

Syllabus for AI for Aspiring Engineers

Course description and Objective: By the end of this course, students will be able to think computationally, write Python programs confidently, and build end-to-end machine learning pipelines using real engineering datasets – developing the foundational skills needed to apply Artificial Intelligence across Civil, Mechanical, Electrical, Electronics, and Chemical Engineering disciplines from day one of their undergraduate journey.

1. **Week 1: Introduction to Computational Thinking** with the help of puzzles and drawing language in Python
2. **Week 2: Getting started with Python**, loops, and functions using the Python language,
3. **Week 3:** Nested loops, File handling, Lists, Dictionaries
4. **Week 4:** Usage of numpy in Data loading, Data generation, Feature Engineering, Model evaluation
5. **Week 5: Data and Statistical Essentials:** Mean, Median, Mode & Standard Deviation, Correlation vs Causation, Usage of Pandas in Data exploration, Data preparation, and Preprocessing
6. **Week 6: Math Foundations for AI:** Functions, Graphs & Coordinate Geometry, Probability Basics & Intuition, Introduction to Matrices & Vectors
7. **Week 7: Intro to Machine Learning**, ML life cycle. Predictive Modeling - Regression, What is Machine Learning? Types Overview (Supervised, Unsupervised, Reinforcement), Training vs Testing Data, Linear Regression using Gradient Descent
8. **Week 8: Clustering & Unsupervised Learning** (K-Means, visualising clusters, feature relevance through clustering, hierarchical clustering)
9. **Week 9: Classification:** Classification vs Regression, Decision Trees – How AI Makes Decisions, k-Nearest Neighbors (kNN) Made Easy
10. **Module 10: Neural Networks – The Basics:** Neurons, Layers & Activation Functions, How a Neural Network Learns, Backpropagation, Building Your First Neural Net
11. **Week 11: Computer Vision Basics:** How Computers See Images – Pixels, Channels & Colour Spaces, Image Processing with OpenCV, Intro to CNNs & Image Classification
12. **Week 12: Natural Language Processing:** How Computers Read Text – Tokenization & Word Embeddings, Sentiment Analysis – Positive or Negative? Intro to Chatbots & Prompt Engineering
13. **Mini Project:** Problem Scoping: Choosing a Real Problem Worth Solving. Building an End-to-End ML Pipeline, Presenting & Communicating AI Results Clearly

Data sets from multiple Engineering disciplines: Each week will have a programming assignment. Datasets for the appropriate assignment will be chosen from the following engineering disciplines: Mechanical: Auto MPG Dataset; Electronics: Appliances Energy Prediction Dataset; Chemical: Wine Quality Dataset; Civil: Energy Efficiency Dataset; Concrete Crack Images Dataset; Electrical: Individual Household Electric Power Consumption.