AI-First Engineering with Generative & Agentic AI

Total Duration: 12 Days (96 Hours)
Format: Instructor-led | Hands-on | Capstone-driven
Level: Intermediate (Python required)

Pre-requisite: Knowledge of python like data types, data structures, functions, OOPs

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Course Objectives

- AI-first software engineering mindset
- Enable developers to use AI pair-programming tools effectively
- Build strong foundations in Generative AI, RAG, and Agentic AI
- Design and implement agent-based systems using LangChain & LlamaIndex
- Deliver production-ready AI applications
- Validate learning through industry-aligned capstone projects

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Learning Outcomes

By the end of this course, participants will be able to:

- Apply AI-assisted development workflows in real projects
- Build Generative AI and RAG-based applications
- Design Agentic AI systems with reasoning and tool usage
- Implement agents using LangChain and LlamaIndex
- Deploy and evaluate enterprise-ready AI solutions
- Work on a complete capstone project demonstrating applied skills

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MODULE-WISE TOC WITH DAY ALLOCATION

Day 1

Module 1: AI-First Software Engineering

Topics Covered

- AI-first development mindset
- Traditional vs AI-assisted engineering

- Introduction to Copilot-assisted development
- Using VS Code with Copilot
- Prompting Copilot for:
    - Code generation
    - Code explanation
    - Refactoring and optimization
- Reviewing, validating, and securing AI-generated code

Hands-On

- AI-assisted coding and refactoring exercises

Day 2

Module 2: AI and Programming with Python

Topics Covered

- Python fundamentals for AI use cases
- Data manipulation using Python (Pandas)
- Basic data analysis workflows
- Data visualization concepts
- Integrating Python with AI tools and APIs

Hands-On

- Python → Data → AI mini pipeline

Day 3

Module 3: Generative AI & LLM Foundations

Topics Covered

- Introduction to Generative AI
- High-level understanding of Large Language Models
- Tokens, context windows, and inference
- Prompt engineering fundamentals
- Writing effective prompts for:

    - Tasks
    - Conversations
- LLM usage patterns:
    - Single-shot
    - Multi-turn interactions

Hands-On

- Prompt design and optimization labs

Day 4

Module 4: Retrieval-Augmented Generation (RAG)

Topics Covered

- Limitations of standalone LLMs
- RAG architecture and workflow
- Document loading and preprocessing
- Chunking strategies (fixed, semantic)
- Embedding generation
- Indexing and querying workflows
- Vector database fundamentals

Hands-On

- Build a complete RAG pipeline

Day 5

Module 5: Building Chatbots & Multimodal AI

Topics Covered

- Designing a RAG-based chatbot
- Document ingestion pipeline
- Query engine configuration
- Chat interaction flow
- Introduction to multimodal AI

- Vector stores for multimodal RAG

Hands-On

- Document chatbot implementation

Day 6

Module 6: Agentic AI – Concepts & Design

Topics Covered

- Introduction to Agentic AI
- RAG vs Agentic RAG
- Agent lifecycle:
    - Planning
    - Execution
    - Reflection
- Agent behaviors and roles
- Tool calling concepts
- Agent safety and guardrails

Hands-On

- Simple agent reasoning workflows

Day 7

Module 7: Agentic AI with LangChain

Topics Covered

- LangChain architecture
- Chains vs Agents
- Tools and toolkits
- Function calling
- Memory types in LangChain
- Multi-step agent execution
- Building agentic workflows

Hands-On

- Agentic system using LangChain

Day 8

Module 8: Agentic RAG with LlamaIndex

Topics Covered

- LlamaIndex architecture
- Query routing strategies
- Tool-augmented agents
- Agent reasoning workflows
- Implementing Agentic RAG systems

Hands-On

- Agentic RAG implementation

Day 9

Module 9: AI-Powered Document Applications

Topics Covered

- Responsive UI for document upload
- Document chat interface (RAG)
- Auto-generated document insights dashboard
- Multi-format document support (PDF, DOCX, TXT)
- Streaming LLM responses
- Persistent chat history
- Context-aware multi-turn conversations
- Advanced prompt grounding
- Response reference citation

Hands-On

- End-to-end document AI application

Day 10

Module 10: Capstone Project

Capstone Focus

Participants will design, build, and present **one complete AI solution**.

Capstone Options

- AI-First Code Assistant
- RAG-based Enterprise Document Chat
- Agentic Research Assistant (LangChain)
- Multimodal Document Intelligence System

Evaluation Tracks

- Generative AI
- Multimodality
- Agentic AI

Outcome: Production-ready demo + evaluation

Day 11 : Capstone Evaluation (Students present their solution for evaluation)

Day 12 : Capstone Solution (Trainer demonstrates the solution)