core data structures and generics in Java for efficient data handling and abstraction	BL4
CO 2	Analyze the architecture and configuration of Hadoop and its components for efficient big data storage and processing	BL3
CO 3	Analyze and implement MapReduce programs using Hadoop APIs to process large-scale datasets efficiently	BL3
CO 4	Analyze streaming data architectures and implement real-time data processing using Spark RDD operations	BL2
CO 5	Analyze large-scale data using Pig Latin and Hive by structuring, querying, and processing data in Hadoop ecosystems	BL4

UNIT I **15Hrs**

Data structures in Java: Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serializati

UNIT II **15Hrs**

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

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UNITIII **12Hrs** **Writing Map Reduce Programs:** A Weather Dataset, Understanding Hadoop API for Map Reduce Framework (Old and New), Basic programs of Hadoop Map Reduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Practitioner
UNIT IV **15Hrs** **Stream Memory and Spark:** Introduction to Streams Concepts– Stream Data Modeland Architecture , Stream computing, Sampling Data in a Stream , Filtering Streams ,Counting Distinct Elements in a Stream , Introduction to Spark Concept , Spark Architecture and components , Spark installation , Spark RDD(Resilient Distributed Dataset) – Spark RDD operations.
UNIT V **12Hrs** **Pig:** Hadoop Programming Made EasierAdmiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin. **Applying Structure to Hadoop Data with Hive:** Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analysing data
Text Books: 1. 1. Wiley & Big Java 4th Edition, Cay Horstmann, Wiley John Sons, INC 2. Hadoop: The Definitive Guide by Tom White, 3rd. Edition, O'reilly
Reference Books: 1. 1. Hadoop in Action by Chuck Lam, MANNING Publ. 2. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss 3. Hadoop in Practice by Alex Holmes, MANNING Publ. 4. Big Data Analytics by Dr. A.Krishna Mohan and Dr.E.Laxmi Lydia 5. Hadoop Map Reduce Cookbook, SrinathPerera, ThilinaGunarathne
Online Learning Resources: 1. https://archive.nptel.ac./courses/106/105/10610517

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ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6T05	L	T	P	C
		3	0	0	3

MACHINE LEARNING

Course Objectives:

The objectives of the course is to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.
- Design and implement linear discriminant models and neural networks for classification tasks.
- Apply various clustering techniques to group and analyze pattern-based data effectively.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Enumerate the Fundamentals of Machine Learning	BL1
CO 2	Build Nearest neighbour based models	BL6
CO 3	Apply Models based on decision trees and Bayes rule	BL3
CO 4	Make use of Linear discriminants for machine Learning	BL3
CO 5	Choose appropriate clustering technique	BL5

UNIT I15Hr

Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT II **15Hrs**

Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures, K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

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UNITIII	**12Hrs**
Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.**The Bayes Classifier:** Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)	
UNIT-IV	**15Hrs**
Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.	
UNIT V	**12Hrs**
Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.	

Text Books:

1. 1"Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019Press (India), 2024

Reference Books:

1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019

Online Learning Resources:

1.https://archive.nptel.ac.in/courses/106/105/106105158/

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ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6T06	L	T	P	C
		3	0	0	3

DATA VISUALIZATION
Common to CSE(AI&DS)/AIML/CSE(AI&ML)

Course Objectives:
The main objectives of the course is to

- Understand the fundamentals of data visualization, its history, principles, and the role of visual perception.
- Learn to create effective visual representations using visual mapping, analytics, and application design principles.
- Understand visualization system types and techniques for representing one-, two-, multi-dimensional, and text data.
- Explore techniques for visualizing hierarchical, relational, and clustered data using metaphorical approaches.
- Understand advanced visualization techniques for spatial, scientific, and collaborative data, including evaluation and recent trends.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze principles of data visualization, perception, and representation to interpret complex information	BL3
CO 2	Visual mapping techniques and design effective visualization applications using reference models.	BL4
CO 3	Visualization systems and techniques for representing multi-dimensional and textual data.	BL4
CO 4	Analyze techniques for visualizing groups, trees, graphs, clusters, networks, and metaphorical data.	BL3
CO 5	Advanced visualization techniques for spatial data, simulations, and recent perceptual trends	BL4

UNIT I **15Hrs**

Introduction: What Is Visualization?, History of Visualization, Relationship between Visualization andOther Fields The Visualization Process, Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

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UNIT II	**15Hrs**
Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications	
UNIT III	**12Hrs**
Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.	
UNIT V	**12Hrs**
Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations **Recent trends** in various perception techniques, various visualization techniques, data structures used in data visualization.	
Text Books: 1. 1. WARD, GRINSTEIN, KEIM.Interactive Data Visualization: Foundations, Techniques, and Applications. Natick : A K Peters, Ltd. 2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.	
Online Learning Resources: 1. 1. https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf	

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III Year - II Semester	Code: 23CS6D05	L	T	P	C
		3	0	0	3

SOFTWARE TESTING METHODOLOGIES
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML),IT)

Course Objectives:

The main objectives of the course is to

- To provide knowledge of the concepts in software testing such as testing process, criteria, strategies, and methodologies.

To develop skills in software test automation and management using the latest tools

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Define key concepts of software testing including purpose, dichotomies, testing models, and types of bugs.	BL1
CO 2	Describe the basics of data flow testing and apply strategies to identify anomalies in variable usage.	BL3
CO 3	Illustrate path products, path expressions, and regular expressions for flow anomaly detection in software.	BL2
CO 4	Assess software testability using state models and transitions.	BL5
CO 5	Demonstrate practical knowledge in automated testing tools (e.g., JMeter, Selenium, SoapUI, Catalon) to design and execute test cases	BL3

UNIT I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT II

Transaction Flow Testing: transaction flows, transaction flow testing techniques.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kv charts, specifications.

UNIT IV

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

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UNIT V Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter/selenium/soapUI/Catalon).
Text Books: 1. Software Testing techniques - Baris Beizer, Dreamtech, second edition. 2. Software Testing Tools – Dr. K. V. K. K. Prasad, Dreamtech.
Reference Books: 1. The craft of software testing - Brian Marick, Pearson Education. 2. Software Testing Techniques – SPD(Oreille) 3. Software Testing in the Real World – Edward Kit, Pearson. 4. Effective methods of Software Testing, Perry, John Wiley. 5. Art of Software Testing – Meyers, John Wiley

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III Year - II Semester	Code: 23AD6D05	L	T	P	C
		3	0	0	3

CRYPTOGRAPHY & NETWORK SECURITY
(Common to CSE(AI&DS)/AI&ML/CSE(AI&ML))

Course Objectives:
The main objectives of the course is to

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand the basic categories of threats to computers and networks
- Discusses the Mathematics of Cryptography
- Discuss the fundamental ideas of Symmetric and Asymmetric Cryptographic Algorithms

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze security principles and classical encryption techniques to address various network threats.	BL3
CO 2	Analyze mathematical foundations of symmetric and asymmetric cryptography for secure data encryption.	BL4
CO 3	Analyze symmetric and asymmetric encryption algorithms to ensure secure communication in cryptographic systems	BL3
CO 4	cryptographic hash functions, MACs, and digital signature algorithms for data integrity and authentication	BL3
CO 5	Analyze network and internet security protocols to ensure secure communication over web, IP, and email	BL4

UNIT I **15Hrs**

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Stegnography.

UNIT II **15Hrs**

Introduction to Symmetric Cryptography: Algebraic Structures-Groups, Rings, Fields, GF(2^n) fields,

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Polynomials.

Mathematics of Asymmetric cryptography: Primes, Checking For Primness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation And Logarithm.

UNIT III **12Hrs**

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

UNIT IV **15Hrs**

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA)

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S,MAC'S Based On Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC

Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

UNIT V **12Hrs**

Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol.

Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.

Text Books:

1. 1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

Reference Books:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
   Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C.

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III Year - II Semester	Code: 23AD6D06	L	T	P	C
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RECOMMENDER SYSTEMS
(Common to CSE(AI&DS)/CSE(AI&ML))

Course Objectives:
The main objectives of the course is to

- Introduce recommender system functions, foundational linear algebra, rating analysis, and real-world applications with challenges.
- Understand collaborative filtering techniques, including user/item-based methods, model-based approaches, and system vulnerabilities.
- Learn content-based and knowledge-based recommendation techniques, including user/item profiling, retrieval, and reasoning methods.
- Understand hybrid recommendation strategies, their design models, implementation approaches, and associated limitations.
- Learn to evaluate recommender systems using various metrics and explore their role in social and personalized contexts.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze recommender system functions and linear algebra concepts to understand rating patterns and applications	BL3
CO 2	Collaborative filtering techniques and model-based approaches to build effective recommender systems	BL4
CO 3	Analyze content-based and knowledge-based recommendation techniques for personalized information retrieval	BL3
CO 4	Analyze hybrid recommendation strategies to enhance system performance using various integration designs.	BL4
CO 5	Evaluation methods and community-based approaches to assess and enhance recommender system effectiveness	BL4

UNIT I **15Hrs**

Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation

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systems, Issues with recommender system.

UNIT II **15Hrs**

Collaborative Filtering:User-based nearest neighbour recommendation,Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems

UNIT III **12Hrs**

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, discovering features of documents, obtaining item features from tags, representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

UNIT IV **15Hrs**

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT V **12Hrs**

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.

Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and recommendations

Text Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.

Reference Books:

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.

Dr. N Ramakrishnaiah, Professor and HOD–CSE UCEK, JNTUK Kakinada	Dr. U.S.N. Raju,Associate Professor, Dept. of CSE, NIT, Warangal	Dr. V. Venkata Krishna, Dean of Computer Science, JBIET, Hyderabad	Mr.B. JnaneswaraRao, Senior Machine Learning Expert HC Robotics Pvt. Ltd., Hyderabad	Dr. S. Rao Chintalapudi, Professor and HOD–CSE (AIML), CMR Technical Campus, Hyderabad	Dr.A.Ramakrishna, Professor and HOD of CSE(AI&ML), AIML CSE(AI&DS)
University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairperson–BOS

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BONAM VENKATA CHALAMAYYA ENGINERING COLLEGE ODALAREVU
– 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6D07	L	T	P	C
		3	0	0	3

NoSQL Databases
Common to CSE(AI&DS)/CSE(AI&ML)

Course Objectives:
The main objectives of the course is to

- To learn the concepts and algorithms in Information Retrieval Systems
- To understand the data/file structures that are necessary to design, and implement information Retrieval (IR) systems.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Explain and compare different types of NoSQL Databases	BL2
CO 2	App Compare and contrast RDBMS with different NoSQL databases.	BL4
CO 3	Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.	BL2
CO 4	Explain performance tune of Key-Value Pair NoSQL databases.	BL2
CO 5	Apply Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.NoSQL development tools on different types of NoSQL Databases.	BL3

UNIT-I:

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

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UNIT-II: Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, Map Reduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT-III: NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT-IV: Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT-V: NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

TEXT BOOKS:

1.Sadalage,P.&Fowler,NoSQLDistilled:ABriefGuidetotheEmergingWorldof PolyglotPersistence, Wiley Publications,1st Edition,2019

WEB REFERENCES:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-databa

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ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6D08	L	T	P	C
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COMPUTER VISION
(Common to CSE(AI&DS)/ AIML/CSE(AI&ML)

Course Objectives:

The main objectives of the course is to

- Understand camera models, radiometry, shading, and color perception in computer vision and image analysis.
- Learn linear filtering, edge detection, and texture analysis techniques for image processing and computer vision.
- Understand multi-view geometry and image segmentation techniques using clustering and human visual principles.
- Learn model-based segmentation, probabilistic fitting, and object tracking using linear dynamic models.
- Understand geometric camera models, calibration techniques, and model-based vision applications in robotics and imaging.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze camera models, lighting, shading, and color theory for realistic image formation and perception.	BL4
CO 2	Analyze linear filtering, edge detection, and texture analysis techniques for image processing applications.	BL3
CO 3	Analyze geometric and clustering techniques for multi-view reconstruction and image segmentation	BL4
CO 4	Analyze model fitting and probabilistic methods for segmentation and tracking in visual data.	BL4
CO 5	Analyze geometric camera models and calibration methods for vision-based localization and alignment.	BL2

UNIT I **15Hrs**

CAMERAS: Pinhole Cameras Radiometry–Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter reflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

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UNIT II **15Hrs**

Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture0: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT III **12Hrs**

The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision:GroupingandGetstalt,Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering.

UNIT ĪV **15Hrs**

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT V **12Hrs**

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,

Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008. 3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

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III Year - II Semester	Code: 23CS6D08	L	T	P	C
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SOFTWARE PROJECT MANAGEMENT
(Common to CSE,CSE-(AI&DS),CSE(AI&ML),IT)

Course Objectives:

At the end of the course, the student shall be able to:

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures

To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Describe the waterfall model and limitations of conventional software management.	BL2
CO 2	Explain various process artifacts – management, engineering, and programmatic – and their significance.	BL2
CO 3	Analyze the checkpoints (milestones and assessments) used in iterative development for effective monitoring.	BL4
CO 4	Describe types of project organizations and their evolution in software project management	BL2
CO 5	Analyze DevOps adoption in real-world projects with respect to technology, tools, people, and processes.	BL4

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance. **Evolution of Software Economics**: Software Economics, pragmatic software cost estimation. **Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.**The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts

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UNIT- III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration workflows.

Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT-IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations. **Process Automation:** Automation Building blocks, The Project Environment.**Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation

UNIT-V:

Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016

Reference Books:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Software Project Management in practice, Pankaj Jalote, PEA, 2005,
4. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

Project Management in IT, Kathy Schwalbe, Cengage

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairman-BOS.

III Year- II Semester	Code:23ML6D02	L	T	P	C
		3	0	0	3

Cloud Computing
(Common to CSE(AI&DS)/AIML)

Course Objectives:
The main objectives of the course is to

- Understand cloud computing fundamentals, service and deployment models, benefits, and major cloud service providers.
- Learn cloud enabling technologies including parallel and distributed computing, SOA, web services, and virtualization.
- Understand virtualization and container technologies, orchestration tools, and their roles in cloud computing.
- Explore key challenges in cloud computing, including security, interoperability, scalability, and energy efficiency.
- Understand advanced cloud concepts including server less computing, IoT integration, edge computing, and DevOps practices.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO1	Analyze cloud computing concepts, service and deployment models, characteristics, and key service providers.	BL4
CO2	Analyze cloud enabling technologies including parallel and distributed computing, SOA, Web services, and virtualization.	BL4
CO3	Analyze virtualization and container technologies, platforms, orchestration tools, and their role in cloud computing.	BL3
CO4	Analyze key challenges in cloud computing ,including security, scalability, interoperability, and economic considerations.	BL2
CO5	Analyze advanced cloud computing concepts including server less architecture, IoT integration, edge computing, and DevOps practices.	BL2

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UNITI **15Hrs** **Introduction to Cloud Computing Fundamentals:** Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google App Engine).
UNITII **15Hrs** **Cloud Enabling Technologies:** Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.
UNITIII **12Hrs** **Virtualization and Containers:** Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container
UNIT ĪV **15Hrs** **Cloud computing challenges:** Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.
UNITV **12Hrs** **Advanced concepts in cloud computing**: Server less computing, Function-as-a-Service, server less computing architecture, public cloud(e.g. AWS Lambda) and open source(e.g. Open FaaS)server less platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.
Text Books: 1. Mastering Cloud Computing ,2nd edition, RajkumarBuyya,ChristianVecchiola,ThamaraiSelvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024. 2. Distributed and Cloud Computing, KaiHwang,GeofferyC.Fox,JackJ.Dongarra,Elsevier, 2012.

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Reference Books:

1. Cloud Computing, Theory and Practice, DanCMarinescu, 2nd edition, MKElsevier, 2018.
2. Essentials of cloud Computing, K.Chandrasekhran, CRCpress, 2014.

Online documentation and tutorials from cloud service providers(e.g.,AWS,Azure,GCP)

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairperson-BOS.

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III Year - I Semester	Code: 23CS5D04/23CS6D04	L	T	P	C
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QUANTUM COMPUTING
Common to CSE, CSE(AI & DS)

Course Objectives:

- To introduce the fundamentals of quantum computing, the problem-solving approach using finite dimensional mathematics

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO 1	Recall the historical development and interdisciplinary foundations of quantum computing involving mathematics, physics, and biology.	BL1
CO 2	Illustrate the biological foundations of quantum biology through genomics, proteomics, and the central dogma.	BL3
CO 3	Design simple quantum circuits using qubit gates for basic quantum operations.	BL6
CO 4	Demonstrate the application of Shor's algorithm for integer factorization and Grover's algorithm for unstructured search.	BL3
CO 5	Analyze the working and significance of quantum cryptographic protocols and quantum teleportation.	BL4

UNIT I **15Hrs**

History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT II **15Hrs**

Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT III **12Hrs**

Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

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UNIT IV **15Hrs** Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm
UNIT V **12Hrs** Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation
Textbooks: 1. Quantum Computation and Quantum Information, Nielsen M. A.,Cambridge 2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, Nic Harrigan, Mercedes Ginemo, Segovia, Oreilly Harrigan, Mercedes Ginemo, Segovia, Oreilly
Reference Books: 1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci 2. Principles of Quantum Computation and Information,Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II 3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithm

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ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6D05	L	T	P	C
		3	0	0	3

SOCIAL NETWORK ANALYSIS
Common to CSE(AI&DS)/AIML

Course Objectives:
The main objectives of the course is to

- Understand the evolution of the Semantic Web and apply social network analysis concepts and tools to web-based data.
- Understand ontology-based knowledge representation and social network data modeling in the Semantic Web.
- Explore methods for detecting, mining, and analyzing communities in dynamic web social networks.
- Understand behavior prediction, privacy concerns, and trust models in online social network environments.
- Learn visualization techniques and applications of social networks using graph-based and matrix-based methods.

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Analyze the evolution of the Semantic and Social Web and their applications in network analysis.	BL3
CO 2	Analyze ontology-based knowledge representation and reasoning techniques for modeling social network data.	BL4
CO 3	Analyze techniques for detecting and mining communities in dynamic web-based social networks	BL3
CO 4	Analyze methods for predicting human behavior and managing privacy and trust in online social networks.	BL4
CO 5	Analyze visualization techniques and graph-based representations for interpreting and applying social network data	BL5

UNIT I **15Hrs**

INTRODUCTION: Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network

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analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis

UNIT II **15Hrs**

MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT III **12Hrs**

EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities

UNIT IV **15Hrs**

PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES Understanding and predicting human behavior for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and counter measures.

UNIT V **12Hrs**

VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks.

Text Books:

1. 1. Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007.
Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

Reference Books:

1. Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo,-Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.

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University Nominee	Subject Expert	Subject Expert	Industrial Expert	Alumni Expert	Chairperson–BOS

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BONAM VENKATA CHALAMAYYA ENGINERING COLLEGE
ODALAREVU – 533 210, Andhra Pradesh, India
Autonomous

III Year - II Semester	Code: 23AD6L03	L	T	P	C
		0	0	3	1.5

DATA VISUALIZATION AND MACHINE LEARNING LAB

Course Objectives:

1. Understand the fundamentals of data types, sources, and principles of data visualization.
2. Learn to use Tableau for connecting datasets and creating meaningful visualizations and dashboards.
3. Apply data preprocessing techniques such as cleaning, transformation, and feature engineering.
4. Implement supervised learning algorithms for classification and regression using Python/R/Weka.
5. Explore and analyze data using unsupervised learning and clustering algorithms like K-Means and EM

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Understand foundational concepts of data and create basic data visualizations using Tableau.	BL2
CO2	Apply Tableau tools and calculations to build and format interactive dashboards and charts.	BL3
CO3	Perform data preprocessing techniques including missing value handling, discretization, and outlier removal.	BL3
CO4	Implement and evaluate classification and regression algorithms using Python/R/Weka.	BL5
CO5	Apply clustering techniques including K-Means, Fuzzy C-Means, and Expectation Maximization for data analysis.	BL3

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, Java FX GUI

Lab Problems:

1. Understanding Data, what is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
2. Getting started with Tableau Software using Data file formats, connecting your Data to Tableau,

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creating basic charts (line, bar charts, Tree maps), Using the Show me panel.

3. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.
6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.
7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.
8. Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9. Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.
10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

Software's Required: Python/R/Weka

List of Experiments:

1. Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.
2. Apply the following Pre-processing techniques for a given dataset.
   a. Attribute selection
   b. Handling Missing Values
   c. Discretization
   d. Elimination of Outliers
3. Apply KNN algorithm for classification and regression
4. Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results

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5. Demonstrate decision tree algorithm for a regression problem
6. Apply Random Forest algorithm for classification and regression
7. Demonstrate Naïve Bayes Classification algorithm.
8. Apply Support Vector algorithm for classification
9. Demonstrate simple linear regression algorithm for a regression problem
10. Apply Logistic regression algorithm for a classification problem
11. DemonstrateMulti-layer Perceptron algorithm for a classification problem
12. Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.
13. Demonstrate the use of Fuzzy C-Means Clustering
14. Demonstrate the use of Expectation Maximization based clustering algorithm

REFERENCE BOOKS:

1. R Programming for Data Science by Roger D. Peng (References)
   The Art of R Programming by Norman Matloff Cengage Learning India

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Autonomous

III Year - II Semester	Code: 23AD6L04	L	T	P	C
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BIG DATA ANALYTICS LAB
Common to CSE(AI&DS)/AIML

Course Objectives:
The aim of this course is to
- Optimize business decisions and create competitive advantage with Big Data analytics
- Introducing Java concepts required for developing map reduce programs
- Derive business benefit from unstructured data
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
- To introduce programming tools PIG & HIVE in Hadoop echo system.

Course Outcomes: Students are able to

CO Number	Course Outcome	Blooms Level
CO1	Analyze the implementation and usage of core data structures and generics in Java for efficient data handling and abstraction	BL4
CO2	Analyze the architecture and configuration of Hadoop and its components for efficient big data storage and processing	BL3
CO3	Analyze and implement MapReduce programs using Haddop APIs to process large-scale datasets efficiently	BL3
CO4	Analyze streaming data architectures and implement real-time data processing using Spark RDD operations	BL2
CO5	Analyze large-scale data using Pig Latin and Hive by structuring, querying, and processing data in Hadoop ecosystems	BL4

Experiments covering the Topics:
- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, Java FX GUI

Software Requirements:
1. **Hadoop** : https://hadoop.apache.org/release/2.7.6.html
2. **Java** : https://www.oracle.com/java/technologies/javase/javase8u211-later-archive-downloads.html
3. **Eclipse** : https://www.eclipse.org/downloads/

List of Experiments:

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Experiment 1: Week 1, 2:

1. Implement the following Data structures in Java
   a) Linked Lists b) Stacks c) Queues d) Set e) Map

Experiment 2: Week 3:

2. (i)Perform setting up and Installing Hadoop in its three operating modes:
   Standalone, Pseudo distributed, Fully distributed
   (ii)Use web based tools to monitor your Hadoop setup.

Experiment 3: Week 4:

3. Implement the following file management tasks in Hadoop:
   - Adding files and directories
   - Retrieving files
   - Deleting files

   Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

Experiment 4: Week 5:

4. Run a basic Word Count MapReduce program to understand MapReduce Paradigm.

Experiment 5: Week 6:

5. Write a map reduce program that mines weather data.
   Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record-oriented.

Experiment 6: Week 7:

6. Use MapReduce to find the shortest path between two people in a
7. social graph.

Hint: Use an adjacency list to model a graph, and for each node store the distance from the original node, as well as a back pointer to the original node. Use the mappers to propagate the distance to the original node, and the reducer to restore the state of the graph. Iterate until the target node has been reached

Experiment 7: Week 8:

1. Implement Friends-of-friends algorithm in MapReduce.
   Hint: Two MapReduce jobs are required to calculate the FoFs for each user in a social network .The first job calculates the common friends for each user, and the second job sorts the common friends

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by the number of connections to your friends.

Experiment 8: Week 9:

2. Implement an iterative PageRank graph algorithm in MapReduce.

Hint: PageRank can be implemented by iterating a MapReduce job until the graph has converged. The mappers are responsible for propagating node PageRank values to their adjacent nodes, and the reducers are responsible for calculating new PageRank values for each node, and for re-creating the original graph with the updated PageRank values.

Experiment 9: Week 10:

3. Perform an efficient semi-join in MapReduce.

Hint: Perform a semi-join by having the mappers load a Bloom filter from the Distributed Cache, and then filter results from the actual MapReduce data source by performing membership queries against the Bloom filter to determine which data source records should be emitted to the reducers.

Experiment 10: Week 11:

4. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

Experiment 12: Week 12:

5. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

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III Year - II Semester	Code: 23HM6S02	L	T	P	C
		0	1	2	2

SOFT SKILLS
(Common to CSE,CSE-(AI&DS),AIML,CSE(AI&ML),IT)

Course Objectives:

- To equip the students with the skills to effectively communicate in English
- To train the students in interview skills, group discussions and presentation skills
- To motivate the students to develop confidence
- To enhance the students' interpersonal skills
- To improve the students' writing skills

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Demonstrate analytical thinking and effective listening skills, and apply verbal and non-verbal communication techniques in personal and professional settings.	BL2
CO 2	Develop self-management competencies such as stress, time, and anger management, and exhibit team building, leadership, and professional etiquette.	BL4
CO 3	Participate effectively in job-related scenarios such as group discussions and interviews, and prepare resumes tailored for employment opportunities	BL6
CO 4	Understand the dynamics of interpersonal relationships, their significance in a workplace, and apply strategies to manage different relationship styles effectively.	BL3
CO 5	Use correct grammar, sentence structure, and formats for professional written communication, including note-making, minutes writing, and email drafting.	BL5

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods : Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

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UNIT-IV **Job-Oriented Skills:** Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews
UNIT-V **Interpersonal relationships**: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships
Text books: 1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011. 2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
Reference books: 1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.

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III Year - II Semester	Code: 23AC6T03	L	T	P	C
		2	0	0	-

TECHNICAL PAPER WRITING & IPR

(Common to CSE, CSE-(AI&DS), AIML, CSE(AI&ML), IT)

Course Objective: The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Course Outcomes: Students are able

CO Number	Course Outcome	Blooms Level
CO 1	Understand the structure and language of technical reports, and demonstrate the ability to plan and organize report content effectively.	BL2
CO 2	Use advanced features of word processors for technical documentation, including formatting, tracking changes, citations, bibliographies, and document protection techniques	BL3
CO 3	Understand the fundamentals of intellectual property rights including patents, copyrights, trademarks, and the international framework for protection and innovation.	BL4
CO 4	Draft clear, concise, and well-structured technical reports using appropriate visuals and adhere to principles of good grammar, spelling, and readability.	BL5
CO 5	Proofread documents for clarity and correctness, summarize content effectively, and develop oral and written presentation skills for technical proposals and reports.	BL6

Unit I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing

Unit II:

Drafting report and design issues: The use of drafts, Illustrations and graphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

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Unit IV: Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes , Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,
Unit V: **Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property
Text Books: 1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016. 2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson. 3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.
Reference Books: 1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011. 2. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)
E-resources: 1. https://www.udemy.com/course/reportwriting/ 2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/ 3. https://www.udemy.com/course/betterbusinesswriting/

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