**Project design phase:**

**1. Introduction**

The Educational AI Assistant is designed to help learners and educators by providing two key features:

1. Concept Explanation – generate detailed explanations of academic and technical concepts.

2. Quiz Generator – create quiz questions on a given topic to aid in self-assessment.This design document describes the architecture, functionality, workflows, and design decisions for the system.

**2. Objectives**

Build an AI-powered tool that supports interactive learning:

Provide clear, example-driven explanations for various topics.Help students practice and test knowledge using quizzes.Ensure a simple, intuitive user interface suitable for both students and teachers.

**3. System Architecture**

**3.1 High-Level Design**

The system consists of three layers:

1. User Interface (UI)

Built with Gradio Blocks.Provides tabs for different features (Concept Explanation, Quiz Generator).Handles user inputs and displays model outputs.

2. Application Logic (Backend)

Functions (concept\_explanation, quiz\_generator) prepare prompts for the model.generate\_response handles tokenization, model inference, and decoding.Applies constraints (max length, temperature, sampling) to control responses.

3. AI Model Layer

Uses ibm-granite/granite-3.2-2b-instruct.

Tokenizer and causal language model from Hugging Face Transformers.Supports GPU acceleration (if available) for faster response times.

**4. Functional Design**

**4.1 Concept Explanation**

Input: User provides a concept (e.g., "machine learning").

Process: System constructs a prompt – “Explain the concept of X in detail with examples.”

Output: AI-generated explanation (up to 800 tokens).

**4.2 Quiz Generator**

Input: User provides a topic (e.g., "physics").

Process: System constructs a prompt – “Generate 5 quiz questions about X … with ANSWERS section.”

Output: 5 mixed-format questions (MCQ, True/False, Short Answer) + answer key.

**5. User Interface** **Design**

Main Screen:

Header: “Educational AI Assistant”.

Two tabs:

1. Concept Explanation → input box + button + output text area.

2. Quiz Generator → input box + button + output text area.

UI Components:

Textbox: For user input and displaying output.

Button: To trigger AI generation.

Markdown: To show project title.

**6. Design Decisions**

Model Selection: Granite 3.2 chosen for being lightweight, instruction-tuned, and efficient.Prompt Engineering: Prompts explicitly request structured responses for explanations and quizzes.

Generation Parameters:

temperature=0.7 for balanced creativity :

The coherence.do\_sample=True for varied output.max\_length tuned separately for explanations (800) and quizzes (1000).

Pad Token Handling: Ensures compatibility if tokenizer lacks a pad token.

**7. Risks & Mitigations**

Risk Impact Mitigation

AI generates incorrect information: High Encourage fact-checking, refine prompts

Output length exceeds UI capacity: Medium Set max\_length, add scrollable textboxes

Response time delays: Medium GPU acceleration where availableRepetitive quiz types Low Explicitly prompt for mixed question types

**8. Future Design Enhancements**

Add explanation depth levels (basic, intermediate, advanced).Provide export options (PDF/DOCX for quizzes).Integrate speech input/output for accessibility.Support multi-language explanations and quizzes.Add user progress track