Information Booklet cum Syllabus

of

Foundation of Machine Learning

September 2024

National Institute of Electronics and Information Technology
An Autonomous Scientific Society under
Ministry of Electronics and Information Technology, Government of India

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CONTENTS

1. About Course

The "**Foundation of Machine Learning**" is a four-week course designed to build solid foundation in machine learning. The course begins with mathematical concepts and guides students through important supervised and unsupervised methods such as nearest neighbors, naive Bayes, decision trees, and strategic alliances. This course also introduces students to the basic of Python Programming to contain control structure, conditional statement, function Sequence Data type and numpy that make students to more skilled.

2. NIELIT

National Institute of Electronics and Information Technology, NIELIT, (Erstwhile DOEACC Society) is an autonomous scientific society of the Ministry of Electronics & Information Technology, Government of India. The Society is registered under the Societies Registration Act, 1860. NIELIT was set up to carry out Human Resource Development and related activities in the area of Information, Electronics & Communications Technology (IECT). NIELIT is engaged both in Formal & Non-Formal Education in the areas of IECT besides development of industry-oriented quality education and training programmes in the state-of-the-art areas. NIELIT has endeavored to establish standards to be the country's premier institution for Examination and Certification in the field of IECT. It is also one of the National Examination Body, which accredits institutes/organizations for conducting courses in IT and Electronics in the non-formal sector.

3. Objective of Course

This course introduces students to the basic concepts and techniques of Machine Learning. The objective of this course is to develop the skills required for Machine Learning Technologies with use of Python to analyze data and solving ML problems like Regression and Classification using machine learning algorithms

By the end of the course, students will:

- Understand the basics of Python language.
- Learn essential mathematics for Machine Learning.
- Understand and apply key Machine Learning algorithms in both supervised and unsupervised learning.
- Develop the ability to preprocess, clean, and visualize data effectively.
- Learn to evaluate and optimize Machine Learning models to improve their performance.
- Apply these skills in real-world scenarios through hands-on projects and case studies.

This course aims to build a strong foundation, enabling students to confidently pursue more advanced topics in Machine Learning and Artificial Intelligence.

4. Job Roles of Course

After successful completion of this course, students will be well-equipped for a range of impactful job roles in the data science and Machine Learning fields. This course prepares graduates to excel as:

- Machine Learning Engineer

- Machine Learning Developer
- AI Researcher

5. Eligibility

Passed or pursuing BE / B.Tech. (Any Branch), BCA, MCA, 3-Year Diploma (Computer Science / Electronics/ IT),NIELIT O/A Level, Graduate in Commerce / Statistics / Mathematics/ Operational Research.

6. Total duration of the Course : 60 Hours

7. Course Details

Day	Course content
1-2	**Basic Mathematics** o Matrix multiplication and inversion o Probability theory basics (conditional probability, Bayes' theorem) o Descriptive statistics (mean, median, mode, variance) o Probability distributions (normal distribution, binomial distribution)
3-4	**Basic Python and Libraries** o Python IDE installation o Basics of python o Functions o Essential libraries for machine learning (numpy, matplotlib, pandas etc.)
5	**Introduction to Machine Learning** o What is Machine Learning? o History and Evolution of Machine Learning o Applications of Machine Learning in Various Fields o Overview of Supervised, Unsupervised, and Reinforcement Learning.
6-7	**Data Visualization** o Understanding Data: Types, Features, Labels, and Instances o Types of Machine Learning Problems: Classification, Regression, Clustering. o Data Preprocessing & Data Cleaning: Handling Missing Data, Outliers o Dimensionality Reduction Techniques (Overview of PCA)
8	**Introduction to Supervised Learning** o Understanding Supervised Learning o Difference Between Supervised and Unsupervised Learning o Overview of Classification and Regression Tasks
9	**Classification Algorithms** o Introduction to Classification o Curse of Dimensionality/Perceptron o k-Nearest Neighbours (k-NN): Distance Metrics and Voting

10-11	**Some advanced Algorithms** o Naïve Bayes o Gradient Descent o Decision tree o Splitting criteria of decision tree
12	**Key Regression Algorithms** o Introduction to Regression o Logistic Regression
13	**Linear Regression and Errors** o Linear Regression: Concepts, Assumptions, and Interpretation o Case studies of different Supervised Algorithms. o Evaluating Regression Models: MSE, RMSE, R^2 Score etc.
14	**Clustering Algorithms** o Introduction to Clustering o k-Means Clustering: Centroid Calculation and Cluster Formation o Hierarchical Clustering: Agglomerative and Divisive Approaches
15	**Dimensionality Reduction Techniques and Model Evaluation** o Principal Component Analysis (PCA): Concept and Applications o Hyperparameters Tuning o Importance of Model Evaluation o Cross-Validation Techniques: k-Fold, Leave-One-Out
16	**Bias and Variance & Model Selection** o Bias-Variance Trade off o Avoiding Overfitting and Underfitting o Ensemble Methods (Bagging & Boosting) o Adaboost and Random Forest
17-18	**Practical Applications, Project and Case Studies** o Case Study 1: Regression model o Case Study 2: Classification model o Case Study 3: Clustering model o Applying Concepts to Solve a Real-World Problem in form of a Project
19-20	**Project** o Project: To Solve a Real-World Problem **Doubt session** o Challenges faced and doubt solving

8. Reference Books/Study Material

- Machine Learning an algorithmic Perspective by Stephen Marshland.
- Introduction to Machine Learning with Python by Andreas C Muller, Sarah Guido.
- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition by Aurélien Géron.