Information Booklet cum Syllabus

Of

Artificial Intelligence using Python

Revision-I

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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

This course provides a strong foundation in Artificial Intelligence by integrating key concepts in machine learning, deep learning, and intelligent systems. Learners gain hands-on experience with tools like Python, Jupyter Notebook, and frameworks such as TensorFlow and PyTorch through practical implementation and real-world projects.

By the end of the program, students will be able to design and develop AI models, work with neural networks, and apply techniques in areas such as computer vision and natural language processing. This course equips learners with the essential skills required to pursue careers in Artificial Intelligence, Machine Learning, and AI-driven application development.

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

The objective of this course is to equip learners with a strong foundation in Artificial Intelligence, combining machine learning, deep learning, and intelligent system design, along with hands-on experience in building AI-driven solutions for real-world problems.

After completing the course, learners will be able to:

- Develop a solid understanding of AI fundamentals, including search algorithms, knowledge representation, and intelligent agents.
- Gain proficiency in programming using Python for developing AI applications and automation.
- Build and evaluate machine learning models using Scikit-learn for tasks such as classification, regression, and clustering.
- Design and implement deep learning models using frameworks like TensorFlow and PyTorch.
- Understand and apply neural networks, including CNNs for computer vision and RNNs for sequential data.
- Work with Natural Language Processing (NLP) techniques for tasks like text classification and sentiment analysis.
- Apply model optimization, tuning, and evaluation techniques to improve AI system performance.
- Develop AI solutions for real-world applications such as recommendation systems, chatbots, and image recognition.
- Communicate AI insights and results effectively for decision-making and business impact.

4. Job Roles of Course

This course is designed to equip learners with the necessary skills for the following job roles:

- AI Engineer (Entry-Level)
- Machine Learning Engineer
- Deep Learning Engineer
- AI Research Assistant
- AI Application Developer
- Data Scientist (AI Specialization)

5. Eligibility

Pursing Diploma /Graduation

6. Total duration of the course

90 Hours (Theory: 35 Hrs, Practical/Tutorial: 55 Hrs)

7. Course Details

7.1. Course Outline and Objective of Each Unit

S. No.	Module Name	Duration (Theory) in Hours	Duration (Practical) in Hours	Total Learning Hrs.	Learning Objectives
1	**Python for AI**	**10**	**15**	**25**	• Understand Python fundamentals (variables, data types, loops, functions) • Work with libraries like Pandas & NumPy for data manipulation • Handle missing data and pre-processing • Visualize data using Matplotlib & Seaborn
2	**Machine Learning**	**8**	**12**	**20**	• Understand supervised & unsupervised learning concepts. • Implement regression and classification models. • Perform model evaluation and validation techniques. • Apply feature engineering techniques.
3	**Deep Learning**	**7**	**12**	**19**	• Understand neural networks and deep learning concepts • Build ANN models using TensorFlow/Keras • Work with CNNs for image data and basic NLP models • Optimize models using tuning techniques
4	**NLP**	**6**	**10**	**16**	• Understand text preprocessing and tokenization • Perform sentiment analysis and text classification • Work with NLP libraries like NLTK/Spacy • Build basic NLP models

5	**Career Practicum & Capstone Project**	**3**	**7**	**10**	• Develop an end-to-end data science project • Apply EDA, modeling, and visualization • Build portfolio-ready projects • Present insights with storytelling techniques

7.2. Detailed Course

Module Name	Unit	Contents	Hrs.
Python for Data Science	**Python Programming Fundamentals**	• Variables, Data Types, Operators • Control Structures (Loops, Conditionals) • Functions and Modules	**25**
	Data Analysis Libraries	• Data manipulation using **Pandas** • Numerical computing with **NumPy** • Data visualization using **Matplotlib** & **Seaborn**	
Machine Learning	**Supervised Learning**	• **Linear** & **Logistic** Regression • Decision Trees & KNN, SVM • Model evaluation (Accuracy, Precision, Recall)	**20**
	Unsupervised Learning	• Clustering (**K-Means**, Hierarchical) • Dimensionality Reduction (**PCA**) • Feature engineering basics	
Deep Learning	**Neural Networks**	• Perceptron and Multi-layer Networks • Activation Functions & Backpropagation • ANN Model building with TensorFlow/Keras	**19**
	Advanced Deep Learning	• Convolutional Neural Networks (CNN) • Introduction to NLP • Model tuning and optimization	
NLP	**Text Processing & Representation**	• Tokenization, Stopword removal • TF-IDF and Word Embeddings • Text preprocessing techniques	**16**
	NLP Applications	• Sentiment Analysis • Text Classification • Introduction to NLP pipelines	
Career Practicum & Capstone Project	**Applied Project & Portfolio**	• End-to-end project development • Data collection, cleaning, and modeling • Visualization and storytelling • Final presentation and evaluation	**10**

8. Reference Books/ Study Materials

1. Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig
2. Deep Learning – Ian Goodfellow, Yoshua Bengio & Aaron Courville
3. Artificial Intelligence and Machine Learning – Pradeep Kumar Singh, Tapan K. Gandhi & Balasubramanian Raman
4. Artificial Intelligence and Machine Learning: A Beginner's Journey – Pramod Kumar
5. Artificial Intelligence and Machine Learning Techniques in Engineering and Management – K. Srinivasa Raju & D. Nagesh Kumar.

9. Practical Assignments

1. Write a Python program to implement basic search algorithms (Breadth-First Search and Depth-First Search) to find a path between two nodes in a graph.
2. Build a simple rule-based chatbot using conditional logic in Python that can answer predefined user queries.
3. Load a dataset and perform preprocessing (handling missing values, encoding categorical data, and feature scaling) using libraries like Pandas.
4. Implement a Linear Regression model using Scikit-learn to predict a continuous variable and evaluate its performance.
5. Build a Classification model (e.g., Decision Tree or Logistic Regression) to solve a real-world problem such as spam detection or customer churn prediction.
6. Implement a basic Artificial Neural Network using TensorFlow or Keras to classify a dataset (e.g., digit recognition).
7. Perform image classification using a Convolutional Neural Network (CNN) and evaluate model accuracy.
8. Create a Natural Language Processing (NLP) model to perform sentiment analysis on text data using libraries like NLTK or SpaCy.
9. Develop a recommendation system (e.g., movie or product recommendation) using collaborative filtering or content-based filtering techniques.
10. Complete an end-to-end AI project: collect a dataset, preprocess it, build and train a model, evaluate performance, and present results with visualizations and a short report.