SYLLABUS

ARTIFICIAL INTELLIGENCE · ADVANCED PROGRAMME

ADVANCED GENERATIVE AI

ARGE LANGUAGE MODELS
EVAL AUGMENTED GENE
E-TUNING . MULTIMODAL

LEVEL	MODULES	MODE	DELIVERY
Advanced	**18**	**Classroom · Online · Hybrid**	**Lecture · Lab · Projects**

01 COURSE OVERVIEW

This programme takes learners from the foundations of artificial intelligence to production-grade generative AI systems. It covers the mathematics and Python engineering that underpin modern models, the architecture of large language models, and the applied disciplines that surround them: prompt engineering, retrieval-augmented generation, agent design, fine-tuning, multimodal generation, evaluation, security and MLOps.

Every module pairs concepts with a lab on the tools used in industry — Hugging Face, LangChain, LlamaIndex, vector databases, FastAPI and Docker — and the programme closes with an end-to-end capstone build.

WHO IT IS FOR

- Software developers moving into AI engineering
- Data science and analytics professionals
- Final-year engineering and MCA students
- Technical leads evaluating AI for their products

PREREQUISITES

Basic programming knowledge. Python fundamentals recommended; the programme revises them in Module 3.

02 LEARNING OUTCOMES

01 Explain how transformer-based language models are built, scaled and served.

02 Write, chain and optimise prompts for reliable production behaviour.

03 Build retrieval pipelines over private documents using vector databases.

04 Design autonomous and multi-agent systems with tool and function calling.

05 Fine-tune open models with LoRA, QLoRA and PEFT on prepared datasets.

06 Generate and integrate image, audio and speech output alongside text.

07 Deploy AI applications as APIs and containers and monitor them in use.

08 Evaluate output with BLEU, ROUGE, perplexity and LLM-as-a-judge methods.

09 Identify and mitigate prompt injection, bias, privacy and governance risks.

03 MODULE STRUCTURE

18 MODULES

01 FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

- Evolution of AI
- Machine Learning vs Deep Learning vs Generative AI
- AI Applications across Industries
- AI Ecosystem
- History of Large Language Models (LLMs)
- AI Ethics and Responsible AI

LAB

SETTING UP AI DEVELOPMENT ENVIRONMENT · INTRODUCTION TO GOOGLE COLLAB, JUPYTER NOTEBOOK · USING PYTHON FOR AI

02 MATHEMATICS FOR GENERATIVE AI

- Linear Algebra
- Probability & Statistics
- Calculus Basics
- Optimization
- Gradient Descent
- Loss Functions

LAB

NUMPY · MATRIX OPERATIONS · DATA VISUALIZATION USING MATPLOTLIB

03 PYTHON FOR AI DEVELOPMENT

- Python Fundamentals
- Functions
- File Handling
- Virtual Environments
- Data Structures
- OOP
- Exception Handling

LAB

PANDAS | NUMPY | MATPLOTLIB | SEABORN | SCIKIT-LEARN BASICS

04 NATURAL LANGUAGE PROCESSING (NLP)

- Text Processing
- Stemming
- Word Embeddings
- Word2Vec
- BERT Introduction
- Tokenization
- Lemmatization
- TF-IDF
- FastText

LAB

NLTK | SPACY | HUGGING FACE TOKENIZERS

05 DEEP LEARNING FUNDAMENTALS

- Artificial Neural Networks
- RNN
- GRU
- Attention Mechanism
- CNN
- LSTM
- Transformers

LAB

TENSORFLOW | KERAS | PYTORCH BASICS

06 LARGE LANGUAGE MODELS (LLMS)

- GPT Architecture
- Encoder vs Decoder
- Attention Layers
- Context Windows
- Transformer Architecture
- Positional Encoding
- Token Prediction
- Model Scaling

POPULAR MODELS

GPT-4/5 | CLAUDE | GEMINI | LLAMA | DEEPSEEK | MISTRAL | QWEN

LAB

HUGGING FACE TRANSFORMERS | MODEL INFERENCE

07 PROMPT ENGINEERING (ADVANCED)

- Zero-shot Prompting
- One-shot Prompting
- Few-shot Prompting
- Chain-of-Thought Prompting
- Tree-of-Thought
- Role Prompting
- System Prompt Design
- Prompt Chaining
- Prompt Optimization

LAB

CHATGPT | CLAUDE | GEMINI | PERPLEXITY

MINI PROJECTS

AI TUTOR | AI HR ASSISTANT | AI CUSTOMER SUPPORT BOT

08 RETRIEVAL-AUGMENTED GENERATION (RAG)

- Why RAG?
- Document Loading
- Chunking
- Embeddings

VECTOR DATABASES

SEMANTIC SEARCH | RETRIEVAL PIPELINES | CONTEXT INJECTION

VECTOR DATABASES

FAISS | CHROMADB | PINECONE | WEAVIATE

LAB

LANGCHAIN | LLAMAINDEX | CHROMADB

PROJECT

PDF CHATBOT | COMPANY KNOWLEDGE ASSISTANT

09 AI AGENTS

- Agent Architecture
- Autonomous Agents
- Planning
- Memory
- Tool Calling
- Function Calling
- Multi-Agent Systems

FRAMEWORKS

LANGGRAPH | CREWAI | AUTOGEN | OPENAI AGENTS SDK

LAB

BUILD AI RESEARCH AGENT | TRAVEL PLANNER AGENT | EMAIL AUTOMATION AGENT

10 FINE-TUNING LLMS

- Supervised Fine-Tuning (SFT)
- Instruction Tuning
- LoRA
- QLoRA
- PEFT
- RLHF
- DPO

LAB

FINE-TUNING WITH HUGGING FACE | DATASET PREPARATION

11 MULTIMODAL AI

- Text Generation
- Image Generation
- Video Generation
- Audio Generation
- Speech Models
- Vision Models

MODELS

DALL·E | STABLE DIFFUSION | FLUX | MIDJOURNEY | WHISPER | ELEVENLABS

LAB

IMAGE GENERATION | SPEECH-TO-TEXT | TEXT-TO-SPEECH

12 AI APPLICATION DEVELOPMENT

- REST APIs
- FastAPI
- Flask
- Streamlit
- Gradio
- Docker
- Deployment Basics

PROJECT

AI WEB APPLICATION

13 AI AUTOMATION

- Workflow Automation
- AI Assistants
- Email Automation
- Document Automation
- OCR Integration
- Calendar Automation

TOOLS

ZAPIER | N8N | MAKE | POWER AUTOMATE

14 AI SECURITY & RESPONSIBLE AI

- AI Risks
- Prompt Injection
- Jailbreaking
- Hallucinations
- Model Bias
- Data Privacy
- AI Governance
- Secure AI Deployment

15 MODEL EVALUATION

- BLEU
- ROUGE
- Perplexity
- Human Evaluation
- LLM-as-a-Judge
- Benchmarking
- Cost Optimization

16 MLOPS FOR GENERATIVE AI

- Model Versioning
- Experiment Tracking
- CI/CD
- Monitoring
- Scaling
- GPU Deployment

TOOLS

MLFLOW · WEIGHTS & BIASES · DOCKER · KUBERNETES · GITHUB ACTIONS

17 CLOUD AI SERVICES

- OpenAI API
- Azure OpenAI
- Google Vertex AI
- AWS Bedrock
- Hugging Face Inference API

LAB

API INTEGRATION · SECURE KEY MANAGEMENT · COST MONITORING

18 CAPSTONE PROJECTS

Students build end-to-end Generative AI solutions, such as:

- AI Legal Assistant
- AI Resume Analyzer
- AI Code Generator
- AI Customer Support Bot
- AI Research Assistant
- AI Sales Assistant
- Enterprise RAG Chatbot
- AI Medical Assistant
- AI Interview Coach
- AI Content Creator
- AI Document Summarizer
- AI Voice Assistant

04 TOOLS & TECHNOLOGIES COVERED

RECOMMENDED TOOLS

PYTHON · VS CODE · GOOGLE COLAB · JUPYTER NOTEBOOK · GIT & GITHUB · HUGGING FACE · LANGCHAIN · LLAMAINDEX · CHROMADB · FAISS · STREAMLIT · GRADIO · FASTAPI · DOCKER · OPENAI API

05 ASSESSMENT & CERTIFICATION

Module assignments and labs	**25%**
Mini projects	**20%**
Internal assessments	**15%**
Capstone project and review	**40%**

CERTIFICATION

Learners who complete all modules, submit the capstone project and clear the final review receive a course completion certificate from Kaizen Infinities Private Limited. Project work is documented for the learner's portfolio and GitHub profile, and interview preparation is included in the final week.

06 CAREER OUTCOMES

ROLES THIS PROGRAMME PREPARES FOR

GENERATIVE AI ENGINEER · LLM APPLICATION DEVELOPER · AI AGENT DEVELOPER · PROMPT ENGINEER · NLP ENGINEER · AI PRODUCT ENGINEER · MLOPS ENGINEER · AI AUTOMATION CONSULTANT

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