Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

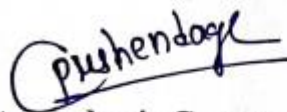## Department of Artificial Intelligence and Data Science

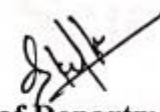## S.Y. B. Tech Syllabus 2024-25 (As per NEP 2020)

Syllabus: Double Minor w. e. f. AY: 2024-2025
SEMESTER-III

Double Minor in Artificial Intelligence and Data Science

SEM	Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
III	DM23001	Artificial Intelligence and Data Science	2	2		10	20	50	20	20		120	2	1		3

Dept. Academic Coordinator
Mr. Pradip Shendage

Head of Department
Dr. C. S. Kulkarni

Dean Academic
Dr. S. M. Bhosle

Principal
Dr. R.S. Bichkar

Head
Department of Artificial Intelligence
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BUCKET OF DOUBLE MINOR DEGREE

DOUBLE MINOR DEGREE (only for students having CGPA >= 7.5)
DM23001: Artificial Intelligence and Data Science

	Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati (Autonomous Institute)

DM23001- Artificial Intelligence and Data Science

Teaching Scheme: Theory: - 2 Hours/Week Practical: 2 Hour/Week	Credits 03	Examination Scheme: Activity: - 10 Marks In-Sem:- 20 Marks End-Sem:- 50 Marks Term Work: 20 Marks Practical: 20 Marks

Prerequisites: Basic python programming

Course Objectives:
- To provide a comprehensive introduction to the concepts and applications of Artificial Intelligence (AI) and Data Science.
- To equip students with the foundational knowledge of machine learning algorithms and data handling techniques.
- To develop practical skills in using AI and Data Science tools and libraries.
- To foster the ability to apply AI and Data Science methods to solve real-world engineering problems.

Course Outcomes (COs): The students will be able to:

CO1: Understand the fundamental principles and applications of AI and Data Science.
CO2: Collect, preprocess, and visualize data effectively.
CO3: Implement basic machine learning algorithms for regression, classification, and clustering tasks.
CO4: Apply neural networks for simple AI tasks and understand their structure and function.

Course Contents

Unit I: Introduction to Artificial Intelligence and Data Science (06 Hours)

Basics of AI and Data Science: Definition and history of AI, Key concepts and applications of AI, Introduction to Data Science and its importance.
Fundamentals of Machine Learning: Types of machine learning: supervised, unsupervised, and reinforcement learning, Basic concepts: features, labels, training, and testing data, Overview of common algorithms: linear regression, classification, clustering.
Tools and Technologies: Introduction to Python for AI and Data Science, Overview of popular libraries: NumPy, pandas, matplotlib, scikit-learn, Setting up the development environment.

Unit II: Data Handling and Pre-processing (06 Hours)

Data Collection and Cleaning: Sources of data: databases, web scraping, APIs, Data cleaning techniques: handling missing values, outliers, duplicates.
Data Manipulation: Data types and structures, Basic operations with pandas: filtering, grouping, merging.Data Visualization: Importance of data visualization, Visualization tools and techniques: matplotlib, seaborn, Creating basic plots: bar charts, histograms, scatter plots.

Unit III: Core Machine Learning Concepts (06 Hours)

Supervised Learning: Regression algorithms: linear regression, polynomial regression, Classification algorithms: logistic regression, decision trees, k-nearest neighbors, Model evaluation metrics: accuracy, precision, recall, F1-score.
Unsupervised Learning: Clustering algorithms: k-means, hierarchical clustering, Dimensionality reduction: PCA, t-SNE, Applications and use cases.
Model Training and Evaluation: Splitting data: training, validation, and test sets, Cross-validation techniques, Avoiding overfitting and underfitting.

Unit IV: Advanced Topics and Applications (06 Hours)
Introduction to Neural Networks: Basics of neural networks and deep learning, Structure of neural networks: neurons, layers, activation functions, Overview of frameworks: TensorFlow, Keras.
AI in Real-World Applications: AI in healthcare, finance, and manufacturing, Ethical considerations and challenges in AI, Case studies of successful AI implementations.

Text Books:
1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly Media, Inc.,2016.
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Third Edition, O'Reilly Media, Inc.,2022.

Reference Books:
1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.

E-Resources:
1. https://nptel.ac.in/courses/106/102/106102220/
2. https://nptel.ac.in/courses/106/105/106105077/
3. https://nptel.ac.in/courses/106/105/106105078/
4. https://nptel.ac.in/courses/106/105/106105079/

List of Assignments

1. Python Basics:
   a. Write a Python program to perform basic arithmetic operations.
   b. Create a program to manipulate strings and lists.
   c. Implement a simple calculator using functions.
2. Data Collection and Cleaning:
   a. Collect a dataset from an online source (e.g., Kaggle, UCI Machine Learning Repository).
   b. Identify and handle missing values in the dataset.
   c. Remove duplicates and handle outliers.
3. Data Exploration and Visualization:
   a. Load the cleaned dataset using pandas.
   b. Perform basic statistical analysis (mean, median, mode).
   c. Create visualizations using matplotlib and seaborn (e.g., histograms, bar plots, scatter plots).
4. Linear Regression:
   a. Implement linear regression from scratch using numpy.
   b. Use scikit-learn to fit a linear regression model to a given dataset.
   c. Visualize the regression line and interpret the results.

5. Neural Networks with Keras:
   a. Create a simple neural network for a classification problem using Keras.
   b. Train and evaluate the model.
   c. Visualize the training history (loss and accuracy plots).