

Advanced Certification in

Applied Data Science, Machine Learning and AI



Electronics & ICT Academy
Indian Institute of Technology Guwahati
An Initiative of Ministry of Electronics & Information Technology (MeitY)



इलेक्ट्रॉनिक्स एवं
सूचना प्रौद्योगिकी मंत्रालय
MINISTRY OF
**ELECTRONICS AND
INFORMATION TECHNOLOGY**

Course Curriculum

Duration: 9 Months (240Hrs)

DS | ML | DL | AI | Generative AI

Advanced Generative AI & LLMs Are Covered

In Collaboration With

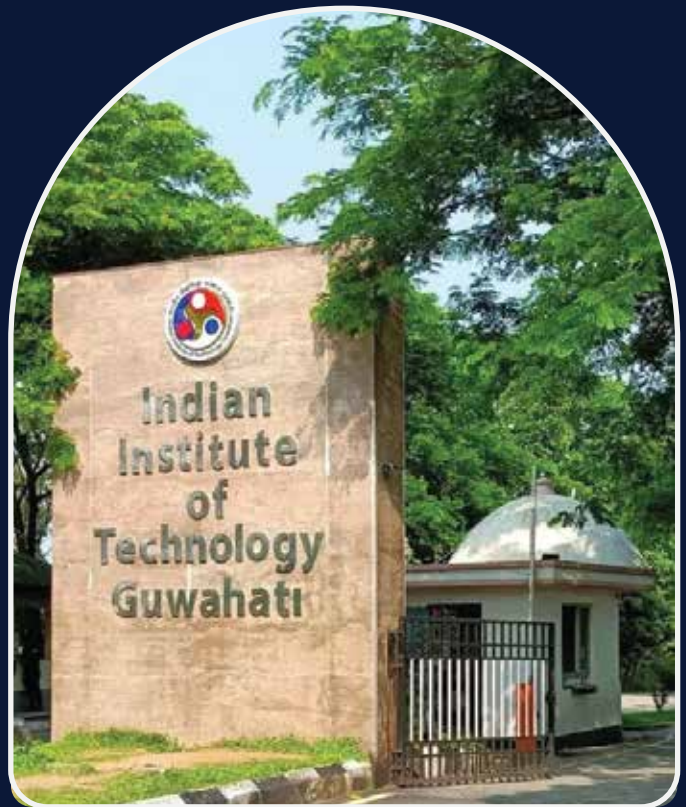
**The IoT
Academy**

Connecting The Unconnected

About The IIT Guwahati

Indian Institute of Technology Guwahati (IIT Guwahati), the sixth member of the IIT fraternity, was established in 1994. The institute began its academic programmes in 1995. Currently, it comprises eleven departments and three interdisciplinary academic centres, covering major disciplines in engineering, science, and humanities. IIT Guwahati offers BTech, BDes, MA, MDes, MTech, MSc, and PhD programmes.

Within a short span of time, IIT Guwahati has established world-class infrastructure and earned a strong academic reputation.



About The E&ICT Academy IIT Guwahati

Electronics and ICT Academy aims to provide specialized training to the faculties and working professionals, Arts, Commerce, Science colleges and polytechnic institutes by developing short term training programmes on fundamental and advanced topics in IT, Electronics & Communication, Product Design, Manufacturing. In addition, the Academy conducts specialized customized training programmes and research promotion workshops for corporate sector & educational





About The Program

Most of the technological advancements in the recent times you see around have an element of Data Science, Machine Learning, AI & Generative AI in it. This 9-month Applied Data Science, Machine Learning & AI course is uniquely designed by E&ICT Academy, IIT Guwahati, and industry leaders, to make you master exactly what the Data Science, Machine Learning & AI jobs market demands. The objective of this certification programme is to perfectly prepare you for the Data Science, Machine Learning & AI job roles you aspire for. You will learn Artificial Intelligence & Data Technologies, AI & Advanced Analytics, Intelligent Systems & Data Science, Machine Intelligence Technologies, AI/ML & Data-Driven Solutions skills through multiple ML, Deep Learning and AI business projects, transforming you into a sought-after New Age DS, ML & AI Specialist.

Integrated with Generative AI & LLMs



Generative AI Modules & Architecture



Building LLM Applications



Generative AI Tools & Case Studies

Data Analytics, Data Science & Visualization with Python

Module-1: Python Basics

- ✓ What is Python
- ✓ Application of Python
- ✓ Why use Python for AI-ML Installation Anaconda/Other Idle
- ✓ Python Tokens
- ✓ Data Types in Python
- ✓ Conditional Statement
- ✓ Loops in Python
- ✓ Functions in Python
- ✓ Advance Functions
- ✓ File Handling
- ✓ **Mini Project**

Module-2: Intro to Git & Github and Kaggle

- ✓ Git and GitHub
- ✓ kaggle

Module-3: Python NumPy & Pandas

- ✓ Introduction to NumPy
- ✓ Exploring a NumPy Array
- ✓ Indexing & Slicing a NumPy Array
- ✓ Manipulating a NumPy Array
- ✓ Performing Mathematical & Statistical Functions using NumPy
- ✓ Performing Linear Algebra Operations using NumPy
- ✓ Introduction to Pandas
- ✓ Exploring Pandas Series
- ✓ Introduction to Pandas DataFrame
- ✓ Importing & Exporting Data
- ✓ Implementing basic DataFrame functionalities
- ✓ Exploring Descriptive Statistics with Pandas
- ✓ **Mini Project**

Modules-4: R Language Essentials

- ✓ Fundamentals of R
- ✓ Vectors & control statements
- ✓ Functions in R
- ✓ Matrices & strings
- ✓ Lists & arrays in R
- ✓ Data visualization in R

Modules-5: Exploratory Data Analysis (EDA)

- ✓ Data Types
- ✓ Dispersion & Skewness
- ✓ Data imputation
- ✓ Data Pre-processing
- ✓ Data Cleaning
- ✓ Data Manipulation
- ✓ Advanced Manipulation
- ✓ **Mini Project**

Module-6: SQL For Data Analytics

- ✓ SQL Basic
- ✓ SQL Joins
- ✓ SQL Aggregations
- ✓ Subqueries and Temp Tables
- ✓ SQL Data Cleaning
- ✓ Window Functions
- ✓ **Mini Project**

Module-7: Data Analysis with Excel

- ✓ Key Formulas and Functions, Ranges and Tables
- ✓ Data Cleaning – Text Functions, Dates and Times
- ✓ Conditional Formatting, Sorting and Filtering
- ✓ Dashboard Creation
- ✓ Analysis with Pivot Tables
- ✓ Data Analysis in Excel – Trends and Patterns
- ✓ Data Visualization in Excel – Charts and Plots
- ✓ Functions in Python
- ✓ Advance Functions
- ✓ File Handling
- ✓ **Mini Project**

Module-8: Data Visualization with Python

- ✓ Why Data Visualization?
- ✓ Introduction to Data Visualization
- ✓ Libraries & Tools for Data Visualization in Python
- ✓ Static Data Visualization Using Seaborn
- ✓ Interactive Data Visualization Using Plotly Express
- ✓ Interactive Animations & Facet Plots

Module-9: Tableau for Business Intelligence

- ✓ Understanding Data
- ✓ Creating Your First visualization
- ✓ Tableau Calculations
- ✓ Formatting Visualizations
- ✓ Manipulating Data in Tableau
- ✓ Creating Dashboards AND Stories
- ✓ Distributing & Publishing Your Visualization
- ✓ **Mini Project**

Module-10: Visual Storytelling using Power BI

- ✓ Introduction To Power BI
- ✓ Creating Power BI Reports, Auto Filters
- ✓ Report Visualization And Properties
- ✓ Chart And Map Report Properties
- ✓ Hierarchies And Drilldown Reports
- ✓ Power BI Deployment & Cloud
- ✓ Improving Power BI Reports And More...
- ✓ **Mini Project**

Capstone Project- 1 in Data Analytics

Applied Maths, Statistics and Probability for ML & AI

Module-1: Mathematics for Machine Learning & AI

- ✓ Linear Algebra
- ✓ Multi-variable Calculus
- ✓ Introduction to Calculus

Module-2: Statistics for Machine Learning & AI

- ✓ Applications of Statistics
- ✓ Sampling techniques
- ✓ Introduction to Statistics
- ✓ Descriptive Statistics
- ✓ Categories of Data
- ✓ Measure Used in Descriptive Statistics
- ✓ Basic Terminologies in Statistics
- ✓ Z-Scores

Module-3: Probability

- ✓ What is Probability?
- ✓ Random Variables
- ✓ Rules of probability
- ✓ Probability Distribution Functions
- ✓ Types of Probability
- ✓ Mini Project

Module-4: Inferential Statistics

- ✓ Introduction to Inferential Statistics
- ✓ One Sample Z test
- ✓ Hypothesis Testing
- ✓ One Sample T test
- ✓ Normal Distribution
- ✓ Independent Sample T test
- ✓ P-value
- ✓ Chi-square test
- ✓ One-tailed and Two-tailed tests
- ✓ ANOVA

Capstone Project- 2

Machine Learning Specialization

Module-1: Introduction to Machine Learning

- ✓ What is Machine Learning?
- ✓ Applications of Machine Learning
- ✓ Machine Learning in your daily life
- ✓ Machine Learning in Retail
- ✓ Steps Involved in Machine Learning

Module-2: Regression

- ✓ Introduction to Regression
- ✓ Linear Regression
- ✓ Evaluation Metrics in Regression Models
- ✓ Logistic Regression
- ✓ Mini Project

Module-3: Supervised Classification

- ✓ Why Use Classification?
- ✓ Application of Classification Algorithms
- ✓ Introduction to Classification
- ✓ Types of Classification Algorithms
- ✓ Classification: Decision Tree
- ✓ Classification: Random Forest
- ✓ ML in Banking & Finance - Benefits
- ✓ Classification: SVM
- ✓ Classification: KNN
- ✓ Classification: Naïve Bayes
- ✓ Evaluating Classification Models
- ✓ Model Optimization Techniques
- ✓ Model Boosting Techniques
- ✓ Introduction to PyCaret
- ✓ Dealing with Unbalanced Datasets
- ✓ 4 Mini Projects

Capstone Project- 3

Module-4: Unsupervised Learning

- ✓ What is Unsupervised Learning?
- ✓ Application of Unsupervised Learning
- ✓ Introduction to Clustering
- ✓ Types of Clustering
- ✓ Partitioning Methods: K-means, DBSCAN, Spectral
- ✓ Hierarchical Methods: Hierarchical
- ✓ **2 Mini Projects**

Module 5 :- Dimension Reduction

- ✓ PCA
- ✓ Factor Analysis
- ✓ LDA
- ✓ **Mini Project**

Module-6: Association Rules Mining

- ✓ What are Association Rules?
- ✓ Association Rule Parameters
- ✓ A-priori Algorithm
- ✓ Market Basket Analysis

Module-7: Recommendation System

- ✓ What is a Recommendation System?
- ✓ Need for a Recommendation System
- ✓ Recommendation System Use Cases
- ✓ Applications of Recommendation System
- ✓ Types of Recommendation Systems
- ✓ Collaborative Filtering
- ✓ Content Based Filtering
- ✓ Matrix Factorization
- ✓ Pros and Cons of Collaborative Filtering
- ✓ Hybrid Recommender System
- ✓ **Mini Project**

Module-8: Time-series Forecasting

- ✓ Introduction to forecasting data
- ✓ Properties of Time Series data
- ✓ Features of Time Series data
- ✓ Markov Processes - Overview and Terminologies
- ✓ Naive, Average and Moving Average Forecasting
- ✓ Exponential Smoothing
- ✓ ARIMA Approach
- ✓ **Mini Project**

Module 09 - Machine Learning Model Deployment

- ✓ Overview of Machine Learning Models
- ✓ Machine Learning System Architecture
- ✓ Research Environment
- ✓ Packaging, Serving and Deploying the model
- ✓ Differential Testing And More...

Capstone Project- 4

Deep Learning & AI Specialization

Module-1: Introduction to Deep Learning

- ✓ What is Deep Learning
- ✓ Curse of Dimensionality
- ✓ Machine Learning vs. Deep Learning
- ✓ Use Cases of Deep Learning
- ✓ Human Brain vs. Neural Network
- ✓ What is Perceptron?
- ✓ Learning Rate
- ✓ Epoch
- ✓ Batch Size

Module-2: Tensorflow 2.0 with Tensor Board

- ✓ Introduction to Tensorflow 2.x
- ✓ Installing Tensorflow 2.x
- ✓ Introduction to TensorBoard
- ✓ Defining Sequence model layers
- ✓ Activation Function
- ✓ Layer Types
- ✓ Model Compilation
- ✓ Model Optimizer
- ✓ Model Loss Function
- ✓ Model Training
- ✓ Digit Classification using Simple Neural Network in Tensorflow 2.x
- ✓ Mini Project

Module-3: Computer Vision

- ✓ Introduction to Convolutional Neural Networks
- ✓ Introduction to images
- ✓ Convolution, Pooling, Padding & its mechanisms
- ✓ Forward Propagation & Backpropagation for CNNs
- ✓ CNN architectures
- ✓ AlexNet, VGGNet, InceptionNet & ResNet
- ✓ Transfer Learning
- ✓ Object Detection

Module-4: Introduction to NLP

- ✓ Introduction to NLP
- ✓ Libraries & Tools for NLP in Python
- ✓ NLTK vs Spacy
- ✓ Applications of NLP:
- ✓ Chatbot
- ✓ Search, Autocorrect and Autocomplete
- ✓ Grammar Checker

Module-5: Text Processing Methods

- ✓ Bag of Words
- ✓ Countvectorizer
- ✓ Term Frequency (TF)
- ✓ Inverse Document Frequency (IDF)
- ✓ Converting text to features and labels
- ✓ Multinomial Naive Bayes Classifier
- ✓ Leveraging Confusion Matrix Assignment
- ✓ Word Embeddings
- ✓ Word2Vec
- ✓ **Mini Project**

Module-6: Introduction to Sequence Learning

- ✓ What is Sequence Learning
- ✓ Application of Sequence Learning
- ✓ What is Sequence Model
- ✓ Bayesian Network
- ✓ Markov Model
- ✓ Markov Chain
- ✓ Hidden Markov Model
- ✓ Viterbi Algorithm

Module-7: RNN vs LSTM

- ✓ Recurrent Neural Network
- ✓ Architecture of RNN
- ✓ Calculation in RNN
- ✓ Backpropagation and Loss calculation
- ✓ Applications of RNN
- ✓ What is LSTM?
- ✓ Structure of LSTM
- ✓ LSTM architecture
- ✓ **Mini Project**

Capstone Project- 5

Module-8: TensorFlow Hub for Object Detection using Faster RCNN

- ✓ Introduction to TensorFlow Hub
- ✓ Use cases of TensorFlow Hub
- ✓ Limitations of CNN in object detection
- ✓ Architecture of RCNN
- ✓ Applications of RCNN
- ✓ Types of RCNN
- ✓ Step by step implementation of Faster RCNN

Module-9: Sentiment Analysis

- ✓ Sentiment Analysis
- ✓ Subjectivity Analysis
- ✓ Topic Extraction
- ✓ Product Reviews
- ✓ Opinion Retrieval and Spam
- ✓ Opinion Summarization
- ✓ Implementing Sentiment Analysis in Python

Module-10: Reinforcement Learning

- ✓ Understanding Reinforcement Learning
- ✓ Algorithms associated with RL
- ✓ Q-Learning Model
- ✓ **Mini Project**

Module-11: MLOps & Deployment

- ✓ Introduction To MLOps
- ✓ Automating Pipelines with Airflow
- ✓ Model Packaging
- ✓ API Building
- ✓ Model Training with AWS SageMaker
- ✓ Model Deployment
- ✓ Model Maintenance

Capstone Project- 6

Advanced Generative AI, LLMs & Agentic AI Specialization

Module-1: Introduction To Generative AI

- ✓ Introduction to Generative AI Models
- ✓ The Future of Generative AI
- ✓ Types of Generative AI Models
- ✓ Ethical Considerations in Generative AI Models & ChatGPT
- ✓ Popular Generative AI Models
- ✓ Benchmarking & Evaluating Models

Module-2: ChatGPT, Prompt Engineering, Explainable AI ChatGPT

Fundamentals of Prompt Engineering

- ✓ Zero-shot, Few-shot, Chain-of-Thought (CoT) Promptin
- ✓ Role-based Prompts, Multi-turn Conversations

Advanced Prompt Techniques

- ✓ System vs. User Prompts, Style Transfer, Iterative Prompting

Explainable AI

- ✓ Introduction to explainable AI
- ✓ Mini Project

Module-3: Advanced Generative AI Models & Architecture

- ✓ Introduction to Generative Models
- ✓ Large Language Models (LLMs)
- ✓ LLMs: GPT-4, DeepSeek, LLaMA, Mistral, Claude, Falcon
- ✓ Variational Autoencoders (VAEs)
- ✓ Generative Adversarial Networks (GANs) - StyleGAN, CycleGAN
- ✓ Attention Mechanisms and Transformers (GPT, BERT, T5)
- ✓ **Mini Project**

Module-4: Advanced Generative AI - Building LLM Applications

- ✓ Langchain and Workflow Design
- ✓ Advanced Prompt Engineering Techniques
- ✓ LLM Application Development
- ✓ LLM Fine-Tuning and Customization
- ✓ Fine-Tuning & Pre-training of LLMs
- ✓ Benchmarking and Evaluation of LLM Capabilities
- ✓ LangChain for LLM Development
- ✓ RAG with Hugging Face & LangChain
- ✓ **2 Mini Projects**

Module-5: Agentic AI & Multimodal AI (Voice, Video & Document AI)

Agentic AI

- ✓ Frameworks
- ✓ Hugging Face Ecosystem

Speech-to-Text & AI Voice Processing

- ✓ Whisper, Wav2Vec, DeepSeek-STT

Multimodal AI

Text-to-Image & Image-to-Image Generation

- ✓ DALL-E, MidJourney, and Stable Diffusion
- ✓ LDMs & Hugging Face Implementations

Advanced Multimodal Models

- ✓ Google's Gemini, OpenAI's GPT-4o, and models from Meta AI
- ✓ **Mini Project**

Module-6: Generative AI Applications In Industries

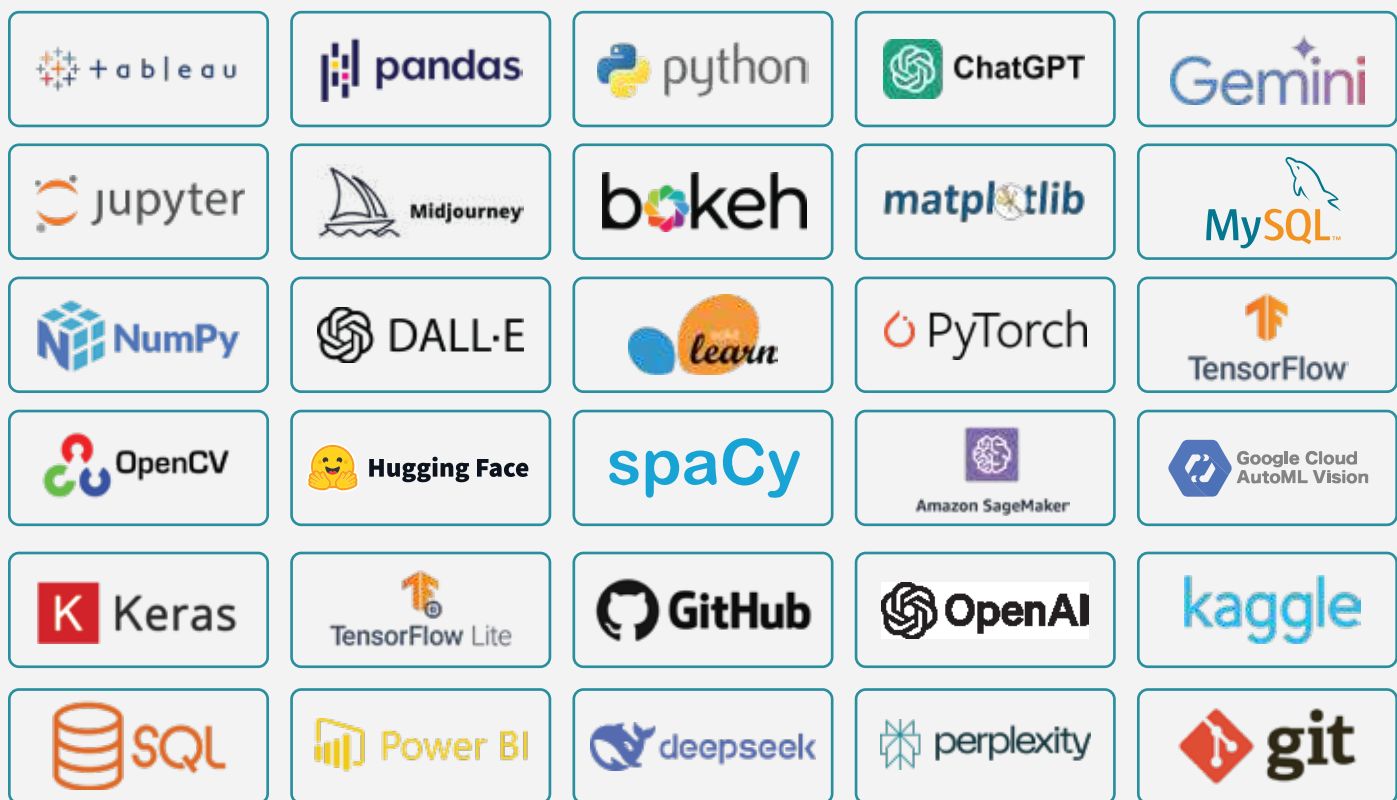
- ✓ Applications in Healthcare (e.g., Medical Imaging, Diagnosis)
- ✓ Applications in Finance (e.g., Risk Modeling, Fraud Detection)
- ✓ Applications in Retail and E-commerce (e.g., Personalized Marketing)
- ✓ Applications in Media and Entertainment (e.g., Content Creation)

Module-7: Responsible AI

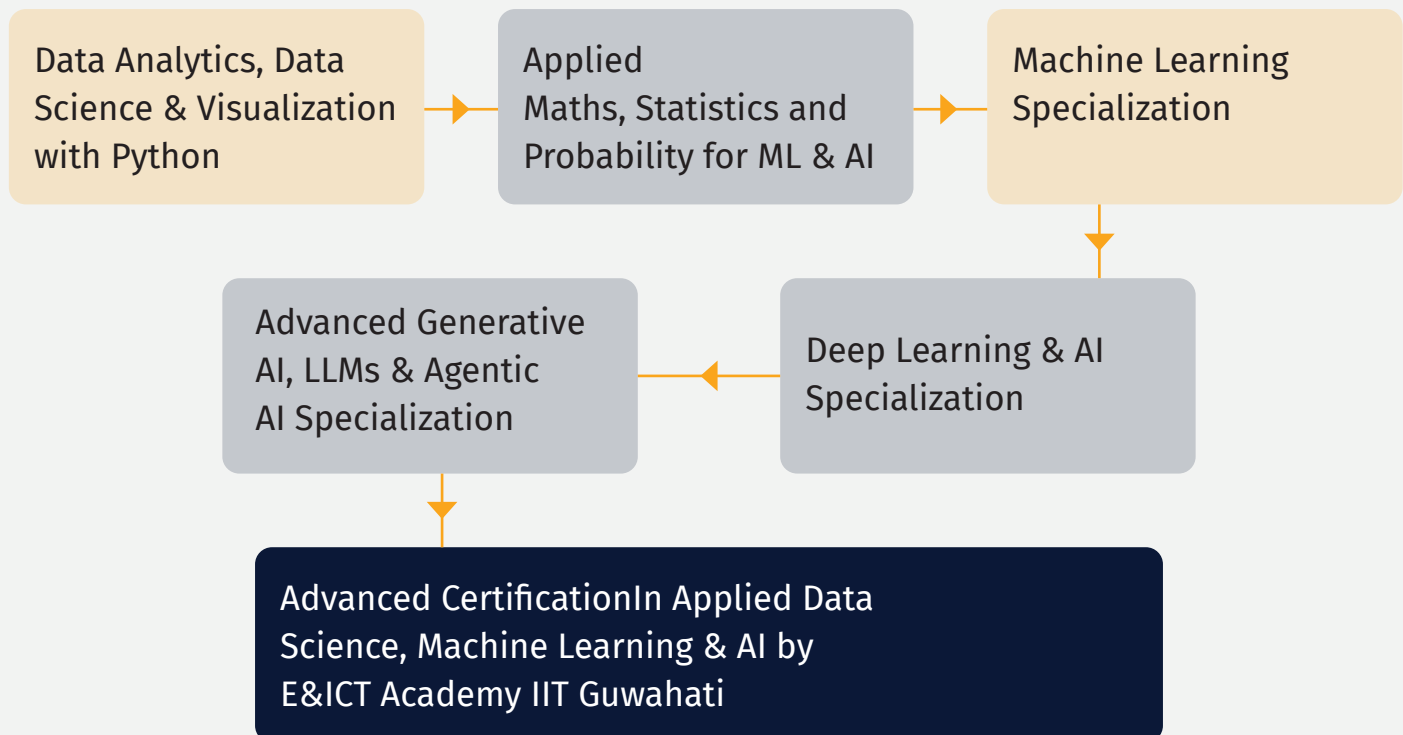
- ✓ Awareness, Toxicity, Misinformation, Bias, Security, Fairness

Capstone Project- 7

Tools, Languages & Frameworks



Learning Path



CONTACT

THANK YOU!

Contact Details



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सत्यमेव जयते

Program Information

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