KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Syllabus

Course Code	Course Name	L	T	P	C
Value Added Course	**Build Intelligent AI Agents: From Generative AI to Agentic AI**	**15**	**0**	**30**	**2**

Course Objectives

- Agent Systems using modern Agentic AI frameworks for real-world applications. Introduce the fundamentals of Generative Artificial Intelligence, Large Language Models (LLMs), Transformer architecture, and their real-world applications.
- Develop students' skills in Prompt Engineering techniques for effective interaction with Large Language Models to solve practical problems.
- Provide hands-on experience with open-source AI ecosystems such as Hugging Face and Ollama for building and deploying AI-powered applications.
- Enable students to design and implement Retrieval-Augmented Generation (RAG) systems using embeddings, vector databases, and frameworks such as LangChain.
- Equip students with the knowledge and practical skills to develop autonomous AI Agents and Multi

UNIT 1: Foundations of Generative AI and Large Language Models (9)

Evolution of Artificial Intelligence- Machine Learning to Deep Learning- Generative AI- Discriminative vs Generative Models- GANs - Variational-Autoencoders (VAE)- Diffusion Models- Large Language Models- Transformer Architecture-Tokenization-Embeddings-Attention Mechanism-Pre-training-Fine-tuning-RLHF-Context Window-Temperature-Top-p-Introduction to GPT, Claude, Gemini, LLaMA, Mistral, Phi and Gemma.

UNIT 2: Prompt Engineering and Open-Source LLMs (9)

Prompt Engineering Fundamentals - Prompt Anatomy - Zero-shot Prompting- One-shot Prompting -Few-shot Prompting- Chain-of-Thought- Prompting - ReAct Prompting - Tree-of-Thought -

Prompt Security - Hugging Face Hub- Transformers Library - Pipelines - Model Cards - Tokenizers- Ollama Installation - Local LLMs - Ollama CLI - REST API - Model Quantization - Local Chatbot Development.

UNIT 3: Retrieval-Augmented Generation (9)

Limitations of LLMs - Hallucination - Knowledge Cut-off-RAG Architecture-Text Chunking - Embeddings - Semantic Search - Vector Databases- ChromaDB - FAISS - LangChain - Prompt Templates - Retrieval Chains - Conversational Memory - Evaluation Metrics - Document Question Answering Systems.

UNIT 4: Agentic AI Frameworks (9)

Introduction to Agentic AI - Autonomous Agents - Agent Loop - Tool Calling-Function Calling-Reflection-Planning-Memory-LangGraph-Nodes -Edges-State Graph-CrewAI-Multi-Agent Systems-AutoGen-Model Context Protocol (MCP)-Guardrails-Human-in-the-loop Systems.

UNIT 5: AI Agent Application Development (9)

AI Agent Design -Research Assistant - Resume Screener - Study Buddy - Customer Support Agent - Campus Assistant - Local Private Chatbot -Integration of LangChain with Ollama-Gradio-Streamlit-Project Development-Deployment-Testing-Demonstration-Performance Evaluation.

Course Outcomes

At the end of the course, students will be able to:

CO1: Explain the fundamentals of Generative AI, Large Language Models (LLMs), Transformer architecture, and Prompt Engineering concepts.

CO2: Apply prompt engineering techniques and utilize Hugging Face and Ollama for developing AI-powered applications.

CO3: Develop Retrieval-Augmented Generation (RAG) applications using LangChain, embeddings, and vector databases.

CO4: Design intelligent AI agents using LangGraph, CrewAI, and other agentic AI frameworks.

CO5: Build and demonstrate end-to-end AI Agent applications to solve real-world problems using open-source AI technologies.

CO-PO Mapping and SDG Mapping

CO - PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	H	M	-	-	M	L	-	-	-	L	M	H	H
CO2	M	H	M	M	H	L	-	-	L	M	M	H	H
CO3	M	H	H	H	H	L	-	-	M	M	H	H	H
CO4	M	H	H	H	H	L	-	-	H	M	H	H	H
CO5	M	H	H	H	H	L	-	-	H	H	H	H	H

SDG Mapping

CO's	SDG mapping with CO's	
CO1	SDG 04 - Quality Education	-
CO2	SDG 04 - Quality Education	-
CO3	SDG 04 - Quality Education	SDG 09 - Industry, Innovation, and Infrastructure
CO4	SDG 04 - Quality Education	SDG 09 - Industry, Innovation, and Infrastructure
CO5	SDG 04 - Quality Education	SDG 09 - Industry, Innovation, and Infrastructure