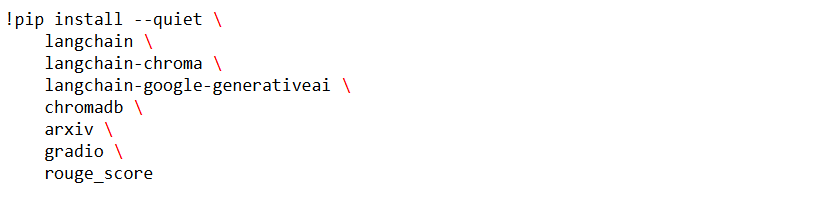
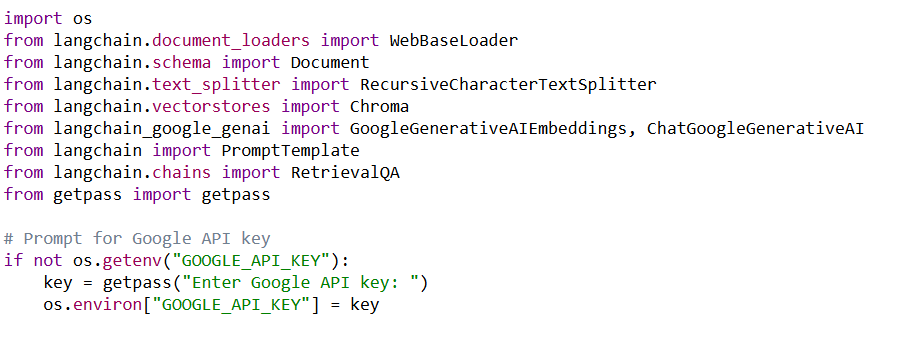
**RAG\_GENAI.ipynb (Gemini‑Powered RAG)**

**Cell 1: Install Dependencies:**

****

**Purpose:**  
Pull in LangChain core, Chroma integration, Gemini adapters, arxiv data loader, Gradio, and ROUGE scorer.

**Cell 2: Imports & Auth:**

****

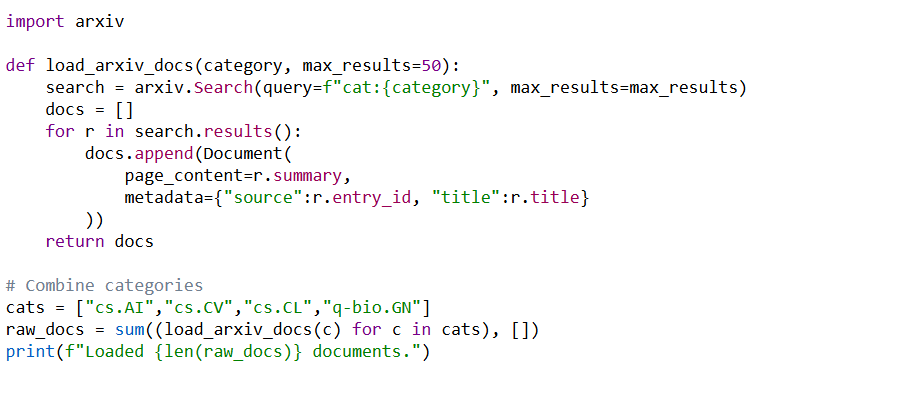
**Purpose:**

* Import all necessary classes
* Securely prompt for GOOGLE\_API\_KEY used by langchain-google-generativeai.

**Notes:**

* Document is LangChain’s standard class for passing text + metadata through the pipeline.

**Cell 3: Fetch Real arXiv Abstract’s:**

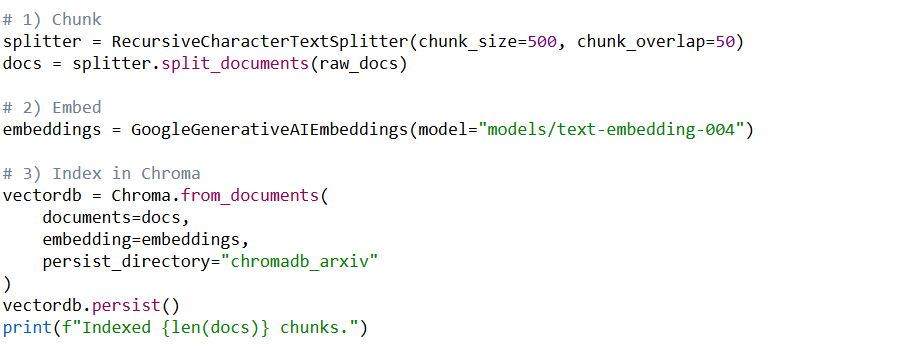
****

**Purpose:**  
Use the arxiv package to pull **actual abstracts** (not just HTML listings) from multiple categories for broad coverage.

**Inputs / Outputs:**

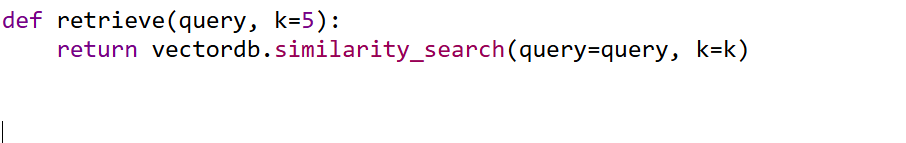
* **Input:** Category strings
* **Output:** raw\_docs list of LangChain Document objects.

**Cell 4: Chunk, Embed & Index:**

****

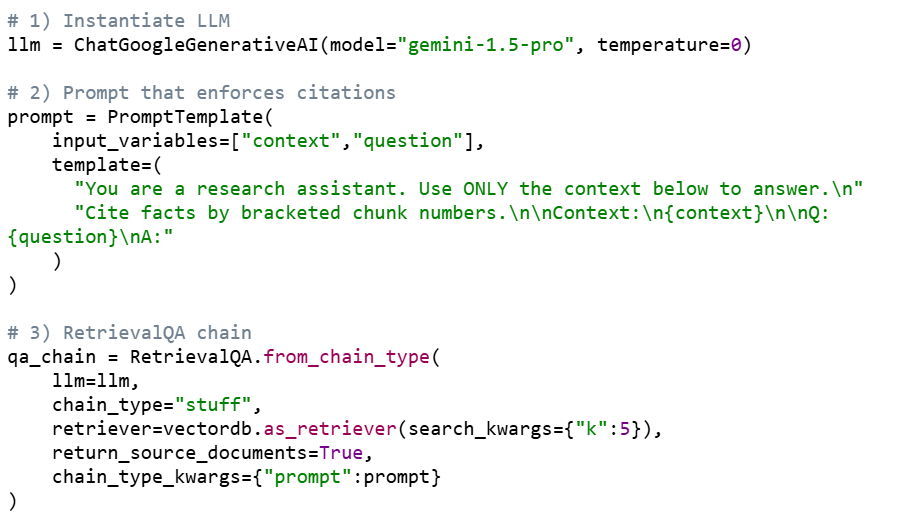
**Purpose:**  
Mirror the tiny‑corpus pipeline but on ~200 abstracts × ~2 chunks each = ~400 embeddings indexed.

**Cell 5: Retrieval Wrapper:**

****

**Purpose:** Simple wrapper around Chroma’s similarity\_search.

**Cell 6: Build Gemini RetrievalQA Chain:**

****

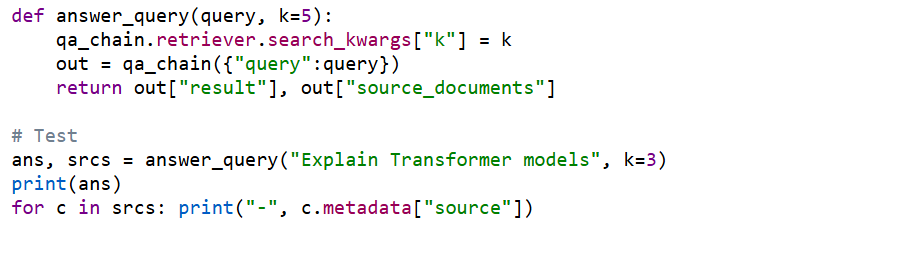
**Purpose:**

* Sets up a LangChain RetrievalQA object combining:
  1. Chroma retriever
  2. Gemini LLM with a custom prompt

**Notes:**

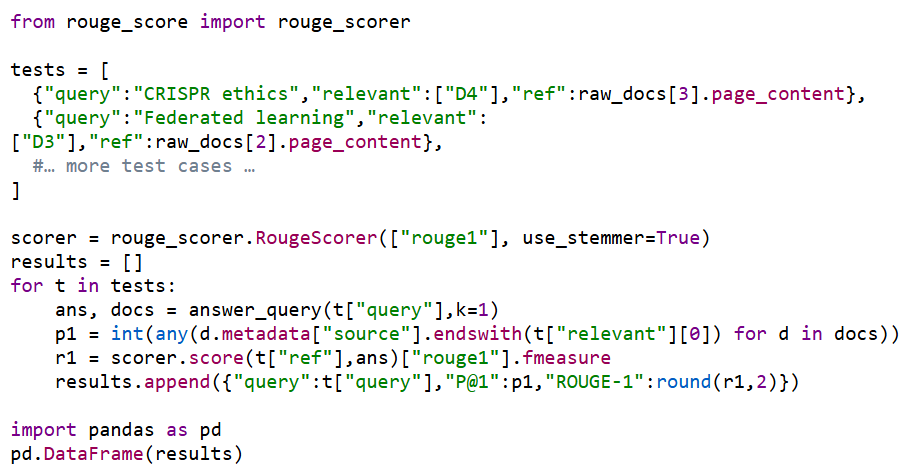
* chain\_type="stuff" means we stuff all retrieved chunks into one prompt.
* return\_source\_documents=True ensures we get back the chunks for citation display.

**Cell 7: Helper & Quick Test:**

****

* **Purpose:**  
  Simplifies calling the chain and prints both the generated answer and the sources’ URLs.

**Cell 8: Evaluation Metrics:**

****

* **Purpose:**  
  Same evaluation approach as before, adapted to the Gemini pipeline and Document metadata.

**Cell 9: Gradio UI (Blocks):**

****

**Purpose:**  
Mirrors the full‑Arxiv UI but plugged into Gemini’s answer\_query.  
Chat history is maintained; sources render as clickable arXiv links.