Python Prerequisites

1.1 Python Basics

- Variables, Data Types, Operators
- Control Flow (if-else, loops)
- Functions and Lambda Functions
- List, Tuple, Dictionary, Set
- List Comprehensions
- Exception Handling

1.2 Object-Oriented Programming (OOP) in Python

- Classes and Objects
- Inheritance, Polymorphism
- Encapsulation

1.3 File Handling & Data Processing

- Reading/Writing Files (CSV, JSON, TXT)
- Regular Expressions (re module)
- Multithreading & Multiprocessing

1.4 Python for Data Science

- NumPy (Arrays, Broadcasting, Matrix Operations)
- Pandas (DataFrames, Data Manipulation, GroupBy, Pivot Tables)
- Matplotlib & Seaborn (Data Visualization)

1.5 Working with APIs & Web Scraping

- Requests Library
- BeautifulSoup & Selenium

Machine Learning Prerequisites

2.1 Linear Algebra & Probability

- Vectors, Matrices, and Tensors
- Eigenvalues and Eigenvectors
- Probability Distributions (Normal, Binomial)
- Bayes' Theorem

2.2 Statistics for ML

- Mean, Median, Mode
- Variance and Standard Deviation
- Correlation and Covariance
- Hypothesis Testing

2.3 Supervised Learning

- Linear Regression, Logistic Regression
- Decision Trees, Random Forest
- Support Vector Machines (SVM)
- Gradient Boosting (XGBoost, LightGBM)

2.4 Unsupervised Learning

- Clustering (K-Means, DBSCAN, Hierarchical)
- Dimensionality Reduction (PCA, t-SNE)
- Anomaly Detection

2.5 Neural Networks & Deep Learning

- Basics of Perceptron & Backpropagation
- Feedforward Neural Networks
- Activation Functions (ReLU, Sigmoid, Tanh)
- Optimizers (SGD, Adam, RMSprop)

2.6 Hands-on with ML Libraries

- Scikit-Learn (Data Preprocessing, Model Building)
- TensorFlow & PyTorch (Neural Networks, Training)

Generative AI and Its Industry Applications

3.1 Generative AI Fundamentals

- Generative AI Principles
- Types of Generative Models
- Applications of Generative Models
- Machine Learning Algorithms with GenAI
- Generative AI: Advantages and Disadvantages
- Ethical Considerations

Hands-on:

- Implementing Generative AI Use Cases

- Implementing Machine Learning with GenAI

NLP and Deep Learning

4.1 Natural Language Processing (NLP) Essentials

- Text Classification
- Text Preprocessing
- Basic NLP Tasks
- Deep Learning for NLP
- Neural Networks
- Backpropagation
- RNN, LSTM
- Deep Learning Applications in NLP

Hands-on:

- Simple Text Classification Task
- Implementing Core NLP Tasks
- Working with Deep Learning for NLP

Autoencoders and GANs

5.1 Autoencoders

- Basic Autoencoders
- Variational Autoencoders (VAEs)
- Applications in Data Compression and Generation

5.2 Generative Adversarial Networks (GANs)

- Basic GAN Architecture
- Training GANs
- Variants of GANs (DCGAN, CycleGAN)

Hands-on:

- Working with GANs
- Data Compression with Autoencoders
- Training Variants of GANs

Language Models and Transformer-based Generative Models

6.1 Language Models

- Exploring Language Models
- Types and Applications of Language Models

6.2 Transformer Architecture

- Attention Mechanism
- Advanced Transformer Models (GPT, BERT)
- Applications of Transformer-based Models

Hands-on:

- Working with GPT
- Implementing BERT
- Applying Advanced Transformer Models

Prompt Engineering

7.1 Understanding Prompt Engineering

- Principles & Importance
- Prompt Design Strategies
- Types of Prompting
- Crafting Effective Prompts
- Parameter Tuning

Hands-on:

- Designing Precise Prompts
- Experimenting with Various Prompt Design Strategies
- Advanced Parameter Tuning for Prompt Engineering

Generative AI with LLMs

8.1 LLMs and Generative AI Project Lifecycle

- LLM Pre-Training and Scaling

- Fine-Tuning LLMs with Specific Instructions
- Efficient Fine-Tuning of Parameters
- Reinforcement Learning from Human Response

Hands-on:

- Experimenting with LLM
- Applying Fine-Tuning on Parameters
- LLM Project Lifecycle
- Reinforcement Learning Exercises

LLMs for Search, Prediction, and Generation

9.1 Applications of LLMs

- Search Query Completion
- Next Word Prediction
- Word Embeddings
- Transformers
- Generating Text
- Stacking Attention Layers

Hands-on:

- Execute Search Query and Next-Word Prediction using LLMs
- Implement LLMs with TensorFlow and PyTorch
- Build a Chatbot using LLMs

LangChain for LLM Application Development

10.1 LangChain Fundamentals

- Foundations & Benefits of LangChain
- Using LangChain for LLM Applications
- Value Propositions & Components of LangChain
- Off-the-Shelf Chains in LangChain

Hands-on:

- Build an LLM-Powered Application using LangChain

- Experiment with Off-the-Shelf Chains in LangChain
- Deploy an LLM Application

Retrieval-Augmented Generation (RAG) with LangChain

11.1 RAG Concepts

- Document Loading & Splitting
- Vector Stores & Embeddings
- Retrieval Techniques
- Question Answering with Chatbots
- Building RAG Models using LangChain

Hands-on:

- Construct a LangChain-RAG Chatbot for Custom Data
- Deploy Chatbot in a Production Environment
- Develop a Basic RAG Model

Generative AI on Cloud

- Cloud Platforms for Generative AI
- Deploying LLM Models on Cloud
- Serverless AI with Cloud Platforms