

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly known as West Bengal University of Technology)
Syllabus of *B.Sc. in Data Science*
Effective from academic session 2023-2024

Detail Syllabus of BSc. Data Science 7th Semester and 8th Semester.

Learning Outcome

LO No.	Learning Outcome
LO1	Data Science Knowledge: Apply the knowledge of mathematics, statistics, computing, artificial intelligence, machine learning, data engineering, and data science principles to solve complex real-world data-driven problems.
LO2	Problem Analysis & Solution Design: Identify, formulate, analyze, and design data-driven solutions for complex problems using appropriate analytical, computational, and intelligent techniques with consideration for societal, ethical, and business requirements.
LO3	Modern AI & Data Science Tools: Create, select, and apply appropriate algorithms, platforms, visualization techniques, cloud technologies, and modern AI/data science tools for effective data analysis, prediction, automation, and intelligent decision-making.
LO4	Ethics, Society & Professional Responsibility: Apply ethical principles and commit to professional responsibilities in artificial intelligence and data science practices, considering fairness, transparency, privacy, sustainability, and societal impact.
LO5	Communication & Teamwork: Communicate effectively with technical and non-technical stakeholders through reports, visualizations, presentations, documentation, and collaborative teamwork in multidisciplinary environments.
LO6	Lifelong Learning: Recognize the need for independent and lifelong learning to adapt to rapidly evolving technologies, research trends, and professional practices in artificial intelligence and data science.

Semester 7

Course Code: BDS701 & BDS791

Course Name: Data Warehousing & Data Warehousing Lab

Credits: 3 + 2

CO Code	Course Outcomes	Bloom's Taxonomy Level	LO Mapping
CO1	Analyze data warehousing architectures, dimensional models, and OLAP operations for business decision support systems.	L4	LO1, LO2, LO4, LO5
CO2	Evaluate preprocessing, transformation, and dimensionality reduction techniques for efficient knowledge discovery.	L5	LO1, LO2, LO3, LO4, LO5
CO3	Design data mining solutions using classification, association rule mining, and prediction algorithms for real-world applications.	L6	LO2, LO3, LO4, LO5
CO4	Assess clustering and advanced mining techniques including web, text, spatial, and multimedia mining for complex datasets.	L5	LO2, LO4, LO5
CO5	Develop data warehousing and mining applications using modern analytical tools and algorithms for intelligent decision-making.	L6	LO3, LO4, LO5

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Theory Course Code: BDS701

Course Name: **Data Warehousing**

Credits: 3

Module No.	Module Title & Topics	CO Mapping	Bloom's Taxonomy Level
Module 1	Data Warehousing – Introduction and Design: Data Warehouse Concepts and Components. Building a Data Warehouse. Data Warehouse Architecture. Infrastructure and Metadata. Principles of Dimensional Modeling. Fact Tables and Dimension Tables. Star Schema and Snowflake Schema. Data Extraction, Transformation and Loading (ETL). Data Quality and Data Integration. Online Analytical Processing (OLAP). Multidimensional Data Analysis.	CO1	L4
Module 2	Data Mining – Pre-processing and Knowledge Discovery: Introduction to Data Mining. Steps in Data Mining Process. Data Mining Functionalities. Architecture of Data Mining Systems. Classification of Data Mining Systems. Knowledge Discovery in Databases (KDD). KDD Process. Data Preprocessing Techniques. Data Cleaning and Data Transformation. Data Compression and Dimension Reduction. Principal Component Analysis (PCA). Binning Methods and Data Smoothing.	CO2	L5
Module 3	Data Mining Techniques: Association Rule Mining. Frequent Itemset Mining. Market Basket Analysis. Apriori Algorithm. FP-Growth and Tree-based Algorithms. Classification and Prediction. Decision Tree Classification. Bayesian Classification. Rule-based Classification. Support Vector Machines (SVM). Neural Network-based Classification. Lazy Learners. Regression Models and Prediction Techniques.	CO3	L6
Module 4	Clustering and Advanced Mining Applications: Clustering Techniques. Partitioning Algorithms. Hierarchical Clustering. Density-based Clustering. Grid-based Clustering. Web Content Mining. Web Structure Mining. Web Usage Mining. Text Mining and Sentiment Analysis	CO4, CO5	L5 ,L6

Practical Course Code: BDS791

Course Name: **Data Warehousing Lab**

Credits: 2

Practical Module No.	Practical Module Title & Experiments	CO Mapping	Bloom's Taxonomy Level
Practical Module 1	Data preprocessing using Python.	CO2	L5
Practical Module 2	Development of Classification Models using Decision Trees and Bayesian Classifiers. Support Vector Machine (SVM) Modeling. Regression and Prediction Analysis. Comparative evaluation of classification and prediction techniques.	CO3	L6
Practical Module 3	Clustering & Cluster Evaluation Techniques. Text Mining and Sentiment Analysis using NLP techniques.	CO4	L5
Practical Module 4	Mini Project	CO5	L6

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Textbooks:

1. Han, Jiawei, Kamber, Micheline, and Pei, Jian, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers (Elsevier), 2011.
2. Kimball, Ralph, and Ross, Margy, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", 3rd Edition, John Wiley & Sons, 2013.
3. Bhatia, Parteek, "Data Mining and Data Warehousing: Principles and Practical Techniques", 1st Edition, Cambridge University Press, 2019.

Reference Books

1. Tan, Pang-Ning, Steinbach, Michael, and Kumar, Vipin, "Introduction to Data Mining", 2nd Edition, Pearson Education, 2018.
2. Ponniah, Paulraj, "Data Warehousing Fundamentals for IT Professionals", 2nd Edition, John Wiley & Sons, 2010.
3. Pujari, Arun K., "Data Mining Techniques", 4th Edition, Universities Press, 2016.
4. Inmon, William H., "Building the Data Warehouse", 4th Edition, John Wiley & Sons, 2005.
5. Dunham, Margaret H., "Data Mining: Introductory and Advanced Topics", 1st Edition, Pearson Education, 2006.

Course Code: BDS702 & BDS792

Course Name: Deep Learning & Deep Learning Lab

Credits: 3 + 2

CO Code	Course Outcome	Bloom's Taxonomy Level	LO Mapping
CO1	Analyze the architecture, learning mechanisms, and optimization strategies of artificial neural networks and deep neural models for solving complex real-world problems.	L4	LO1, LO2, LO3
CO2	Evaluate deep learning architectures including CNNs, RNNs, LSTMs, GRUs, and Transformer models for computer vision, natural language processing, and sequential data analytics applications.	L5	LO1, LO2, LO3, LO6
CO3	Design and develop deep learning solutions using transfer learning, generative models, regularization, and model optimization techniques for domain-specific intelligent applications.	L6	LO1, LO2, LO3, LO5
CO4	Assess deployment strategies, ethical implications, fairness, privacy, explainability, and societal impacts of deep learning systems in modern AI-driven environments.	L5	LO2, LO4, LO5, LO6

Theory Course Code: BDS702

Course Name: Deep Learning

Credits: 3

Module No.	Module Title & Topics	CO Mapping	Bloom's Level
Module 1	Deep Neural Networks and Regularization: Deep Feedforward Neural Networks. Hidden Layer Architectures. Hyperparameter Tuning. Model Evaluation Metrics. Bias-Variance Trade-off. Overfitting and Underfitting. Regularization Techniques.	CO1	L4

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	Performance Analysis and Model Generalization.		
Module 2	Convolutional Neural Networks and Computer Vision: Convolution Operations, Feature Maps, Padding and Stride. Pooling Techniques. CNN Architectures: LeNet, AlexNet, VGG, ResNet and DenseNet. Transfer Learning for Vision Tasks. Image Classification and Feature Extraction.	CO1, CO2	L5
Module 3	Sequence Modeling and Recurrent Architectures: Sequential Data Processing. Recurrent Neural Networks (RNNs). Long Short-Term Memory (LSTM). Gated Recurrent Unit (GRU).	CO2	L5
Module 4	Transformer Networks and Modern Deep Learning Architectures: Limitations of Recurrent Networks. Transformer Architecture. BERT models.	CO2, CO3	L5
Module 5	Transfer Learning and Multimodal Deep Learning: Transfer Learning Concepts. Feature Extraction and Fine-Tuning.	CO3	L6
Module 6	Advanced Deep Learning Applications and Emerging Architectures: Deep Reinforcement Learning Fundamentals. Deep Learning for Biomedical Signal Processing & Recommender Systems. Emerging Trends and Future Directions in Deep Learning.	CO3, CO4	L6

Practical Course Code: BDS792

Course Name: **Deep Learning Lab**

Credits: 2

Practical Module No.	Practical Module Title & Experiments	CO Mapping	Bloom's Taxonomy Level
Practical Module 1	Deep Neural Networks and Regularization	CO1	L4
Practical Module 2	Convolutional Neural Networks and Computer Vision	CO1, CO2	L5
Practical Module 3	Sequence Modeling and Recurrent Architectures: Applications in Speech Recognition and Natural Language Processing.	CO2	L5
Practical Module 4	Transformer Networks	CO2, CO3	L5
Practical Module 5	Transfer Learning	CO3	L6
Practical Module 6	Mini Project	CO1, CO2, CO3, CO4	L6

Textbooks:

- Goodfellow, Ian, Bengio, Yoshua, and Courville, Aaron, *"Deep Learning"*, 1st Edition, MIT Press, 2016.
- Aggarwal, Charu C., *"Neural Networks and Deep Learning: A Textbook"*, 1st Edition, Springer, 2018.
- Zhang, Aston, Lipton, Zack C., Li, Mu, and Smola, Alexander J., *"Dive into Deep Learning"*, 1st Edition, Cambridge University Press, 2023.

Reference Books:

- Bishop, Christopher M., and Bishop, Hugh J., *"Deep Learning: Foundations and Concepts"*, 1st Edition, Springer, 2023.
- Géron, Aurélien, *"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow"*, 3rd Edition, O'Reilly Media, 2022.

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3. Chollet, François, "Deep Learning with Python", 2nd Edition, Manning Publications, 2021.
4. Patterson, Josh, and Gibson, Adam, "Deep Learning: A Practitioner's Approach", 1st Edition, O'Reilly Media, 2017.
5. Nielsen, Michael, "Neural Networks and Deep Learning", Determination Press, 2015.

Course Code: BDS703

Course Name: Optimization Techniques

Credits: 4

CO Code	Course Outcomes	Bloom's Taxonomy Level	LO Mapping
CO1	Analyze optimization problems and formulate mathematical models for engineering and real-world applications.	L4	LO1, LO2, LO3, LO6
CO2	Evaluate classical optimization methods and linear programming techniques for constrained and unconstrained problems.	L5	LO1, LO2, LO3, LO6
CO3	Design solutions for nonlinear and constrained optimization problems using appropriate optimization algorithms.	L6	LO1, LO2, LO3, LO5, LO6
CO4	Assess the effectiveness of linear, nonlinear, geometric, and dynamic programming methods for optimization applications.	L5	LO1, LO2, LO3, LO4, LO6
CO5	Develop optimization-based computational models for engineering design, machine learning, and decision-support systems.	L6	LO2, LO3, LO4, LO5, LO6

Course Code: BDS703

Course Name: Optimization Techniques

Credits: 4

Module No.	Module Title & Topics	CO Mapping	Bloom's Taxonomy Level
Module 1	Introduction to Optimization Techniques: Introduction to Optimization. Engineering Applications of Optimization. Formulation of Optimization Problems. Structural Optimization Problems. Mathematical Programming Models.	CO1	L4
Module 2	Optimization Techniques: Classical Optimization Techniques. Single-variable Optimization. Multi-variable Optimization. Unconstrained Optimization Methods. Constrained Optimization. Penalty Function Techniques. Lagrange Multiplier Method. Feasibility Techniques.	CO1	L4
Module 3	Linear Programming: Linear Programming Problem Formulation. Standard Form of Linear Programming. Geometry of Linear Programming. Graphical Solution Methods.	CO2	L5
Module 4	LPP: Simultaneous Linear Equations. Pivot Operations. Simplex Algorithm. Revised Simplex Method. Duality in Linear Programming. Sensitivity Analysis. Applications of Linear Programming in Engineering and Decision Sciences.	CO3	L6
Module 5	Nonlinear Programming: Introduction to Nonlinear Programming. One-dimensional Minimization Methods.	CO3	L6

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	Elimination Methods. Fibonacci Search Method. Golden Section Method. Quadratic and Cubic Interpolation Methods. Direct Search Methods. Random Search Methods. Descent Methods. Gradient-based Optimization. Applications in Engineering, Artificial Intelligence and Machine Learning.		
Total			

Text Book:

1. Rao, Singiresu S., "Engineering Optimization: Theory and Practice", 5th Edition, John Wiley & Sons, 2019.
2. Taha, Hamdy A., "Operations Research: An Introduction", 10th Edition, Pearson Education, 2017.
3. Hillier, Frederick S., and Lieberman, Gerald J., "Introduction to Operations Research", 11th Edition, McGraw-Hill Education, 2020.

Reference Book:

1. Boyd, Stephen, and Vandenberghe, Lieven, "Convex Optimization", 1st Edition, Cambridge University Press, 2004.
2. Deb, Kalyanmoy, "Optimization for Engineering Design: Algorithms and Examples", 2nd Edition, PHI Learning, 2012.
3. Nocedal, Jorge, and Wright, Stephen J., "Numerical Optimization", 2nd Edition, Springer, 2006.
4. Winston, Wayne L., "Operations Research: Applications and Algorithms", 4th Edition, Cengage Learning, 2004.
5. Arora, Jasbir S., "Introduction to Optimum Design", 4th Edition, Academic Press, 2016.

Semester 8

Course Code: BDS801 & BDS891

Paper Name: Generative AI & Generative AI Lab

Credits: 3 + 2

CO Code	Course Outcomes	Bloom's Taxonomy Level	LO Mapping
CO1	Analyze the evolution, concepts, capabilities, and limitations of Generative AI.	L4	LO1, LO2, LO4, LO5
CO2	Evaluate and compare major Generative AI models and their architectures.	L5	LO1, LO2, LO3, PO4, PO5
CO3	Analyze prompt engineering techniques for effective interaction with Generative AI systems.	L4	LO2, LO3, LO4, LO5
CO4	Evaluate the use of Generative AI models in healthcare applications.	L5	LO2, LO4, LO5, LO6
CO5	Analyze the role of Generative AI in education and assess its opportunities and challenges.	L4	LO2, LO3, LO4, LO5

Theory Course Code: BDS801

Course Name: **Generative AI**

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Credits: 3

Module No.	Module Title & Topics	CO Mapping	Bloom's Taxonomy Level
Module 1	Introduction and Evolution of Generative AI: Introduction of Generative AI. Generative AI vs. Traditional AI. Evolution of Generative Models. Overview of Foundation Models and Large Language Models (LLMs). Types of Generated Content. Capabilities and Limitations of Generative AI Systems.	CO1	L4
Module 2	Generative AI Models Overview: Introduction of Autoregressive Models, Encoder–Decoder Models, Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), Diffusion Models. Comparative Analysis of Different Generative AI Models.	CO2	L4, L5
Module 3	Prompt Engineering and Human AI Interaction: Fundamentals of Prompt Engineering. Anatomy of a Prompt. Zero-Shot, One-Shot, Few-Shot, and Chain-of-Thought Prompting. Role-Based and Context-Aware Prompting. Prompt Chaining and Prompt Templates. Structured Output Generation. Hallucination and Response Validation. Prompt Optimization Techniques. Human-AI Collaboration and Effective Interaction Strategies.	CO3	L4
Module 4	Generative AI in Healthcare: Clinical Documentation and Medical Report Generation, Electronic Health Record (EHR) Summarization, Medical Question Answering Systems, Medical Image Generation and Enhancement, Synthetic Healthcare Data Generation. Benefits, Challenges, and Ethical Considerations in Healthcare Applications.	CO4	L5
Module 5	Generative AI in Education: Personalized Learning and Adaptive Content Generation. Intelligent Tutoring Systems. Automated Question, Quiz, and Assessment Generation. Automated Feedback and Evaluation. AI-Assisted Academic Writing and Research Support. Language Translation and Accessibility Enhancement. Challenges, and Responsible Use of Generative AI in Education.	CO5	L4

Practical Course Code: BDS891

Course Name: **Generative AI Lab**

Credits: 2

Practical Module No.	Practical Module Title & Experiments	CO Mapping	Bloom's Taxonomy Level
Practical Module 1	Familiarization with Generative AI platforms. Exploring text, image, and generation. Understanding tokens, context windows, and model responses. Comparative analysis of outputs from different GenAI tools.	CO1	L4
Practical Module 2	Using pre-trained text generation models. Text summarization and translation. Image generation using diffusion-based tools.	CO1, CO2	L4, L5
Practical Module 3	Designing effective prompts. Zero-shot, one-shot, and few-shot prompting. Chain-of-Thought and role-based prompting.	CO2	L5
Practical Module 4	Medical report summarization. Clinical note generation. Medical question-answering systems. Healthcare chatbot development using prompt engineering. Demonstration of synthetic medical data or image generation.	CO3	L6

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Practical Module 5	Automated quiz and assignment generation. Personalized learning content creation. Automated feedback generation.	CO3	L4
Practical Module 6	Mini Project	CO5	L4

Text books:

1. “Generative AI for everyone: Understanding the essentials and applications of this breakthrough technology”.Altaf Rehmani .
2. Hands-On Generative AI with Transformers and Diffusion Models by Omar Sanseviero, Pedro Cuenca, et al., O’Reilly.
3. Generative AI on Kubernetes: Operationalizing Large Language Models by Roland Huß and Daniele Zonca, O’Reilly
4. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play by David Foster, O’Reilly

Reference Books:

1. "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal.
2. Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models” , Joseph Babcock and Raghav Bali , 2024
3. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
4. Responsible AI: Implementing Ethical and Unbiased Algorithms, by Shashin Mishra and Sray Agarwal

Course Code: BDS802 & BDS892

Course Name: Text and Speech Analytics & Text and Speech Analytics Lab

Credits: 3 + 2

CO Code	Course Outcomes	Bloom’s Taxonomy Level	LO Mapping
CO1	Analyze natural language processing fundamentals, text representation methods, and deep learning architectures for language and speech applications.	L4	LO1, LO2, LO3, LO6
CO2	Evaluate machine learning and deep learning techniques for text classification, language modeling, and speech processing tasks.	L5	LO1, LO2, LO3, LO6
CO3	Design intelligent NLP systems for question answering, dialogue management, and conversational AI applications.	L6	LO1, LO2, LO3, LO5, LO6
CO4	Assess modern text-to-speech synthesis and automatic speech recognition techniques using neural architectures and evaluation metrics.	L5	LO2, LO3, LO4, LO6
CO5	Develop end-to-end language and speech processing applications using Transformers, RNNs, and deep learning frameworks.	L6	LO2, LO3, LO4, LO5, LO6

Theory Course Code: BDS802

Course Name: Text and Speech Analytics

Credits: 3

Module No.	Module Title & Topics	CO Mapping	Bloom’s Taxonomy Level
Module 1	Foundations of Natural Language Processing: Introduction to	CO1	L4

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	Natural Language Processing. Foundations of NLP. Language Syntax and Structure. Text Preprocessing and Wrangling. Feature Engineering for Text Representation. Bag-of-Words Model. Bag-of-N-Grams Model. TF-IDF Representation. Document Similarity Analysis.		
Module 2	Text Classification and Deep Learning for NLP: Advanced Feature Representation Models. Word Embeddings: Word2Vec, GloVe, FastText. Traditional Text Classification Methods. Support Vector Machines (SVM). Deep Learning for NLP. Recurrent Neural Networks (RNN). Long Short-Term Memory Networks (LSTM). Transformer Architectures. Attention Mechanisms. Topic Modeling and Text Summarization. Transfer Learning in NLP.	CO2	L5
Module 3	Question Answering and Dialogue Systems: Information Retrieval for NLP. Relation Extraction. Time and Event Extraction. Question Answering Systems. IR-based Question Answering. Knowledge-based Question Answering. Language Models for QA. Evaluation of Factoid Answers. Human Conversation Modeling. Chatbots and Conversational Agents. Dialogue-State Architectures. Dialogue Management. Evaluation of Dialogue Systems. Conversational AI Applications.	CO3	L6
Module 4	Text-to-Speech Synthesis: Introduction to Text-to-Speech (TTS). Text Normalization. Letter-to-Sound Conversion. Prosody Modeling. Speech Data Collection. TTS Evaluation Techniques. Speech Signal Processing. Concatenative TTS Systems. Parametric Speech Synthesis. Deep Learning-based TTS. WaveNet Architecture. Neural Vocoder. Applications of TTS Systems.	CO4	L5
Module 5	Automatic Speech Recognition: Fundamentals of Automatic Speech Recognition (ASR). Speech Recognition Pipeline. Feature Extraction for Speech. Acoustic Modeling. Hidden Markov Models (HMM). Deep Neural Network Acoustic Models. Hybrid HMM-DNN Systems. Connectionist Temporal Classification (CTC). Attention-based ASR. Listen-Attend-Spell Models. Multi-task Objectives for End-to-End ASR. Transformer-based Speech Models. Speech Recognition Evaluation. Word Error Rate (WER).	CO4, CO5	L5, L6
Module 6	Contemporary Issues and Emerging Trends: Large Language Models (LLMs). Multimodal NLP Systems. Retrieval-Augmented Generation (RAG). Ethical Issues in NLP and Speech AI. Explainable NLP. Low-resource Language Processing. AI-powered Voice Assistants. Generative AI in NLP and Speech. Recent Trends and Future Directions.	CO5	L6

Practical Course Code: BDS892

Course Name: Text and Speech Analytics Lab

Credits: 2

Practical Module No.	Practical Module Title & Experiments	CO Mapping	Bloom's Taxonomy Level
Practical Module 1	Text Preprocessing and Feature Engineering	CO1	L4
Practical Module 2	Text Classification and Deep Learning for NLP: Word Embedding Implementation using Word2Vec, GloVe, and FastText. Text Classification using SVM. NLP implementation using RNN and LSTM. Transformer-based NLP experiments. Text Summarization and Sentiment Analysis.	CO2	L5
Practical Module 3	Question Answering and Conversational AI: Chatbot Development. Question Answering System Implementation. Dialogue Flow Design. Conversational AI Applications using	CO3	L6

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	Transformer Models. Evaluation of Chatbot and Dialogue Systems.		
Practical Module 4	Text-to-Speech Synthesis: Text-to-Speech Conversion. Prosody Analysis. Speech Signal Processing Experiments. Deep Learning-based TTS Demonstration using WaveNet or Tacotron. Evaluation of Speech Synthesis Quality.	CO4	L5
Practical Module 5	Automatic Speech Recognition: Introduction to speech recognition systems, speech feature extraction (MFCC), implementation of basic speech-to-text applications using pre-trained ASR models, and evaluation of recognition performance using Word Error Rate (WER).	CO4, CO5	L5 , L6
Practical Module 6	Mini Project	CO5	L6

Text Books

1. Jurafsky, Daniel, and Martin, James H., "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 3rd Edition (Draft), Pearson Education, 2024.
2. Aggarwal, Charu C., "Machine Learning for Text", 2nd Edition, Springer Nature, 2023.
3. Manning, Christopher, and Schütze, Hinrich, "Foundations of Statistical Natural Language Processing", 1st Edition, MIT Press, 1999.

Reference Books

1. Bird, Steven, Klein, Ewan, and Loper, Edward, "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit", 1st Edition, O'Reilly Media, 2009.
2. Atkinson-Abutridy, John, "Text Analytics: An Introduction to the Science and Applications of Unstructured Information Analysis", 1st Edition, CRC Press, 2022.
3. Öhman, Emily, "Introduction to Text Analytics: A Guide for Digital Humanities & Social Sciences", 1st Edition, Sage Publications, 2024.
4. Goldwater, Sharon, and Renals, Steve, "Speech Processing: A Computational Introduction to Phonetics, Speech Synthesis, and Recognition", Cambridge University Press, 2024.
5. Radhakrishnan, R., "Text and Speech Analysis for BE Anna University", 1st Edition, Technical Publications, 2023.

Course Code: FYBDS 881A

Course Name: Industry Capstone Project

Course Type: Sessional

Credits: 12

CO Code	Course Outcomes	Bloom's Taxonomy Level	LO Mapping
CO1	Identify and analyze real-world industry problems using data science, artificial intelligence, and analytical techniques to develop feasible solutions.	L4	LO1, LO2
CO2	Apply appropriate data collection, experimentation, statistical analysis, and AI/ML methodologies to execute industry-oriented projects effectively.	L3	LO1, LO2, LO3
CO3	Develop and implement data-driven models, prototypes, products, or intelligent systems using modern AI and data science tools and technologies.	L6	LO2, LO3
CO4	Evaluate project outcomes with respect to reliability, reproducibility, ethical considerations, sustainability, and professional standards in	L5	LO4, LO6

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	industry practices.		
CO5	Prepare professional technical reports, scholarly outputs, and project documentation following academic integrity, ethical guidelines, and publication standards.	L6	LO4, LO5
CO6	Demonstrate effective communication, presentation, teamwork, and defense of project findings through technical presentations and viva voce examinations.	L3	LO5, LO6

Rubric for Academic Project

S. No.	Assessment Parameter	Marks	Sub-components
1.	Completion of Experimentation / Fieldwork/ Data collection and Analysis	40	Quality, reproducibility, adequacy, and reliability of data or field observations
2.	Final Report Submission: Aim, Review of Literature, Objectives, Methodology, Results, Conclusions, Discussion, Further Scope of Research	80	Proper referencing, similarity index upto 10%, AI-generated content upto 20%, academic integrity, and adherence to ethical standards
3.	Recommendations and submission of any one Scholarly Output as listed below:	40	** Marks to be followed based on the outcomes. # Students can secure at the maximum 30 marks out of 40 under 'other scholarly work'.
	**Research Publication	30-40	
	**Book / Book Chapter Publication	20-40	
	** Prototype / Product /Patent	20-40	
	** Other Scholarly Work	Upto 30#	
	** Draft Policy formulation\$	20-40	
4.	End-Term Presentation and Viva Voce	80	Presentation skills (20) + Viva voce (60) demonstrating understanding, defense of findings, and readiness for scholarly discourse

\$: to be considered under Academic Projects

For students pursuing the Academic Project Track

Students pursuing the Academic Projects track must fulfil the following requirements by the end of Semester VIII:

- Completion of Research Activities:** Successful completion of experimentation, fieldwork, data collection, data analysis, or any equivalent academic and research tasks initiated in Semester VII.
- Final Report Submission:** Submission of the final Dissertation or Academic Project Report in the prescribed format.
- Research Outcomes:** Each student must provide evidence of **at least one [3(a-d)]** of the following scholarly outcomes:
 - Research Publication:** Publication in Scopus / Web of Science indexed journals or in any other reputed journal approved by the University. In case the publication is in the process then a proof of communication from the Editor / Editor-in-Chief indicating that the manuscript has been considered for review or is under consideration, should be submitted by the student. / **OR**
 - Book / Book Chapter Publication:** A Book or Book Chapter bearing an ISBN number must be published by a reputed publisher. In case the publication is still in process, the student must submit an official acceptance letter from the Editor / Publisher clearly stating that the manuscript has been accepted and is under consideration for publication. / **OR**
 - Prototype / Product / Patent:** Development of a prototype or product or filing of a patent based on the research work. / **OR**

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- d. Any other scholastic work (any one of the following two):
 - i. Paper or poster presentation related to the research topic at a recognized National or International Conference / Seminar. /OR
 - ii. Participation in International / National / State level Hackathons, Exhibitions, or Entrepreneurship platforms to showcase the work.