Artificial Intelligence (AI) – Engineering Capstone

Advanced AI Engineering, Deployment, MLOps, AI Agents & Autonomous Systems

Target Audience

High School Students (Grades 9–12) and learners who have completed AI Specialist or have strong knowledge of Python, Machine Learning, Deep Learning, Generative AI, LLMs, Computer Vision, NLP, and AI development.

Program Pathway

AI Engineering Capstone

Total Duration

108 Hours

Delivery

Cohort-Based + Instructor-Led + Hands-On Labs

Program Goal

The AI Engineering Capstone program builds on the AI Specialist pathway and focuses on designing, developing, integrating, testing, deploying, and documenting complete AI-powered systems. Students explore AI system architecture, advanced AI application development, model deployment, APIs, cloud AI, MLOps, Edge AI, advanced AI agents, robotics, autonomous AI, and end-to-end AI engineering projects.

Program Structure

Module	Topic	Hours
Module 1	AI Engineering & System Architecture	22
Module 2	Advanced AI Application Development & AI Agents	22
Module 3	Model Deployment, Cloud AI & MLOps	22
Module 4	Edge AI, Robotics & Autonomous AI Systems	20

Module 5	AI Engineering Capstone Project	22
Total		**108 Hours**

Curriculum

Module 1 – AI Engineering & System Architecture

Students learn how AI components are designed and combined to create reliable, scalable, and production-oriented AI systems.

Topics:

AI Engineering Fundamentals, AI System Lifecycle, AI Solution Architecture, AI System Components, Data Pipelines, Model Selection, Model Integration, AI APIs, Application Layers, Backend & Frontend Concepts, AI Infrastructure Fundamentals, Databases for AI Applications, Vector Databases Fundamentals, Embeddings, Model Serving Fundamentals, System Integration, AI Workflow Design, Scalability Fundamentals, Performance Considerations, AI System Security, Responsible AI Architecture.

Module 2 – Advanced AI Application Development & AI Agents

Students learn how to build intelligent applications that combine LLMs, APIs, tools, retrieval systems, and AI agents to perform complex tasks.

Topics:

Advanced Generative AI, Large Language Model Applications, Advanced Prompt Engineering, Structured Outputs, Function Calling, Tool Use, AI APIs, Multimodal AI Applications, Retrieval-Augmented Generation, Vector Search, Document Processing, Knowledge Bases, AI Assistants, Advanced AI Agents, Agent Workflows, Multi-Step Reasoning Workflows, Agent Tools, Agent Memory Fundamentals, Multi-Agent Systems Fundamentals, AI Application Integration, AI Evaluation, Hallucination Reduction, AI Safety & Guardrails.

Module 3 – Model Deployment, Cloud AI & MLOps

Students learn how AI and Machine Learning models are prepared, deployed, monitored, and maintained in real-world environments.

Topics:

AI Model Deployment Fundamentals, Model Serving, REST APIs, API Development, Cloud AI Fundamentals, Cloud Compute, Cloud Storage, Containers & Docker Fundamentals, Deployment Workflows, Model Versioning, Data Versioning, MLOps Fundamentals, Continuous Integration & Continuous Deployment, Model Monitoring, Performance Monitoring, Model Evaluation in Production, Logging & Observability, Model Optimization, Scaling AI Applications, Cloud AI Services, AI Security, Cost Optimization, Production AI Lifecycle.

Module 4 – Edge AI, Robotics & Autonomous AI Systems

Students learn how AI systems can operate on edge devices and autonomous platforms to sense, analyze, decide, and respond in real-world environments.

Topics:

Edge AI Fundamentals, AI on Edge Devices, Edge Model Deployment, Model Optimization, Computer Vision on Edge Devices, Sensor Data Processing, Real-Time AI, Robotics AI Architecture, Robot Perception, Sensor Fusion, AI-Based Decision-Making, Path Planning, Navigation, Obstacle Detection & Avoidance, Autonomous Systems, Autonomous AI Workflows, Robotics Simulation, AI-Based Control, Human-Robot Interaction, Autonomous Vehicles & Drones, Edge AI Security, Robotics Safety.

Module 5 – AI Engineering Capstone Project

Students apply concepts learned throughout the program to design, develop, integrate, test, deploy, and present a complete AI-powered engineering solution.

Topics:

Problem Identification, Requirements Analysis, AI Solution Architecture, System Design, Data Selection & Preparation, Model Selection, AI Model Integration, LLM Integration, Generative AI Integration, RAG Integration, AI Agent Integration, API Development, Database or Vector Database Integration, Cloud Deployment, MLOps Concepts, Testing & Debugging, Performance Evaluation, Security Review, Responsible AI Review, Documentation, Deployment Planning, Project Demonstration, Final Presentation.

Final Project:

Build, deploy, test, and present an end-to-end AI engineering solution that integrates multiple AI technologies such as Machine Learning, Deep Learning, Generative AI, LLMs, RAG, AI Agents, APIs, Cloud AI, MLOps, Computer Vision, Edge AI, Robotics, or Autonomous AI.

Hands-On Learning

Students learn through instructor-led lessons, advanced Python exercises, AI architecture activities, API development, LLM application development, RAG and AI agent labs, cloud deployment activities, MLOps exercises, Edge AI activities, robotics simulations, system integration exercises, testing and evaluation activities, mini-projects, assessments, and a final AI Engineering Capstone project.

What Students Build

Students develop practical experience with AI system architecture, AI-powered applications, LLM applications, RAG systems, AI assistants, advanced AI agents, AI APIs, vector database applications, cloud-deployed AI applications, model deployment workflows, MLOps pipelines, Edge AI applications, computer vision systems, robotics applications, autonomous AI workflows, and complete end-to-end AI engineering solutions.

Recommended Lab Requirements

Each student should ideally have:

Windows or Mac desktop/laptop
8 GB RAM minimum
16 GB RAM recommended
10 GB+ free storage

Windows/Mac systems are recommended. Chromebooks are not preferred.

Cloud-based environments may be used for intensive AI model training, deployment, MLOps, and development activities, so a dedicated GPU is not required.

Next Step

Students who complete the AI Engineering Capstone will have experience designing and developing end-to-end AI systems and can progress toward advanced studies and career pathways in **AI Engineering, Machine Learning Engineering, Generative AI Engineering, MLOps, Cloud AI, Robotics, Autonomous Systems, and advanced AI application development.**