SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi, Affiliated to JNTUK, Kakinada)
Accredited by NAAC with 'A+' Grade.
Recognised as Scientific and Industrial Research Organisation
SRKR MARG, CHINA AMIRAM, BHIMAVARAM – 534204 W.G.Dt., A.P., INDIA

Regulation: R23	**III / IV - B.Tech. I - Semester**

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE STRUCTURE
(With effect from 2023-24 admitted Batch onwards)

Course Code	Course Name	Category	L	T	P	Cr	C.I.E.	S.E.E.	Total Marks
B23AD3101	Fundamentals of Data Mining	PC	3	0	0	3	30	70	100
B23AD3102	Principles of Machine Learning	PC	3	0	0	3	30	70	100
B23AD3103	Operating Systems	PC	3	0	0	3	30	70	100
#PE-I	Professional Elective-I	PE-I	3	0	0	3	30	70	100
#OE-I	Open Elective-I	OE-I	3	0	0	3	30	70	100
B23AD3110	Data Mining and Machine Learning Lab	PC	0	0	3	1.5	30	70	100
B23AD3111	Data Visualization Lab	PC	0	0	3	1.5	30	70	100
B23BS3101	Soft skills	SEC	0	1	2	2	30	70	100
B23AD3112	User Interface Design Using Flutter (**TinkeringLab**)	ES	0	0	2	1	30	70	100
B23AD3113	Evaluation of Community Service Internship	PR	--	--	--	2	--	50	50
		TOTAL	**15**	**1**	**10**	**23**	**270**	**680**	**950**

	Course Code	Course
#PE-I	B23AD3104	Object Oriented Analysis Design
	B23AD3105	Soft computing
	B23AD3106	Internet of Things
	B23AD3107	Exploratory Data Analysis with Python
	B23AD3108	Computer Networks
	B23AD3109	MOOCS-I
#OE-I	Student has to study one Open Elective offered by CE or ECE or EEE or ME or S&H from the list enclosed.	

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3101	PC	3	--	--	3	30	70	3 Hrs.

FUNDAMENTALS OF DATA MINING

For AIDS

Course Objectives: Students are expected to

1.	Understand and implement classical models and algorithms in data warehousing and data mining.
2.	Analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
3.	Apply various methods to perform various data mining tasks.

Course Outcomes: By the end of the course, the student will be able to:

S.No	Outcome	Knowledge Level
1.	Summarize the architectures and operations of a data warehouse.	**K2**
2.	Apply different data preprocessing techniques and proximity measures on given raw data.	**K3**
3.	Apply suitable classification technique on a given data set.	**K3**
4.	Apply various techniques for generation of strong association rules.	**K3**
5.	Apply suitable techniques to form clusters from a given data set.	**K3**

SYLLABUS

UNIT-I (10Hrs)	**Data Warehousing and Online Analytical Processing**: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, OLTP Vs OLAP, Extract, Transform, and Load (ETL) operations of DWH preparation, Data Warehouse Design and Usage, Operations on a Data cube: Roll-Up, Drill-Down, Slice, Dice, and Pivot, Data Warehouse Implementation, Introduction to Data Mining, Kinds of Patterns That Can Be Mined, Technologies Used, Applications Targeted, Major Issues to Consider in Data Mining**.** (Text Book- 1)
UNIT-II (10 Hrs)	**Data Pre-processing:** An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity. (Text Book- 1)
UNIT-III (10 Hrs)	**Classification:** Basic Concepts, General Approach to Solving a Classification Problem, Decision Tree Induction, Evaluating the Performance of a Classifier, Rule-Based Classifier, Bayesian Classifiers: Bayes Theorem, Using the Bayes Theorem for Classification, Naïve Bayes Classifier. (Text Book- 2)
UNIT-IV (10 Hrs)	**Association Analysis:** Problem Definition, Frequent Itemset Generation, Rule Generation: Confidence-Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of Frequent Item Sets, FP-Growth Algorithm. (Text Book- 2)

UNIT-V (10 Hrs)	**Cluster Analysis**: Overview, Clustering Techniques, Different Types of Clusters, K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-**m**eans, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm**,** Specific Techniques, Key Issues in Hierarchical Clustering, **BIRCH**, Density-Based Approach**: D**BSCAN Algorithm, Strengths and Weaknesses**, OPTICS**. (Text Book**s**- 1**&**2)
Textbooks:	
1.	Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2.	Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.
Reference Books:	
1.	Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher
2.	Data Mining Techniques, Arun K Pujari, 3rd edition, Universities Press,2013.
3.	Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020
e-Resources	
1.	(NPTEL course by Prof.PabitraMitra) http://onlinecourses.nptel.ac.in/noc17_mg24/preview
2.	http://www.saedsayad.com/data_mining_map.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3102	**PC**	**3**	**0**	**0**	**3**	**30**	**70**	**3 Hrs.**

PRINCIPLES OFMACHINE LEARNING

(For AIDS)

Course Objectives:

1.	**To introduce** the fundamental concepts, types, applications, and challenges of Machine Learning
2.	**To develop** the ability to implement regression, classification, and clustering algorithms for data-driven decision-making
3.	**To apply** various Machine Learning models and use performance metrics and optimization techniques to assess their effectiveness.
4	**To describe** the principles of advanced Machine Learning models, including ensemble methods, neural networks, and reinforcement learning, and explain their applications.

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Explain** core Machine Learning concepts, types, challenges, and key principles.	K2
2.	**Apply** appropriate regression techniques, including linear, non-linear, and regularized models like Ridge and Lasso, to solve real-world prediction problems.	K3
3.	**Apply** classification algorithms such as Decision Trees, Naive Bayes, and K-Nearest Neighbors to solve binary, multi-class, and imbalanced classification problems using appropriate evaluation metrics.	K3
4.	**Apply** Support Vector Machines, ensemble learning techniques, and clustering algorithms such as K-Means and K-Medoids to solve classification and clustering problems using appropriate similarity measures.	K3
5.	**Apply** the concepts of Random Forest, Reinforcement Learning, and Artificial Neural Networks to solve real-world classification and decision-making problems.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Machine Learning:** Definition, Relation between AI, ML, DL, Need of Machine Learning, Types of Machine Learning, Applications, Challenges of Machine Learning, Data Acquisition. Features selections and features extraction, Overfitting Vs Underfitting, Bais and variance.

UNIT-II (10 Hrs)	**Linear Regression, Non-Linear Regression:** Introduction, Key differences between Linear Regression and Non-Linear Regression. **Regularization:** Introduction, Types of Regularization, Ridge Regression vs Lasso Regression. **Logistic Regression:** Binary Classification.
UNIT-III (10 Hrs)	**Classification:** Introduction, Types of learners, Binary classifier, Multi-class classification, Multi label classification, Imbalanced classification. **Decision Tree:** Representation, Decision Tree Learning Algorithm (ID3), Metrics for Evaluating Classifier Performance. **Navie Bayes:** Theorem, Bayesian Classification algorithm. K-Nearest Neighbors: Distance Metrics, (KNN) Algorithm, Limitations.
UNIT-IV (10 Hrs)	**Support Vectors:** Linear SVM, Non-Linear SVM, SVR. **Ensembled Learning:** Bagging, Boosting, Stacking, Random Forest. **Cluster Analysis:** Introduction, Basic Clustering Methods, Measures of Similarity and Dissimilarity. **Partitioning Methods:** K-Means and K-Medoids algorithms.
UNIT-V (10 Hrs)	**Introduction:** Random Forest, Reinforcement Learning. **Dimensionality Reduction:** Principal Component Analysis (PCA). **Artificial Neural Networks (ANN):** Introduction, Biological Neurons, Artificial Neurons, Perceptron, Multi-layer Perceptron, performing logical operations, Feedforward Network, Back propagation Algorithm.
Textbooks:	
1.	Machine Learning, Tom M. Mitchell, First Edition, 2017, McGraw Hill Education.
2.	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, AurelienGeron, Third Edition, 2022, O'Reilly
Reference Books:	
1.	Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, 2012, MIT Press
2.	"Machine Learning for Absolute Beginners" – Oliver Theobald
e-Resources	
1.	Introduction to Machine Learning :https://nptel.ac.in/courses/106105152
2.	Introduction to Machine Learning :https://nptel.ac.in/courses/106106139
3.	Machine Learning :https://nptel.ac.in/courses/106106202

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3103	PC	3	--	--	3	30	70	3 Hrs.

OPERATING SYSTEMS

(For AIDS)

Course Objectives:

1.	Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
2.	Makeuseofprocessschedulingalgorithmsandsynchronizationtechniquestoachievebetter Performance of a computer system.
3.	Illustrate different conditions for the deadlock and their possible solutions.

Course Outcomes: By the end of the course, the student will be able to

S.No	Outcome	Knowledge Level
1.	**Describe** Operating System features and system structures.	K2
2.	**Apply** CPU Scheduling Algorithms for Multi Process and Multi-Threaded Operating systems.	K3
3.	**Solve** Process Synchronization problems to avoid the occurrence of Deadlock situations	K3
4.	**Apply** various Memory Management Schemes for Primary and Secondary memory.	K3
5.	**Describe** file Operations and protection methods.	K2

SYLLABUS

UNIT-I (10Hrs)	**Operating Systems Overview:** Introduction, Operating system functions/Operating systems operations, Types of Operating Systems, Free and Open-Source Operating Systems **System Structures**: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating System Structure, Building and Booting on Operating System, Operating system debugging.
UNIT-II (10 Hrs)	**Processes**: Process Concept, Process scheduling, Operations on processes, Inter-process communication. **Threads and Concurrency**: Multithreading models, Thread libraries, Threading issues. **CPU Scheduling**: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.
UNIT-III (10 Hrs)	**Synchronization Tools:** The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from

	Deadlock's
UNIT-IV (10 Hrs)	**Memory-Management Strategies:** Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. **Virtual Memory Management:** Introduction, Demand paging, copy on-write, Page replacement, Frame Allocation, Thrashing, **Storage Management:** Overview of Mass Storage Structure, HDD Scheduling
UNIT-V (10 Hrs)	**File System:** File System Interface: File concept, Access methods, Directory Structure. **File system Implementation:** File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management. **System Protection:** Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.

Textbooks:	
1.	Operating System Concepts, Silberschatz A, Galvin P B, Gagne G,10th Edition Wiley, 2018.
2.	Modern Operating Systems, Tanenbaum A S,4th Edition, Pearson, 2016.
Reference Books:	
1.	Operating Systems-Internals and Design Principles, Stallings W,9th edition, Pearson,2018.
2.	Operating Systems: A Concept Based Approach, D.M Dhamdhere,3rd Edition, McGraw- Hill, 2013.
3.	Nutt G, Operating Systems,3rd edition, Pearson Education,2004.
4.	Operating Systems-Internals and Design Principles, Stallings W,9th edition, Pearson,2018.
5.	Operating Systems: A Concept Based Approach, D.M Dhamdhere,3rd Edition, McGraw- Hill, 2013.
e-Resources	
1.	https://nptel.ac.in/courses/106106144
2.	https://peterindia.net/OperatingSystems.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3104	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

OBJECT-ORIENTED ANALYSIS AND DESIGN

(For AIDS)

Course Objectives:

1.	Become familiar with all phases of OOAD
2.	Understand how to solve complex problems.
3.	Analyze and design solutions to problems using object-oriented approach
4.	Study the notations of Unified Modeling Language
5.	Learn the Object design Principles and understand how to apply them towards Implementation

Course Outcomes: By the end of the course, the student will be able to

S.No	Outcome	Knowledge Level
1.	**Understand** the fundamental concepts of object orientation and structure of complex systems	K2
2.	**Illustrate** & relate the conceptual model of the UML, identify & design the classes and relationships	K3`
3.	**Analyze** & design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams.	K3
4.	**Apply** techniques of Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems.	K3

SYLLABUS

UNIT-I (8 Hrs)	**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation.
UNIT-II (8 Hrs)	**Introduction to UML:** Importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.
UNIT-III (10 Hrs)	**Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.
UNIT-IV (8 Hrs)	**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams.

	Case Study: Web Application: Vacation Tracking System
UNIT-V (8 Hrs)	**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams **Case Study:** Weather Forecasting
Textbooks:	
1.	Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, "Object- Oriented Analysis and Design with Applications", 3rd edition, 2013, PEARSON
2.	Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.
Reference Books:	
1.	Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2.	Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd..
3.	Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies
4.	Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc19_cs48/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3105	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

SOFT COMPUTING

(For AIDS)

Course Objectives:

1.	To introduce the foundations of Artificial Neural Networks.
2.	To acquire knowledge on Soft Computing Concepts.
3.	To learn various types of Genetic algorithms and their applications.
4.	To gain knowledge to apply optimization strategies.

Course Outcomes: At the end of the course, students will be able to

S.No	Outcome	Knowledge Level
1.	**Understand** the concepts of Artificial intelligence and soft computing techniques	K2
2.	**Analyze** the concepts of Neural Networks and select the Learning Networks in modeling real world systems.	K3
3.	**Implement** the concepts of Fuzzy reasoning and concepts of Genetic algorithm and its applications to soft computing.	K3
4.	**Summarizing** Biologically inspired algorithms such as neural networks, genetic algorithms, ant colony optimization, and bee colony optimization.	K2
5.	**Interpreting** hybrid system incorporating neural network, genetic algorithms, fuzzy systems.	K2

SYLLABUS

UNIT-I (6 Hrs)	**Soft Computing and Artificial Intelligence**: Introduction of Soft Computing, Soft Computing vs. Hard Computing, Various Types of Soft Computing Techniques, Applications of Soft Computing, AI Search Algorithm, Predicate Calculus, Rules of Interference, Semantic Networks, Frames, Objects, Hybrid Models.
UNIT-II (9 Hrs)	**Artificial Neural Networks and Paradigms**: Introduction to Neuron Model, Neural Network Architecture, Learning Rules, Perceptrons, Single Layer Perceptrons, Multilayer Perceptrons, Back propagation Networks, Kohnen's self-organizing networks, Hopfield network, Applications of NN.
UNIT-III (12 Hrs)	**Fuzzy Logic**: Introduction, Fuzzy sets and Fuzzy reasoning, Basic functions on fuzzy sets, relations, rule-based models and linguistic variables, fuzzy controls, Fuzzy decision making, applications of fuzzy logic.
UNIT-IV (12 Hrs)	**Genetic Algorithms and Swarm Optimizations**: Introduction, Genetic Algorithm, Fitness Computations, Cross Over, Mutation, Evolutionary Programming, Classifier Systems, Genetic Programming Parse Trees, Variants of GA, Applications, Ant Colony

	Optimization, Particle Swarm Optimization, Artificial Bee Colony Optimization.
UNIT-V (09 Hrs)	**Hybrid Systems**: Neuro fuzzy hybrid systems, Adaptive neuro fuzzy inference systems, Fuzzy backpropagation network, Genetic neuro hybrid system, Genetic algorithm-based backpropagation network, Genetic-fuzzy hybrid systems
Textbooks:	
1.	Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition.
2.	S. Rajasekaran & G. A. Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications", PHI,2003
Reference Books:	
1.	S. N. Sivanandam& S. N. Deepa" Principles of Soft Computing" Wiley – India, 2nd Edition, 2007. 2. 3.
2.	Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall, 1998.
3.	Jacek M. Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House,1994
4.	Zimmermann, "Fuzzy Set Theory and its Application", 3rd Edition
5.	D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y, 1989.
6.	Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3rd edition 2009.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3106	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

INTERNET OF THINGS

(For AIDS)

Course Objectives:

1.	The application areas of IOT
2.	The revolution of Internet in Mobile Devices, Cloud & Sensor
3.	Networks building blocks of Internet of Things and characteristics

Course Outcomes: Upon the completion of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Review** Internet of Things (IoT).	K2
2.	**Apply** design principles for connected devices for efficient data management and device integration	K3
3.	**Implement** web connectivity for connected devices using web communication and message communication protocols.	K3
4.	**Organize** sources of data acquisition related to IoT, integrate to enterprise systems.	K3
5.	**Utilize** IoT with Cloud technologies	K3

SYLLABUS

UNIT-I (10 Hrs)	**Internet of Things: An Overview**- Internet of things, Technology behind IoT, IoT Conceptual Framework, IoT Architectural View, Sources of the IoT, Examples OF IoT, Application Layer Protocols- HTTP, HTTPS, FTP, Telnet.
UNIT-II (10 Hrs)	**Design Principles for Connected Devices:** M2M Communication, IoT/M2M systems Layers and designs standardization- Modified OSI Stack for the IoT/M2M Systems, ETSI M2M domains and High-level capabilities. **Communication Technologies:** Wireless Communication Technology, Wired Communication Technology. Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability.
UNIT-III (10 Hrs)	**Design Principles for the Web Connectivity**: Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected Devices.
UNIT-IV (8 Hrs)	**Data Acquiring, Organizing and Analytics:** Data Acquiring and storing data for an application, service or business process. **Organizing the Data**: Databases, Query Processing, SQL, NOSQL, Extract, Transform and Load, Relational Time Series Service, Real-Time and Intelligence. Transactions, Business Processes, Integration and Enterprise Systems.

UNIT-V (12 Hrs)	**Data Collection, Storage and Computing Using a Cloud Platform:** Cloud computing paradigm for data collection, storage and computing services, everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms. **Sensors, Participatory Sensing, RFIDs and Wireless Sensor Networks:** Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT, Actuator, Radio Frequency Identification, Wireless Sensor Network Technology.
Textbooks:	
1.	Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education
2.	Internet of Things, A. Bahgya and V.Madisetti, University Press, 2015.
Reference Books:	
1.	Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley.
2.	Getting Started with the Internet of Things Cuno Pfister, Oreilly.
3.	Internet of Things and Data Analytics Handbook, HWAIYU GENG, Wiley publications.
4.	Internet of Things from Hype to Reality: The road to Digitization, Ammar Rayes Samersalam.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3107	PE	3	--	--	3	30	70	3 Hrs.

EXPLORATORY DATA ANALYSIS WITH PYTHON

(For AIDS)

Course Objectives:

1.	Introduce the fundamentals of Exploratory Data Analysis
2.	Cover essential exploratory techniques for understanding multivariate data by
3.	Summarizing it through statistical methods and graphical methods.
4.	Evaluate the Models and select the best model

Course Outcomes: Upon the completion of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Demonstrate** knowledge on the concepts of data science to perform mathematical computations using efficient storage and data handling methods in NumPy.	K2
2.	**Apply** Data visualization tools and techniques.	K3
3.	**Apply** Data Preparation and Exploration methods using Pandas to gain insights about raw data and transform quality data to perform analysis.	K3
4.	**Apply** methods to analyze and interpret time series data to extract meaningful statistics.	K3
5.	**Demonstrate** the level of machine learning in Data science.	K2

SYLLABUS

UNIT-I (10 Hrs)	**Exploratory Data Analysis Fundamentals:** Understanding data science, the significance of EDA, Steps in EDA, making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, getting started with EDA. **Sample Experiments:** 1. a) Download Dataset from Kaggle using the following link: https://www.kaggle.com/datasets/sukhmanibedi/cars4u b) Install python libraries required for Exploratory Data Analysis (numpy,pandas, matplotlib, seaborn) 2. Perform Numpy Array basic operations and Explore Numpy Built-in functions. 3. Loading Dataset into pandas dataframe 4. Selecting rows and columns in the dataframe
UNIT-II (10 Hrs)	**Visual Aids for EDA:** Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart Case Study: EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis.

	Sample Experiments: 1. Apply different visualization techniques using sample dataset a. Line Chart b. Bar Chart c. Scatter Plots d.Bubble Plot 2. Generate Scatter Plot using seaborn library for iris dataset 3. Apply following visualization Techniques for a sample dataset a. Area Plot b. Stacked Plot c. Pie chart d. Table Chart 4. Generate the following charts for a dataset. a. Polar Chart b. Histogramc.Lollipop chart 5. Case Study: Perform Exploratory Data Analysis with Personal Email Data
UNIT-III (10 Hrs)	**Data Transformation: Merging database**-style data frames, Concatenating along with an axis, merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges. **Sample Experiments:** 1. Perform the following operations a) Merging Dataframes b) Reshaping with Hierarchical Indexing c) Data Deduplication d) Replacing Values 2. Apply different Missing Data handling techniques a) NaN values in mathematical Operations b) Filling in missing data c) Forward and Backward filling of missing values d) Filling with index values e) Interpolation of missing values 3. Apply different data transformation techniques a) Renaming axis indexes b) Discretization and Binning c) Permutation and Random Sampling d) Dummy variables
UNIT-IV (8 Hrs)	**Descriptive Statistics:** Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis **Sample Experiments:** 1. Study the following Distribution Techniques on sample data a) Uniform Distribution b) Normal Distribution c) Gamma Distribution d) Exponential Distribution e) Poisson Distribution f) Binomial Distribution 2. Perform Data Cleaning on a sample dataset. 3. Compute measure of Central Tendency on a sample dataset a) Mean b) Median c) Mode 4. Explore Measures of Dispersion on a sample dataset a) Variance b) Standard Deviation c) Skewness d) Kurtosis 5. a) Calculating percentiles on sample dataset b) Calculate Inter Quartile Range (IQR) and Visualize using Box Plots 6. Perform the following analysis on automobile dataset.

	a) Bivariate analysis b) Multivariate analysis 7. Perform Time Series Analysis on Open Power systems dataset
UNIT-V (12 Hrs)	Model Development and Evaluation: Unified machine learning workflow, Data pre-processing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, best model selection and evaluation, Model deployment Case Study: EDA on Wine Quality Data Analysis **Sample Experiments:** 1. Perform hypothesis testing using stats model's library a) Z-Test b)T-Test 2. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score. 3. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset
Textbooks:	
1.	Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020.
Reference Books:	
1.	Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press, 2020
2.	RadhikaDatar, Harish Garg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, 1st Edition, Packt Publishing, 2019
e-Resources	
1.	https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python
2.	https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-dataanalysis-eda-using-python/#h-conclusion
3.	https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3108	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

COMPUTER NETWORKS

(For AIDS)

Course Objectives:

1.	To understand the different types of networks.
2.	To discuss the software and hardware components of a network.
3.	To develop an understanding of the principles of computer networks.
4.	To calculate IPv4 subnet addresses proficiently and explain network layer protocols such as IP, ICMPv4, and routing algorithms.
5.	To explain the functionalities of transport layer protocols (TCP and UDP), including flow control, error control, and congestion control mechanisms. Describe common application layer protocols like HTTP, Telnet, and DNS and their respective roles in networking applications.

Course Outcomes: Upon the completion of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Explain** protocol layering, digital, analog signals, data rates, and performance issues in the physical layer.	K2
2.	**Explain** transmission media, switching, link layer addressing, and error handling.	K2
3.	**Explain** various data link layer protocols.	K2
4.	**Calculate** IPv4 subnet addresses, explain network layer protocols.	K3
5.	**Explain** transport layer and application layer protocols	K2

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** Data communications, Networks, Network Types, Standards and administration; Protocol Layering, TCP/IP Protocol suite, OSI Model (introduction); Introduction to Physical layer: Data and Signals, Periodic analog signals, Digital signals, Transmission impairments, data rate limits, performance.
UNIT-II (10 Hrs)	**Transmission Media:** Introduction, Guided media, Un-guided media. Switching: Introduction, Circuit-Switched networks, Packet switching, Structure of a switch. **Data Link Layer:** Introduction, Link-layer addressing. Error Detection and Correction: Types of errors, Block Coding, Cyclic Redundancy Check, Checksum. Hamming code
UNIT-III (10 Hrs)	**Data Link Control:** DLC Services, Framing, Finite State Machine (FSM), Stop-and-Wait protocol, HDLC, PPP. Media Access Control (MAC): Random Access, ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled access: reservation, polling, token passing. Channelization: FDMA, TDMA, CDMA. Introduction to Ethernet and types of Ethernets.

UNIT-IV (10 Hrs)	**Network Layer:** network layer services, packet switching, network layer performance, IPv4 addressing, DHCP, NAT, Forwarding of IP Packets. Network Layer Protocols: Internet Protocol (IP), Datagram Format, ICMPv4, Distance vector and Link state routing. Hierarchical routing, Introduction to IPv6.
UNIT-V (10 Hrs)	**Transport Layer**: Services, flow control, error control, congestion control, connectionless and connection-oriented protocols, Stop-and-wait, Go-back-N. UDP and TCP segment formats. TCP services, connection establishment, TCP three-way handshake, TCP States, and state transition diagram. **Application Layer protocols:** HTTP, Telnet, DNS.

Textbooks:	
1.	Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2.	Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition
Reference Books:	
1.	James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.
2.	Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.
3.	Computer Networks and Internets, Douglas E Corner, fourth Edition, Pearson Education.
e-Resources	
1.	Cisco Networking Academy, CCNAv7 Introduction to Networks
2.	https://www.geeksforgeeks.org/computer-networks-for-gate/
3.	https://www.netacad.com/courses/ccna-introduction-networks?courseLang=en-US
4.	https://www.cisco.com/c/en/us/solutions/enterprise-networks/what-is-computer-networking.html
5.	https://www.cisco.com/site/in/en/products/networking/index.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3110	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

DATA MINING AND MACHINE LEARNING LAB

(For AIDS)

Course Objectives:

1	Introduce students to data mining and machine learning using the WEKA toolkit through hands-on dataset exploration and model evaluation.
2	To implement different mechanisms in preprocessing and model evaluation using python
3	To implement different dimensionality reduction, clustering & classification techniques.
4	To implement simple linear, logistic regressions and Feed-Forward Network.

Course Outcomes: Upon the completion of the course students will be able to

S.No	Outcome	Knowledge Level
1	**Apply** WEKA tool to perform data preprocessing tasks like filtering, attribute selection and data transformation.	K3
2	**Apply** preprocessing techniques, dimensional reduction on custom data sets.	K3
3	**Develop**, evaluate and save the different clustering, regression and classification models	K4
4	**Implement** perceptron models using machine learning frameworks	K3

SYLLABUS

1	**Explore machine learning tool "WEKA"** Explore WEKA Data Mining/Machine Learning Toolkit. Downloading and/or installation of WEKA data mining toolkit. Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface. Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, classify panel, Cluster panel, Associate panel and Visualize panel). Study the *.arff*(Attribute-Relation File Format) Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.). **Load each dataset and observe the following:** a. List the attribute names and their types b. Number of records in each dataset c. Identify the class attribute (if any) d. Plot Histogram e. Determine the number of records for each class. f. Visualize the data in various dimensions.

2	**Demonstrate performing classification on data sets (Weather dataset, Iris dataset) using WEKA tool.** a. Load each dataset and run the ID3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistics. b. Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix. c. Load each dataset into Weka and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained. d. Plot ROC (Receiver Operating Characteristic) Curves. e. Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify.
3	**DATA PREPROCESSING – CONTINUOUS / DISCRETE DATA**: For a given set of training data examples stored in a .CSV file, demonstrate Data Preprocessing in Machine learning with the following steps a. Getting the dataset. b. Importing libraries. c. Importing datasets. d. Finding Missing Data. e. Finding Outliers f. Splitting dataset into training and test set. g. Feature scaling
4	Data Preprocessing: Write a program to implement Categorical Encoding, One-hot Encoding
5	Analyze an online dataset by identifying the optimal balance between bias and variance to minimize overall prediction error.
6	Develop a program to implement linear and multiple regression models.
7	Write a program to implement logistic regression for binary classification and multiclass classification
8	Apply regularization methods (Lasso and Ridge Regression) on a dataset and evaluate their effectiveness in reducing overfitting and minimizing prediction error.
9	Implement the ID3 algorithm for decision tree construction and apply it to a dataset for classification tasks.
10	Implement the Naive Bayes classification algorithm and apply it on a dataset to predict class labels with probabilistic reasoning.
11	Compare the performance of a simple classifier K-NN using different distance metrics.
12	Implement and visualize basic clustering techniques such as K-Means and Hierarchical Clustering on real-world or synthetic datasets.
13	Implement a program to reduce the dimensionality of a dataset using PCA while retaining the most significant features and to visualize the effect of dimensionality reduction.
14	Implement the K-Means clustering algorithm and analyze the grouping of data into clusters based on similarity.
15	Implement a single-layer and multi-layer perceptron using a framework like scikit-learn or TensorFlow.
Textbooks:	
1.	Machine Learning with WEKA Author: Ian H. Witten

2.	Chris Albon, “Machine Learning with Python Cookbook-practical solutions frompreprocessing to Deep learning”, O’REILLY Publisher,2018
Reference Books:	
1.	https://scikit-learn.org/stable/modules/generated/sklearn.linear_model.Perceptron
2.	https://medium.com/ml-research-lab/
3.	https://machinelearningmastery.com/implement-backpropagation-algorithm-scratch-python/
4.	https://www.analyticsvidhya.com/blog/2016/01/guide-data-exploration/
5.	https://www.pyimagesearch.com/2020/02/17/autoencoders-with-keras-tensorflow-and-deeplearning

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3111	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

DATA VISUALIZATION LAB

(For AIDS)

Course Objectives:

1	To visualize the different datasets using histograms, line charts.
2	To understand the use of bar charts and box plots.
3	To understand Scatter plots, mosaic plots
4	To understand different Map visualizations
5	To learn advanced graphs such as correlogram, heatmap and 3D graphs.

Course Outcomes: Upon the completion of the course students will be able to

S.No	Outcome	Knowledge Level
1	**Visualize** the different datasets using histograms, line charts	K2
2	**Make** use of bar charts and box plots on different datasets	K3
3	**Apply** Scatter plots, mosaic plots in R for different datasets	K3
4	**Apply** different Map visualizations in R	K3
5	**Create** advanced graphs such as correlogram, heatmap and 3D graphs.	K4

SYLLABUS

1	a) Load VADeaths (Death Rates in Virginia) dataset in R and visualize the data using different histograms. b) Load air quality dataset in R and visualize La Guardia Airport's daily maximum temperature using histogram.
2	Load AirPassengers dataset in R and visualize the data using line chart that shows increase in air passengers over given time period.
3	a) Load iris dataset in R, visualize the data using different Bar Charts and also demonstrate the use of stacked plots. b) Load air quality dataset in R and visualize ozone concentration in air.
4	a) Load iris dataset in R, visualize the data using different Box plots including group by option and also use color palette to represent species. b) b) Load air quality dataset in R and visualize air quality parameters using box plots.
5	Visualize iris dataset using simple scatter, multivariate scatter plot and also visualize scatter plot matrix to visualize multiple variables across each other.
6	Load diamonds dataset in R and visualize the structure in datasets with large data points using hexagon binning and also add color palette then use the
7	Load HairEyeColor dataset in R and plot categorical data using mosaic plot.
8	Load mtcars dataset in R and visualize data using heat map.
9	Install leaflet library in R and perform different map visualizations.
10	Visualize iris dataset using 3d graphs such as scatter3d, cloud, xyplot.

11	Make use of correlogram to visualize data in correlation matrices for iris dataset.
12	Install maps library in R and draw different map visualizations.
Text Books:	
1	Machine Learning with WEKA Author: Ian H. Witten
2	Chris Albon, “Machine Learning with Python Cookbook-practical solutions frompreprocessing to Deep learning”, O’REILLY Publisher,2018
E-Resources:	
1	https://www.analyticsvidhya.com/blog/2015/07/guide-data-visualization-r/
2	https://www.geeksforgeeks.org/data-visualization-in-r/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23BS3101	SEC			2	1	30	70	3 Hrs.

SOFT SKILLS

(For AIDS, CIC, CSIT, CSD, ECE and EEE)

Course Objectives:

1	To familiarise students with soft skills and how they influence their professional growth.
2	To build/refine the professional qualities/skills necessary for a productive career and to instill confidence through attitude building.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Interpret the essence of key soft skills such as creativity & problem solving, emotional intelligence, leadership qualities, etc.	K2
2	Outline interview essentials for graduate-job prospects.	K2
3	Apply presentation skills in academic and professional settings.	K3
4	Demonstrate knowledge about domain specific industry and the prospective workplace.	K2

SYLLABUS

1	**INTRODUCTION** Introduction to soft skills, definition and meaning, importance and need in personal and professional settings; soft skills vs. hard skills; personality development.
2	**INTRA-PERSONAL AND INTER-PERSONAL COMMUNICATION** Significance of Inter & Intra-Personal Communication; SWOT Analysis; Goal Setting – Guidelines for Goal Setting; Emotional Intelligence; Creativity & Problem Solving; Stress and Time Management; Leadership & Team Work; Building a positive attitude, Social Consciousness.
3	**WRITTEN COMMUNICATION** Resume Preparation: Common resume blunders, Tips for betterment, Resume Review; Report Writing; Writing an SOP (Statement of purpose).
4	**PRESENTATION SKILLS** Importance of Presentation Skills; JAM; Essential guidelines for Group Discussions; Debates; Role Plays; PPTs etc.
5	**INTERVIEW SKILLS** Employability Skills: Knowing about Selection Process; Interview Skills, types of Interviews, E-Interviews, Do's and Don'ts of Interviews, FAQs, Mock Interviews; Awareness about Industries; Importance of researching the prospective workplace.

Text Books:

1	Sherfield, M. Robert et al, Cornerstone Developing Soft Skills,(4th edition), Pearson Publication, New Delhi, 2014.
2	Alka Wadkar, Life Skills for Success,(1st edition), Sage Publications India Private Limited, 2016.

3	Soft Skills : Know Yourself and Know the World by Dr. K. Alex, S. Chand & Company Ltd., New Delhi, 2009.
Reference Books:	
1	Sambaiah.M. Technical English, Wiley Publishers India. New Delhi. 2014.
2	Gangadhar Joshi, From Campus to Corporate, SAGE TEXT, 2015.
3	Alex.K, Soft Skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
4	Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principle and Practice, Oxford University Press, 2009.
5	Emotional Intelligence by Daniel Goleman, Random House Publishing Group, 2012.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3112	ES	--	1	2	2	30	70	3 Hrs.

USER INTERFACE DESIGN USING FLUTTER (TINKERING LAB)

(For AIDS)

Course Objectives:

1.	Learns to Implement Flutter Widgets and Layouts
2.	Understands Responsive UI Design and with Navigation in Flutter
3.	Knowledge on Widgets and customize widgets for specific UI elements, Themes
4.	Understand to include animation apart from fetching data

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Develop** mobile user interfaces using Flutter widgets like Text, Image, Container, Row, and Column.	K3
2.	**Implement** responsive layouts using Flutter's layout widgets and media queries to support multiple screen sizes.	K3
3.	**Use** Flutter's navigation system to create multi-screen applications with both direct and named route navigation.	K3
4.	**Apply** appropriate widget types (stateless or stateful) in Flutter applications to manage UI updates based on user interactions.	K3
5.	**Apply** navigation techniques and basic state management using set State and named routes in Flutter applications.	K3

SYLLABUS

1.	a) Install Flutter and Dart SDK. b) Write a simple Dart program to understand the language basics.
2.	a) Explore various Flutter widgets (Text, Image, Container, etc.). b) Implement different layout structures using Row, Column, and Stack widgets.
3.	a) Design a responsive UI that adapts to different screen sizes. b) Implement media queries and breakpoints for responsiveness.
4.	a) Set up navigation between different screens using Navigator. b) Implement navigation with named routes.
5.	a) Learn about stateful and stateless widgets. b) Implement state management using set State and Provider.
6.	a) Create custom widgets for specific UI elements. b) Apply styling using themes and custom styles.
7.	a) Design a form with various input fields. b) Implement form validation and error handling.
8.	a) Add animations to UI elements using Flutter's animation framework. Experiment with different types of animations (fade, slide, etc.).
9.	a) Fetch data from a REST API. Display the fetched data in a meaningful way in the UI.
10.	a) Write unit tests for UI components. b) Use Flutter's debugging tools to identify and fix issues.

Reference Books:

1.	Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2.	Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres
3.	Richard Rose, Flutter & Dart Cookbook, Developing Full stack Applications for the Cloud, Oreilly.
E-Resources:	
1.	https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_SMARTBRIDGE_06
2.	https://onlinecourses.nptel.ac.in/noc21_ar05/preview

Regulation: R23	III / IV - B.Tech. II - Semester

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE STRUCTURE
(With effect from 2023-24 admitted Batch onwards)

Course Code	Course Name	Category	L	T	P	Cr	C.I.E.	S.E.E.	Total Marks
B23AD3201	Big Data Analytics	PC	3	0	0	3	30	70	100
B23AD3202	Deep Learning	PC	3	0	0	3	30	70	100
B23AD3203	Natural Language Processing	PC	3	0	0	3	30	70	100
#PE-II	Professional Elective-II	PE-II	3	0	0	3	30	70	100
#PE-III	Professional Elective-III	PE-III	3	0	0	3	30	70	100
#OE-II	Open Elective – II	OE-II	3	0	0	3	30	70	100
B23AD3215	Deep Learning & Natural Language Processing Lab	PC	0	0	3	1.5	30	70	100
B23AD3216	Big Data Analytics Lab	PC	0	0	3	1.5	30	70	100
B23AD3217	Full Stack Development-2	SEC	0	1	2	2	30	70	100
B23AC3201	Technical Paper Writing & IPR	AC	2	0	0	--	30	--	30
B23MC3201	Employability Skills	MC	2	0	0	--	30	--	30
		TOTAL	**22**	**1**	**8**	**23**	**330**	**630**	**960**

	Course Code	Course
#PE-II	B23AD3204	Cryptography & Network Security.
	B23AD3205	Object Oriented Software Engineering
	B23AD3206	Recommender System
	B23AD3207	Computer Vision
	B23AD3208	Automata Theory & Compiler Design
	B23AD3209	MOOCS-II
#PE-III	B23AD3210	Quantum Computing
	B23AD3211	NoSQL databases
	B23AD3212	Cloud Computing
	B23AD3213	Social Media Analytics
	B23AD3214	MOOCS-III
#OE-II	Student has to study one Open Elective offered by CE or ECE or EEE or ME or S&H from the list enclosed.	
*Mandatory Industry Internship /Mini Project of 08 weeks duration during summer vacation		

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3201	PC	3	--	--	3	30	70	3 Hrs.

BIG DATA ANALYTICS

(For AIDS)

Course Objectives:

1	Provide an overview of an exciting growing field of Big Data analytics.
2.	Understand how to solve complex problems using Map Reduce
3.	Introduce the tools required to manage and analyze Big Data like Hadoop Map Reduce, Pig & Hive etc.,

Course Outcomes: By the end of the course, the student should have the ability to

S.No	Outcome	Knowledge Level
1.	**Understand** the existing technologies and the need of distributed files Systems to analyze the Big Data	K2
2.	**Explore** the features of HDFS and Map Reduce to handle the Big Data and identify the need of interfaces to perform I/O operations in Hadoop	K2
3.	**Implement** and **analyze** Map-Reduce programming model for better optimization on Big Data.	K3
4.	**Apply** stream processing techniques to analyze real-time data streams and explore the spark environment.	K3
5.	**Identify** the need of Modern tools, viz., Pig and Hive, Hbase etc., and its applications on Big Data Analytics	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Big Data**: Introduction to Big Data, Characteristics of Big Data Applications of BD, Types of Data, Concept of Serialization, Wrapper Classes. **Distributed File System:** Scaling Out, Google File System (GFS), Hadoop Distributed File System (HDFS), Components/Building blocks of Hadoop-v1 and Hadoop-v2.
UNIT-II (10Hrs)	**HDFS Design**: HDFS features, HDFS Concepts: Rack, Cluster, File Blocks, Rack awareness and Replication, Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files, HDFS Read & Write. **Map Reduce**: Anatomy of a Map Reduce Job Run (classic Map Reduce and Yarn), Job Scheduling, Shuffle and Sort, Failures.
UNIT-III (12 Hrs)	**Analyzing the Data with Hadoop:** Hadoop Streaming, Java Interfaces to Map Reduce**,** Basic programs of Hadoop Map Reduce: Mapper code, Reducer code, Driver code, Record Reader, Combiner, Pratitioner, Map Reduce word count example, Matrix multiplication using Map Reduce.

UNIT-IV (8 Hrs)	**Stream Processing:** Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Queries on Streams- Filtering Streams: Blooms Filter, Counting Distinct Elements in a Stream: FM Algorithm, Estimating Moments, Finding frequent elements: Decaying Window, Counting 1's in a window: DGIM Algorithm**.** **Introduction to Spark:** Spark Concept, Architecture and components, Spark RDD (Resilient Distributed Dataset) – Spark RDD operations.
UNIT-V (10Hrs)	**Pig:** Hadoop Programming Made Easier Admiring the Pig Architecture, Data processing operators in Pig, Basic Scripting with Pig Latin. **Applying Structure to Hadoop Data with Hive:** Hive Architecture, HiveQL, Hive Data Types, Querying Data in Hive. **Hbase and Zookeeper:** Fundamentals of Hbase, Hbase Data model, Architecture of Hbase, Compaction, Zookeeper Architecture and its role in Hbase Architecture.
Textbooks:	
1.	Hadoop: The Definitive Guide by Tom White, 3rd Edition, O‟ Reilly
2.	Wiley & Big Java 4th Edition, Cay Horstmann, Wiley John Sons, INC
Reference Books:	
1.	Hadoop in Action by ChuckLam, MANNING Publications
2.	Hadoop for Dummies by DirkdeRoos, PaulC. Zikopoulos, RomanB. Melnyk, Bruce Brown and Rafael Coss
e-Resources	
1.	Hadoop: https://hadoop.apache.org/
2.	Hive:https://cwiki.apache.org/confluence/display/Hive/Home/
3.	Piglatin: https://pig.apache.org/docs/r0.7.0/tutorial.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3202	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DEEP LEARNING

(For AIDS)

Course Objectives:

1.	**Understand** the fundamental concepts of deep learning, including neural networks, optimization techniques, and activation functions.
2.	**Apply** deep learning models using TensorFlow and PyTorch for computer vision and natural language processing tasks.
3.	**Analyze** model performance using evaluation metrics and optimization techniques to improve accuracy and generalization.
4.	**Create** and deploy deep learning applications for real-world problems, including image classification, NLP, and generative models.

Course Outcomes :By the end of the course, the student should have the ability to

S.No	Outcome	Knowledge Level
1.	**Demonstrate** a strong understanding of deep learning concepts, including neural networks, CNNs, RNNs, and optimization techniques.	K2
2.	Understand the working of Artificial Neural Network in decision making	K2
3.	Apply Convolutional Neural Networks to solve problem in Computer vision	K3
4	Apply Deep learning techniques in solving practical applications in NLP	K3
5.	**Develop** and deploy real-world deep learning applications to solve practical problems in areas such as image classification and NLP.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Deep Learning: Biological** Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logi**c,** Linear Perceptron, Perceptron Learning Algorithm, Linear separability, Convergence theorem for Perceptron Learning Algorithm...
UNIT-II (10Hrs)	**Artificial Neural Networks (ANN):** Architecture of ANN (Input, Hidden, Output Layers), Backpropagation and Gradient Descent Activation Functions: ReLU, Sigmoid, Tanh, Softmax. Loss Functions: MSE, Cross-Entropy, Hinge Loss. **Overfitting & Underfitting:** Regularization Techniques (Dropout, L1/L2)
UNIT-III (10 Hrs)	**Convolutional Neural Networks (CNN) for Computer Vision:** Introduction to CNNs and Their Importance, Convolution & Pooling Operations, CNN Architectures (LeNet, AlexNet, VGG, ResNet), Transfer Learning & Pretrained Models, **Object Detection** (YOLO, SSD, Faster R-CNN)

UNIT-IV (10 Hrs)	**Recurrent Neural Networks (RNN) & NLP Applications**: Introduction to Sequential Data Processing, Basics of RNN, Vanishing Gradient Problem, LSTMs, Word Embeddings (Word2Vec, GloVe), Attention Mechanisms & Transformers, Introduction to Large Language Models (BERT, GPT)
UNIT-V (10 Hrs)	**Advanced Deep Learning & Applications:** Generative Models (GANs, Variational Autoencoders), Reinforcement Learning (Q-Learning, Deep Q Networks), Explainability & Interpretability in Deep Learning, Model Deployment (Flask, Fast API), Ethics in AI & Future Trends
Textbooks:	
1.	Hadoop: The Definitive Guide by Tom White, 3rd Edition, O‟ Reilly
2.	Wiley & Big Java 4th Edition, Cay Horstmann, Wiley John Sons, INC
Reference Books:	
1.	Hadoop in Action by ChuckLam, MANNING Publications
2.	Hadoop for Dummies by DirkdeRoos, PaulC. Zikopoulos, RomanB. Melnyk, Bruce Brown and Rafael Coss
e-Resources	
1.	Hadoop: https://hadoop.apache.org/
2.	Hive:https://cwiki.apache.org/confluence/display/Hive/Home/
3.	Piglatin: https://pig.apache.org/docs/r0.7.0/tutorial.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3203	PC	3	–	--	3	30	70	3 Hrs.

NATURAL LANGUAGE PROCESSING

(For AIDS)

Course Objectives:

1.	This course introduces the fundamental concepts and techniques of natural language processing (NLP).
2.	Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
3.	The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approach
4	Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Demonstrate** a given text with basic Language features	K2
2.	**Execute** an innovative application using NLP components	K3
3.	**Explain** a rule-based system to tackle morphology/syntax of a language	K2
4.	**Design** a tag set to be used for statistical processing for real-time applications	K3
5.	**Execute** different statistical approaches for different types of NLP applications.	K2

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** Origins and challenges of NLP-Language Modeling: Grammar-based LM, Statistical LM, Regular Expressions, Finite-State Automata, English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.
UNIT-II (10 Hrs)	**Word Level Analysis:** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS Tagging-Hidden Markov and Maximum.
UNIT-III (10 Hrs)	**Syntactic Analysis:** Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar, Dependency Grammar, Syntactic Parsing, Ambiguity, Dynamic Programming parsing, Shallow parsing, Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs, Feature structures, Unification of feature structures

UNIT-IV (10 Hrs)	**Semantics And Pragmatics:** Requirements for representation, First-Order Logic, Description Logics, Syntax-Driven Semantic analysis, Semantic attachments, Word Senses, Relations between Senses, Thematic Roles, selectional restrictions, Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods, Word Similarity using Thesaurus and Distributional methods.
UNIT-V (10 Hrs)	**Discourse Analysis and Lexical Resources:** Discourse segmentation, Coherence, Reference s Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm, Coreference Resolution, Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).
Textbooks:	
1.	Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication, 2014.
2.	Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.
Reference Books:	
1.	Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2.	Natural Language Processing with Java, 2nd Edition, Richard M Reese, OReilly Media, 2015.
3.	Handbook of Natural Language Processing, Second, Nitin Indurkhya and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4.	Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press,2008.
e-Resources	
1.	https://nptel.ac.in/courses/106105158
2.	https://sites.google.com/view/nlp-cs60075/course-materials
3.	https://intellipaat.com/blog/what-is-natural-language-processing/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3204	PE	3	--	--	3	30	70	3 Hrs.

CRYPTOGRAPHY & NETWORK SECURITY

(For AIDS)

Course Objectives:

1.	Solving problems using algorithm design methods such as the RSA, DES, AES
2.	Analyze the performance of algorithms.
3.	Demonstrate a familiarity with major algorithms and Internet security Protocols.

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Apply** the mathematical background required for cryptography.	K3
2.	**Analyze** the algorithms on security problems	K3
3.	**Analyze** symmetric and asymmetric approaches for cryptography.	K3
4.	**Understand** authentication mechanisms for internet security.	K2
5.	**Understand** the principles of Internet security protocols for Internet applications.	K2

SYLLABUS

UNIT-I (8Hrs)	**INTRODUCTION TO NUMBER THEORY:** Prime Numbers, Fermat's and Eulers Theorems, Testing for Primality, The Chinese Remainder Theorem, Euclidean theorem. **INTRODUCTION TO SECURITY:** The need for security-Security approaches, principals of security, plain text and cipher Text- Types of attacks
UNIT-II (8 Hrs)	**CRYPTOGRAPHY CONCEPTS AND TECHNIQUES:** Substitution and Transportation Techniques –Encryption Techniques –Encryption and Decryption-Symmetric and Asymmetric Cryptography – Stenography **SYMMETRIC KEY CRYPTOGRAPHIC ALGORITHMS:** Feistel Cipher Structure, Data encryption standard, Triple DES, Stream Ciphers and RC4.
UNIT-III (8 Hrs)	**ASYMMETRIC KEY CRYPTOGRAPHIC ALGORITHMS:** Overview of asymmetric key cryptography, Diffie Hellman Key exchange, RSA algorithm-symmetric and asymmetric key cryptography together-Message Digest- MAC- HMAC- digital signatures.
UNIT-IV (8 Hrs)	**PUBLIC KEY INFRASTRUCTURE:** Introduction-Digital Certificates-Private Key management-The PKIX model. **USER AUTHENTICATION MECHANISMS:** Introduction-Authentication basics-passwords authentication tokens-certificate based authentication-biometrics authentication-KDC, Kerberos

UNIT-V (8 Hrs)	**INTERNET SECURITY PROTOCOLS:** Basic concepts -SSL-SHTTP-TSP-SET- SSL versus SET-Email security- Simple SMTP, Privacy Enhanced Mail (PEM), Pretty Good Privacy (PGP) S/MIME, Introduction to firewalls-IP security-Virtual Private Networks
Textbooks:	
1.	Cryptography and Network security, Atul Kahate, Tata McGraw-Hill Pub company Ltd., New Delhi
2.	Cryptography and network security, principles and Practices by William Stallings, 3rd edition, Pearson Pub
Reference Books:	
1.	Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi.
2.	Network Security: The Complete Reference by Roberta Bragg, Mark Phodes- Ousley, Keith Strassberg Tata Mcgraw-Hill.
3.	Computer Security by William Stallings and Lawrie Brown, Pearson Pub

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3205	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

OBJECT ORIENTED SOFTWARE ENGINEERING

(For AIDS)

Course Objectives:

1.	**Explain** the importance of OOSE in Software development.
2.	**Explain** the students the importance of Requirements Engineering.
3.	**Explain** the role of UML and Testing in Software Development.
4	**Explain** the role of UML and Testing in Software Development.

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Apply** OOSE concepts to define a problem and perform analysis to Requirements Engineering.	K2
2.	**Design** UML diagrams for the requirements gathered.	K3
3.	**Implement** the designed problem in Object Oriented Programming Language.	K3
4.	**Test** whether all the requirements specified have been achieved or not.	K3
5	**Apply** OOSE concepts to define a problem and perform analysis to Requirements Engineering.	K2

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Object Oriented Software Engineering**: Nature of the Software, Types of Software, Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction to Object Orientation, Software Process Models-Waterfall Model, Opportunistic Model, Phased Released Model, Spiral Model, Evolutionary Model, Concurrent Engineering Model. **Requirements Engineering**: Domain Analysis, Problem Definition and Scope, Requirements Definition, Types of Requirements, Techniques for Gathering and Analyzing Requirements.
UNIT-II (10 Hrs)	**Unified Modeling Language & Use Case Modeling:** Introduction to UML, Modeling Concepts, Types of UML Diagrams with Examples; User-Centered Design, Characteristics of Users, Developing Use - Case Models of Systems, Use-Case Diagram, Use- Case Descriptions, Basics of User Interface Design, Usability Principles, Interaction and Behavioral Diagrams: Interaction Diagrams, State Diagrams, Case Study.
UNIT-III (10 Hrs)	**Class Design and Class Diagrams**: Class Design and Class Diagrams: Essentials of UML Class Diagrams, Associations and Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Component, Deployment Diagrams and Activity Diagrams, Case Study.

UNIT-IV (10 Hrs)	**Software Design and Architecture**: Process of Design, Principles Leading to Good Design, Pattern Introduction, Design Patterns: Abstraction-Occurrence Pattern, General Hierarchical Pattern, Play-Role Pattern, Singleton Pattern, Observer Pattern, Delegation Pattern, Adaptor Pattern, Façade Pattern, Immutable Pattern, Read-Only Interface Pattern and The Proxy Pattern; Software Architecture Contents of Architecture Model, Architectural Patterns: Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter and MVC Architectural Patterns.
UNIT-V (10 Hrs)	**Software Testing & Software Process Management**: Overview of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OO Test Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis, Introduction to Software Project Management, Activities of Software Project Management, Structure of Project Plan, Software Cost Estimation, Project Scheduling.

CASE STUDY	
1	Simple Chat Instant Messaging System
2	GPS Based Automobile Navigation System
3	Waste Management Inspection Tracking System (WMITS)
4	Geographical Information System
5	Simple Chat Instant Messaging System
Textbooks:	
1.	Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert, LanganiereMcgraw-Hill
2.	Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.
Reference Books:	
1.	Software Engineering: A Practitioner's Approach, Roger S Pressman.
2.	A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A Sykes, Addison-Wesley Professional.
3.	Software Engineering, K.K. Agarwal, New Age Publications 2008

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3206	PE	3	--	--	3	30	70	3 Hrs.

RECOMMENDER SYSTEMS

(For AIDS)

Course Objectives:

1.	This course covers the basic concepts of recommended systems, including personalization algorithms, evaluation tools, and user experiences.

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Explain** the core functions, applications, and challenges of recommender systems using linear algebra concepts.	K2
2.	**Apply** user-based and item-based collaborative filtering techniques to generate personalized recommendations.	K3
3.	**Apply** classification techniques on given item profiles for content-based and knowledge-based recommendations.	K3
4.	**Summarize** various hybridization strategies in recommender systems and their limitations.	K2
5.	**Apply** appropriate evaluation metrics to assess the performance of recommender systems on historical data.	K3

SYLLABUS

UNIT-I (10 Hrs)	**Introduction:** Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.
UNIT-II (10 Hrs)	**Collaborative Filtering**: User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.
UNIT-III (10 Hrs)	**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 (10 Hrs)	**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 (10 Hrs)	**Evaluating Recommender System:** Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centered metrics. **Recommender Systems and communities:** Communities, collaboration and recommender systems in personalized web search, social tagging recommender systems, Trust and recommendations.
Textbooks:	
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.
e-Resources	
1.	https://nptel.ac.in/courses/127105390
2.	https://www.edx.org/learn/machine-learning/universite-de-montreal-recommender-systems-behind-the-screen

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3207	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

COMPUTER VISION

(For AIDS)

Course Objectives:

1.	To introduce students the fundamentals of image formations, the major ideas, methods, and techniques of computer vision and pattern recognition.
2.	To develop an appreciation for various issues in the design of computer vision and object recognition systems.
3.	To provide the student with programming experience from implementing computer vision and object recognition applications.

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	**Identify** basic concepts, terminology, theories, models and methods in the field of computer vision	K2
2.	**Describe** known principles of feature detection and matching	K2
3	**Describe** Structure and motion concepts.	K2
4	**Describe** basic methods of computer vision related to image stitching, photography like high dynamic range imaging and blur removal.	K2
5	**Suggest** a design of a computer vision system for 3D Reconstruction, Albedos, image-based rendering views and depths.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction:** Image Formation: Geometric Primitives and Transformation, Photometric Image Formation, Digital Camera, Image Processing: Point Operators, Linear Filtering, More Neighborhood Operators, Fourier Transforms, Pyramids and Wavelets, Geometric Transformations, Global Optimization.
UNIT-II (10 Hrs)	**Feature Detection and Matching**: Points and Patches, Edges, Lines, Segmentation: Active Contours, Split and Merge, Mean Shift and Mode Finding, Normalized Cuts, Feature-Based Alignment: 2D and 3D Feature-based Alignment, Pose Estimation, Geometric Intrinsic Calibration.
UNIT-III (10 Hrs)	**Structure and Motion**: Triangular, Two-frame Structure from Motion, Factorization, Bundle Adjustment, Constrained Structure and Motion, Dense Motion Estimation: Translation Alignment, Parametric Motion, Spline-based Motion, Optical Flow, Layered motion
UNIT-IV	**Image Stitching**: Motion Models, Global Alignment, Composing, Computational

(10 Hrs)	Photography: Photometric Calibration, High Dynamic Range Imaging, Super-Resolution and Blur Removal, image Matting and Compositing, Texture Analysis and Synthesis.
UNIT-V (10 Hrs)	**3D Reconstruction**: Shape From X, Active Range Finding, Surface Representation, Point- based Representation, Volumetric Representation, Model-based Reconstruction, Recovering Texture Maps and Albedos, Image- based Rendering: View Interpolation, Layered Depth Images, Light Fields and Lumigraphs, Environment Mattes, Video-based Rendering.
Textbooks:	
1.	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 2011.
2.	Simon J.D Prince, Computer Vision: Models, Learning and Inference, 1st Edition, 2012.
Reference Books:	
1.	Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B.K. P. Horn, McGraw-Hill.
2.	Haralick & Shapiro, "Computer and Robot Vision", Vol II.
e-Resources	
1.	NPTEL LINK: https://onlinecourses.nptel.ac.in/noc22_ee48/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3208	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

AUTOMATA THEORY AND COMPILER DESIGN

(For AIDS)

Course Objectives:

1.	To learn the fundamentals of Finite Automata and Context-Free Grammars and Languages, establishing a foundation for understanding computational models.
2.	To understand the relationship between Regular Expressions and Finite Automata and identify Regularity of Languages using the Pumping Lemma.
3.	To learn the concepts of Pushdown Automata and their equivalence to Context-Free Grammars, and to gain knowledge on Turing Machines and their variations.
4.	To introduce the fundamental phases of a Compiler, with a focus on understanding the processes of Lexical Analysis and Syntax Analysis.
5.	To explore the concepts involved in the later stages of Compiler Design, including Semantic Analysis, Intermediate Code Generation, and introductory techniques for Code Optimization.

Course Outcomes: At the end of this course, the students will be able to

S.No	Outcome	Knowledge Level
1.	**Apply** DFA and NFA concepts to design models for simple applications like text search, RL acceptance	K3
2.	Build finite automata from the regular expressions and parse trees from the context free grammars	K3
3.	**Construct** Context-Free Grammars for language syntax and analyze derivations, parse trees, and ambiguity in relation to PDAs.	K3
4.	**Apply** the principles of lexical analysis for token recognition and syntax analysis for basic parsing in compiler construction.	K3
5.	**Apply** semantic rules, intermediate code forms (like three-address code), and basic optimization techniques in compiler design.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Finite Automata**: Structural Representations, Automata and Complexity, Chomsky Hierarchy, The Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. **Nondeterministic Finite Automata**: Formal Definition, an Application-Text Search, Finite Automata with Epsilon-Transitions. **Deterministic Finite Automata**: Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA
UNIT-II	**Regular Expressions**: Finite Automata and Regular Expressions, Applications of Regular

(10Hrs)	Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions. Pumping Lemma for Regular Languages- Statement of the pumping lemma, Applications of the Pumping Lemma. **Context-Free Grammars**: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Parse Trees, Ambiguity in Grammars and Languages.
UNIT-III (12 Hrs)	**Push Down Automata**: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state and empty stack. **Turing Machines**: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine, Types of Turing Machine-Multi-Tape Turing Machine, Non-Deterministic Turing Machine.
UNIT-IV (12 Hrs)	**Introduction to Compiler Design**: The structure of a compiler, Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, **Syntax Analysis**: Introduction, Context-Free Grammars, writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers.
UNIT-V (10Hrs)	**Semantic Analysis**: Syntax-Directed Definitions, Evaluation Orders for SDD's, Syntax Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate-Code Generation: Variants of Syntax Trees, Three-Address code. **Code Optimization and Generation**: Principle sources of Optimization, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Issues in the design of a code Generator, The Target Language, A simple code Generator, Peephole Optimization.
Textbooks:	
1.	Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2.	Compilers: Principles, Techniques and Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, 2nd Edition, Pearson.
Reference Books:	
1.	Introduction to Languages and The Theory of Computation, John C. Martin, McGraw Hill.
2.	Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007
3.	Compiler Construction, K.V.N. Sunitha, Pearson, 2013
4.	Compiler Design, SandeepSaxena, Rajkumar Singh Rathore, S.Chand publication
5.	Theory of Computer Science – Automata languages and computation, Mishra and Chandra shekaran, 2nd Edition, PHI.
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc21_cs07/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3210	PE	3	--	--	3	30	70	3 Hrs.

QUANTUM COMPUTING

(For AIDS)

Course Objectives:

1.	Understand the Mathematical Foundations of Quantum Computing
2.	Explore Quantum Computation and Quantum Algorithms
3.	Comprehend Quantum Mechanics and Quantum State Representation
4.	Analyze Quantum Search and Error-Correction Techniques

Course Outcomes: At the end of this course, the students will be able to

S.No	Outcome	Knowledge Level
1.	Apply linear algebra concepts to understand quantum computing principles	K3
2.	Understand quantum circuits and fundamental quantum algorithms	K2
3.	Explain quantum mechanics concepts related to state evolution and measurement	K2
4.	Understand quantum search algorithms and evaluate their efficiency	K2
5.	Understand and apply quantum error-correction techniques to mitigate computational errors	K2

SYLLABUS

UNIT-I (10Hrs)	**Mathematical Foundation for Quantum computing:** Linear algebra: Bases and linear independence, Linear operators and matrices, The Pauli matrices, Inner products Eigenvectors and eigenvalues, Adjoints and Hermitian operators, Tensor products, Operator functions, The commutator and anti-commutator, The polar and singular value decompositions.
UNIT-II (10Hrs)	**Introduction to Quantum computing**: History of Quantum computation , Quantum bits: Multiple qubits, Quantum computation: Single qubit gates, Multiple qubit gates, Measurements in bases other than the computational basis, Quantum circuits, Qubit copying circuit, Bell states, quantum teleportation. Quantum algorithms: Classical computations on a quantum computer, Quantum parallelism, Deutsch's algorithm, The Deutsch–Jozsa algorithm.
UNIT-III (12 Hrs)	**Quantum mechanics:** State space, Evolution, Quantum measurement, Distinguishing quantum states, Projective measurements, POVM measurements, Phase, Composite systems, The density operator: Ensembles of quantum states, General properties of the density operator, The reduced density operator.

UNIT-IV (8 Hrs)	**Quantum Computation:** Quantum Circuits: Quantum algorithms, Single qubit operations, Controlled operations, Measurement, Universal quantum gates: Two-level unitary gates are universal, Single qubit and CNOT gates are universal, A discrete set of universal operations, Approximating arbitrary unitary gates is generically hard, Quantum computational complexity, Summary of the quantum circuit model of computation, Simulation of quantum systems: Simulation in action, The quantum simulation algorithm, An illustrative example, Perspectives on quantum simulation.
UNIT-V (10Hrs)	**Quantum search algorithms:** The quantum search algorithm: The oracle, The procedure Geometric visualization, Performance. Quantum search as a quantum simulation, Quantum counting, Speeding up the solution of NP-complete problems, Quantum search of an unstructured database , Optimality of the search algorithm, Black box algorithm limits. Quantum error-correction: The three qubit bit flip code, Three qubit phase flip code, The Shor code. Theory of quantum error-correction, Discretization of the errors, Independent error models, Degenerate codes, The quantum Hamming bound.

Textbooks:	
1.	Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2.	Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson
Reference Books:	
1.	Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts,
2.	Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms
e-Resources	
1.	https://homepages.cwi.nl/~rdewolf/qcnotes.pdf
2.	https://homes.cs.washington.edu/~oskin/quantum-notes.pdf

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3211	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

NOSQL DATABASE

(For AIDS)

Course Objectives:

1.	Understanding the issues concerning the design, implementation and querying of relational and non-relational databases.
2.	Familiarize students with NoSQL database technology and provide hands-on experience with popular databases like MongoDB, HBASE and graph-based databases
3.	Perform basic database administration tasks, Develop NoSQL desktop and cloud database solutions.

Course Outcomes: At the end of this course, the students will be able to

S.No	Outcome	Knowledge Level
1.	**Explain** and compare different types of NoSQL Databases	K2
2.	**Compare** and contrast RDBMS with different NoSQL databases	K2
3.	**Demonstrate** the detailed architecture and performance tune of Document-oriented NoSQL databases	K3
4.	Illustrate the Column Oriented NoSQL database using H-Base applications	K2
5.	**Apply** NoSQL development tools on different types of NoSQL Databases	K3

SYLLABUS

UNIT-I (10Hrs)	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.
UNIT-II (10Hrs)	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 (12 Hrs)	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

(8 Hrs)	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 (10Hrs)	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.
Textbooks:	
1.	Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition,2019.
Reference Books:	
1.	Dan Sullivan, "NoSQL for Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2.	Meier & Kaufmann. SQL & NoSQL Databases: Models, Languages, Consistency Options and Architectures for Big Data Management, 1st ed. Springer, 2019
3.	Pramod J. Sadalage, Martin Fowler. NoSQL Distilled, Addison Wesley 2013
e-Resources	
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/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3212	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

CLOUD COMPUTING

(AIDS)

Course Objectives:

1.	To explain the evolving utility computing model called cloud computing
2.	To introduce the various levels of services offered by cloud.
3.	To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
4.	To emphasize the security and other challenges in cloud computing.
5.	To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

Course Outcomes: At the end of this course, the students will be able to

S.No	Outcome	Knowledge Level
1.	**Interpret** the fundamental concepts and challenges associated with cloud computing.	K3
2.	**Analyze** the economic, financial, and technological factors influencing the adoption of cloud solutions in organizations.	K3
3.	**Assess** virtualization techniques and resource management strategies for deploying cloud-based applications.	K3
4.	**Evaluate** organizational requirements related to scalability, capacity planning, and security in cloud environments.	K3
5.	**Develop** real-time cloud applications using leading platforms such as AWS, Google Cloud, and Microsoft Azure.	K3

SYLLABUS

UNIT-I (08 Hrs)	**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 AppEngine.
UNIT-II (08 Hrs)	**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.
UNIT-III	**Virtualization and Containers:** Characteristics of virtualized environments, taxonomy of

(08 Hrs)	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 Service) offerings.
UNIT-IV (8 Hrs)	**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.
UNIT-V (08 Hrs)	**Advanced concepts in cloud computing:** Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, cloud-centric IoT - IoT architecture and cloud layers, edge and fog computing – Edge vs Fog vs Cloud, Introduction to DevOps – CI/CD, infrastructure-as-code, Quantum-as-a-Service (QaaS).
Textbooks:	
1.	Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, ShivanandaPoojara, Satish N. Srirama, Mc Graw Hill, 2024
2.	Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012
Reference Books:	
1.	Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018
2.	Essential of Cloud Computing, 1st Edition, K Chandrasekharan, CRC Press, 2014.
3.	Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)
4.	Cloud Computing, Theory and Practice, Dan C Marinescu, 1st edition, MK Elsevier, 2013.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3213	PE	3	--	--	3	30	70	3 Hrs.

SOCIAL MEDIA ANALYTICS

(For AIDS)

Course Objectives:

1.	Knowledge on social media and its analytics Course

Course Outcomes: At the end of this course, the students will be able to

S.No	Outcome	Knowledge Level
1.	**Understanding** characteristics and types of social media	K2
2.	**Knowledge** on layers of social media analytics	K2
3.	**Apply** text analysis tools on social media data	K3
4.	**Understand** the significance of action analytics	K2
5.	**Detect** viral topics on social media (YouTube)	K3

SYLLABUS

UNIT-I (08 Hrs)	Introduction to social media World Wide Web, Web 1.0, Web 2.0, Web3.0, social media, Core Characteristics of social media, Types of social media, Social Networking Sites, Using Facebook For Business Purposes, Content Communities
UNIT-II (08 Hrs)	Social Media Analytics Overview Purpose of Social Media Analytics, Social Media Vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Social Media Analytics Tools. **Case Study**: The Underground Campaign That Scored Big
UNIT-III (08 Hrs)	Social Media Text Analytics Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools. **Case Study**: Tapping Into Online Customer Opinions
UNIT-IV (8 Hrs)	Social Media Actions Analytics Introduction to Actions Analytics, Common Social Media Actions, Actions Analytics Tools. **Case Study:** Cover-More Group
UNIT-V (08 Hrs)	Social Media Hyperlink Analytics Types of Hyperlinks, Hyperlink Analytics, Types of Hyperlink Analytics, Hyperlink Analytics Tools. **Case Study**: Hyperlinks And Viral YouTube Videos

Textbooks:

1.	Seven Layers of Social Media Analytics Mining Business Insights from Social Media Text,

	Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data by Gohar F. Khan ISBN: 1507823207, Isbn-13: 9781507823200
Reference Books:	
1.	Social Media Analytics: Techniques And Insights for Extracting Business Value Out of Social Media by Matthew Ganis, Avinash Kohirkar, Pearson Education.
2.	Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH.
3.	Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wiley Publications.
4.	Big Data, Black Booktm, DreamtechPress,2015Edition.
5.	Social Media Analytics: Techniques And Insights for Extracting Business Value Out of social media by Matthew Ganis, Avinash Kohirkar, Pearson Education.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3215	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

DEEP LEARNING AND NATURAL LANGUAGE PROCESSING LAB

(For AIDS)

Course Objectives:

1	**Understand** the basic concepts and techniques of Deep Learning and the need of Deep Learning techniques in real-world problems.
2	**apply** Deep Learning to learn, predict and classify the real-world problems
3	**Design** Artificial Neural Networks of Supervised Learning for the selected problems and very different parameters.
4	**Design** the concept of CNN, RNN, GANs, Auto-encoders.

Course Outcomes: At the end of this course, the students will be able to

S.No	Outcome	Knowledge Level
1	**Design** Neural networks to solve real world problems	K3
2	**Build** RNN, CNN models for classification	K3
3	**Choose**an appropriate pre-trained model to solve real time problem	K3
4	**Apply** different NLP techniques using NLTK package.	K3
5	**Design** solutions to real-world problems using NLP	K3

Software Packages Required:

- Keras
- Tensorflow
- PyTorch
- NLTK

SYLLABUS

1	Implement Multilayer Perceptron algorithm for MNIST Handwritten Digit Classification.
2	Design Neural Network for the following problems i). Movie reviews classification (Binary Classification) using IMDB dataset. News Wires classification (Multiclass Classification) using Reuters dataset
3	Implement a Recurrent Neural Network (RNN) and LSTM for IMDB movie review classification problem.
4	Build a Convolution Neural Network for Simple image (dogs and Cats) Classification
5	Use a Pre-trained Convolution Neural Network LeNet, AlexNet for image classification.
6	Implement One Hot Encoding and Word Embeddings on any real-world dataset
7	Create a Sample list of at least 10 words POS tagging and find the POS for any given word.
8	Write a Python program to i). Perform Morphological Analysis using NLTK library ii). Generate n-grams using NLTK N-Grams library Implement N-Grams Smoothing

9	Write a program to implement Named Entity Recognition (NER)for any corpus.
10	Using NLTK package to convert audio files to text and text file to audio files
11	Write a program to perform Auto-Correction of spellings for any text
12	Implement twitter sentiment analysis using NLP
e-Resources:	
1	https://github.com/MITDeepLearning/introtodeeplearning
2	https://www.nltk.org/book/
3	https://spacy.io/usage

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3216	**PC**	**--**	**--**	**3**	**1.5**	**30**	**70**	**3 Hrs.**

BIG DATA ANALYTICS LAB

(For AIDS)

Course Objectives:

1.	Understand Distributed Systems and Parallel Processing.
2.	Implement distributed applications using Hadoop platform

Course Outcomes: At the end of this course, the students will be able to

S.No	Outcome	Knowledge Level
1	**Understand the Installation of** Hadoop Distributed File system in Sudo distributed and fully distributed mode	K2
2	**Apply** Map Reduce Programs for different applications	K3
3	**Run** different tools like Pig and Hive on top of HDFS	K3
4	**Write** different scripts and Queries on Pig and Hive tools	K3

Software Packages Required:

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/

SYLLABUS

1	**Week 1, 2:** Implement the following Data structures in Java Linked Lists b) Stacks c) Queues d) Set e) Map
2	**Week 3:** i). Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, fully distributed Use web based tools to monitor your Hadoop setup.
3	**Week 4:** 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.
4	**Week 5:** Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

5	**Week 6:** i). Implement Map Reduce program using Combiner. Implement Map Reduce program using Partitioner.
6	**Week 7:** 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.
7	**Week 8:** Implement Friends-of-friend's algorithm in Map Reduce. **Hint:** Two Map Reduce 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 by the number of connections to your friends
8	**Week 9:** Implement Matrix Multiplication with Hadoop Map Reduce.
9	**Week 10:** Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
10	**Week 11:** i). Run the Pig Latin Scripts to find Word Count Run the Pig Latin Scripts to find a max temp for each and every year.
11	**Week 12:** 11**.** Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes
Reference Books:	
1	Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH,2012.
2	Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3	Hadoop in Practice by Alex Holmes, MANNING Publishers
4	Mining of massive datasets, Anand Rajaraman, Jeffrey D Ullman, Wiley Publications

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AD3217	**SEC**	**--**	**1**	2	**2**	**30**	**70**	**3 Hrs.**

FULL STACK DEVELOPMENT-II

(For AIDS)

Course Objectives:

1	To implement Forms, inputs and Services using AngularJS
2	To develop a simple web application using Nodejs; Angular JS and Express
3	To implement data models using MongoDB

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1	**Apply** MongoDB queries to implement CRUD operations on a document-based database	K3
2	**Apply** Express.js and RESTful API concepts to develop a single-page web application.	K3
3	**Apply** ReactJS concepts including components, props, and state to render dynamic data in a web application.	K3
4	**Apply** router and hooks in designing ReactJS applications.	K3

SYLLABUS

1	**Experiment 1: Node.js**
	Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
	Write a program to transfer data over http protocol using http module.
	Create a text file src.txt and add the following content to it. (HTML, CSS, Javascript, Typescript, MongoDB, Express.js, React.js, Node.js)
	Write a program to parse an URL using URL module.
	Write a program to create an user-defined module and show the workflow of Modularization of application using Node.js
2	**Experiment 2: Typescript**
	Write a program to understand simple and special types.
	Write a program to understand function parameters and return types.
	Write a program to show the importance of Arrow function. Use optional, default and REST parameters.
	Write a program to understand the working of typescript with class, constructor, properties, methods and access specifiers.
	Write a program to understand the working of namespaces and modules.
	Write a program to understand generics with variables, functions and constraints.
3-5	**Experiment 3-5: Augmented Programs: (Any 2 must be completed from Experiment 3-5)**
	Write a CSS program, to apply 2D and 3D transformations in a web page.

	a web page with new features of HTML5 and CSS3.
	Design a to-do list application using JavaScript.
6	**Experiment 6: ExpressJS – Routing, HTTP Methods, Middleware**
	Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
	Write a program to accept data, retrieve data and delete a specified resource using http methods.
	Write a program to show the working of middleware.
7	**Experiment 7: ExpressJS – Templating, Form Data**
	Write a program using templating engine.
	Write a program to work with form data.
8	**Experiment 8: ExpressJS – Cookies, Sessions, Authentication**
	a. Write a program for session management using cookies and sessions.
	b. Write a program for user authentication
9	**Experiment 9: ExpressJS – Database, RESTful APIs**
	Write a program to connect MongoDB database using Mangoose and perform CRUD operations.
	Write a program to develop a single page application using RESTful APIs
10	**Experiment 10: ReactJS – Render HTML, JSX, Components – function & Class**
	Write a program to render HTML to a web page.
	Write a program for writing markup with JSX.
	Write a program for creating and nesting components (function and class).
11	**Experiment 11: ReactJS – Props and States, Styles, Respond to Events**
	Write a program to work with props and states.
	Write a program to add styles (CSS & Sass Styling) and display data.
	Write a program for responding to events.
12	**Experiment 12: ReactJS – Conditional Rendering, Rendering Lists, React Forms**
	Write a program for conditional rendering.
	Write a program for rendering lists.
	Write a program for working with different form fields using react forms
13	**Experiment 13: ReactJS – React Router, Updating the Screen**
	Write a program for routing to different pages using react router.
	Write a program for updating the screen.
14	**Experiment 14: ReactJS – Hooks, Sharing data between Components**
	Write a program to understand the importance of using hooks.
	Write a program for sharing data between components
15	**Experiment 15: ReactJS Applications – To-do list and Quiz**
	Design to-do list application
16	**Experiment 16: MongoDB – Installation, Configuration, CRUD operations**
	Install MongoDB and configure ATLAS
	Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

17	**Experiment 17: MongoDB – Databases, Collections and Records**
	Write MongoDB queries to Create and drop databases and collections.
	Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate()
18	**Experiment 18-20: Augmented Programs: (Any 2 must be completed)**
	Design a to-do list application using NodeJS and ExpressJS.
	Design a Quiz app using ReactJS.
	Complete the MongoDB certification from MongoDB University website.
Text Books:	
1	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2	Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, A Press, O'Reilly.
e-Resources	
1	ExpressJS- https://www.tutorialspoint.com/expressjs .MongoDB
2	ReactJS - https://www.w3schools.com/REACT (and) https://react.dev/learn#
3	https://learn.mongodb.com/learning-paths/introduction-to-mongodb

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AC3201	AC	2	0	0	-	30		3 Hrs.

TECHNICAL PAPER WRITING & IPR

(For AIDS)

Course Objectives:

1.	Learn how to write clear, structured, and well-organized technical reports using proper grammar and formatting.
2.	Develop proofreading techniques, summarize key points effectively, and present reports professionally in both written and verbal formats.
3.	Gain practical skills in Microsoft Word for report writing and learn the basics of patents, copyrights, and innovation protection.

Course Outcomes: By the end of the course, the student will be able to:

S.No	Outcome	Knowledge Level
1.	**Write** clear and structured technical reports.	K3
2.	**Edit** and proofread documents for clarity and accuracy.	K3
3.	**Use** advanced Word processing tools effectively	K3
4.	**Summarize** and present technical reports confidently	K3
5.	**Understand** patents, copyrights, and intellectual property laws.	K2

SYLLABUS

UNIT-I (10Hrs)	**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. (Textbook 2)
UNIT-II (10 Hrs)	**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. (Textbook 2)
UNIT-III (10 Hrs)	**Proofreading and summaries:** Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice. (Textbook 2)
UNIT-IV (10 Hrs)	**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. (Textbook 2)
UNIT-V (10 Hrs)	**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. (Textbook 1,3)
Textbooks:	
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.
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)
3.	Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.
e-Resources	
1.	https://onlinecourses.swayam2.ac.in/ntr20_ed30/preview
2.	https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview
3.	https://www.udemy.com/course/reportwriting/
4.	https://www.udemy.com/course/professional-business-english-and-technical-report-writing/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MC3201	MC	2	--	--		30	--	

EMPLOYABILITY SKILLS

(For AIDS, CIC, CSIT, CSD, ECE and EEE)

Course Objectives:

1.	To introduce concepts required in framing grammatically correct sentences and identifying errors while using standard English.
2.	To acquaint the learner of making a coherent and cohesive sentences and paragraphs for composing a written discourse.
3.	To inculcate logical thinking in order to frame and use data as per the requirement.

Course Outcomes

S.No	Outcome	Knowledge Level
1	Match various vocabulary items that appear in competitive examinations with their contextual meanings accurately.	K1
2.	Identify grammatical and ungrammatical usage of English language in all the grammar related questions asked in various competitive examinations like CAT, GRE, IBPS.	K3
3.	Infer meaning from complex texts that are set as questions in different competitive examinations held for higher education or employment	K2
4.	Find solutions to complex arithmetic problems set as questions in the competitive examinations held for employment or higher education	K1
5.	Apply logical thinking abilities in solving the problems of reasoning that appear in the examinations like CAT, GRE, GATE, IBPS.	K3

SYLLABUS

UNIT-I (10Hrs)	Synonyms, Antonyms, Frequently Confused Words, Foreign Phrases, Idioms and Phrasal Verbs, Collocations. Spotting Errors, Sentence Improvement
UNIT-II (10 Hrs)	Time and work, Pipes and Cisterns. Time and Distance Problems, Problems on boats and streams. Percentages, Profit and loss, Simple interest and Compound interest. Discount Problems.
UNIT-III (10 Hrs)	Analogies, Odd One Out. (Verbal ability) Number Series, Letter Series, Analogy, Alpha Numeric Series, Order and Ranking, Directions, Data sufficiency, Syllogisms.
UNIT-IV (10 Hrs)	Sentence Completion, Sentence Equivalence, Close Test Reading Comprehension , Para Jumbles

UNIT-V (10 Hrs)	Number System: Divisibility tests, finding remainders in various cases, Problems related to numbers, Methods to find LCM, Methods to find HCF.
Textbooks:	
1.	*How to Prepare for Verbal Ability and Reading Comprehension for CAT* (10th edition) by Arun Sharma and Meenakshi Upadhyay, McGraw Hill Education, 2022.
2.	How to Prepare for Quantitative Aptitude for CAT (10th edition) by by Arun Sharma , McGraw Hill Education, 2022.
Reference Books:	
1.	*English Collocation in Use*- Intermediate (2nd edition) by Michael McCarthy& Felicity O'Dell, CUP, 2017.
2.	*Magical Book On Quicker Maths* (5th Edition) By M.Tyra, BSC Publishing Co Pvt. Ltd, 2018.
e-Resources	
1.	www.Indiabix.com
2.	www.800score.com