National University of Computer & Emerging Sciences

Course: CS – 4015 Agentic AI (Section: A, B, C)

Homework – I (Phase I)

Scenario: Building an AI Research Assistant for University Students

❖ Project Overview:

Universities are overloaded with study material: lecture notes, course outlines, research summaries, policies and FAQs. Students often struggle to find **relevant information quickly.**

You are part of a startup team building an **AI Research Assistant** that:

- Searches through academic content
- Remembers relevant information
- Answers questions intelligently using retrieved context

This assistant will be developed in **two phases**

Phase 1 (Semantic Search Module with GUI):

You are tasked with building the **memory system** of the AI Research Assistant. Before the agent can answer questions, it must learn how to **store and retrieve knowledge semantically.**

❖ **Problem Statement:** Design a **semantic search engine** that allows the AI assistant to retrieve relevant academic documents based on meaning rather than keywords.

❖ Mandatory Requirements:

Task 1: GUI-Based Data Selection

Using the GUI, allow the user to:

- Upload or select a dataset (minimum 10 – 15 text documents)
- View basic dataset information (number of documents, size)

No dataset should be hard coded in the backend.

Task 2: Embedding and Vector Store Configuration

Allow the user to select:

- **Hugging Face embedding model**
- Vector database (FAISS/Chroma)

Based on these selections:

- Generate embeddings
- Store embeddings in the selected vector database using LangChain

Task 3: Semantic Retrieval

- Provide the query input box in the GUI

- Allow the user to set top-*k* most relevant documents based on semantic similarity
- Display results clearly with relevance ordering

Task 4: Retrieval Evaluation and Analysis

Test the system with multiple queries. Analyze the quality of retrieval results across different datasets and different embedding models.

Document the observations in the report.

❖ Deliverables (Phase 1):

1. GUI-based application
2. Source Code
3. Short Report (2 – 3 pages)