SD0109	DESIGNING CONVERSATIONAL AI: BUILDING CHATBOTS WITH GENERATIVE AI	L	T	P	C
		1	0	2	2

COURSE OBJECTIVES:
The course should enable the students to:

- Understand the architecture, workflow, and components of modern AI-powered chatbots
- Learn prompt engineering and conversational flow design using GenAI models like GPT
- Build multi-turn, contextual chatbots with memory, retrieval, and tool integration
- Deploy chatbots using Python, Streamlit, Gradio, or web frameworks
- Gain hands-on experience in building secure and scalable chatbot applications

UNIT - I	FOUNDATIONS OF CONVERSATIONAL AI AND GENAI MODELS	9

Introduction to Conversational AI and Generative AI, Types of Chatbots (Rule-based, Retrieval-based, Generative), Understanding Language Models (GPT, PaLM, LLaMA, Claude), Key Concepts: Tokens, Parameters, Embeddings, Fine-tuning vs Prompting, Overview of Model APIs (OpenAI, HuggingFace), Single-turn vs Multi-turn Conversations, Token Limits and Generation Parameters, Ethics and Bias in AI, Hands-on: Building a Simple Chatbot using OpenAI API and Python.

UNIT -II	PROMPT ENGINEERING AND DIALOGUE MANAGEMENT	9

What is Prompt Engineering, Prompt Structure and Tokens, Zero-shot, Few-shot, and Role-based Prompting, Design of Conversational Prompts for Multi-turn Flow, Controlling Model Behavior: Temperature, Max Tokens, Stop Sequences, Using System and Assistant Roles in Chat, Conversational Flowcharts and Scenario Planning, Handling Interruptions and Errors in Dialogue, Prompt Debugging Techniques, Hands-on: Multi-role Prompting and Dialogue Scripting.

UNIT - III	MEMORY, TOOL USAGE, AND RETRIEVAL-AUGMENTED GENERATION (RAG)	9

Introduction to Context Memory in Chatbots, Types of Memory (Buffer, Summary, Token-based), Storing and Recalling Conversation History, LangChain Memory Classes, Using External Tools inside Chatbots (Calculator, Web Search, API Calls), Introduction to Embeddings and Vector Databases, FAISS and ChromaDB for Document Search, Implementing RAG for Knowledge-Aware Conversations, Hands-on: Build a Memory + RAG-powered Q&A Chatbot.

UNIT - IV	BUILDING AND DEPLOYING FULL-STACK CHATBOTS	9

Building End-to-End Chatbot Architecture in Python, Integrating LLMs with Gradio, Streamlit, and Flask Interfaces, UI/UX Best Practices for Chatbots, Managing Secrets and API Keys, Using LangServe for API Deployment, Connecting Chatbots with External Tools and APIs, Logging and Monitoring Token Usage, Chatbot Testing and Feedback Collection, Hands-on: Deploy a Domain-Specific Chatbot on Streamlit Cloud.

UNIT - V	CAPSTONE PROJECT AND DOMAIN-SPECIFIC APPLICATIONS	9

Capstone Planning and Dataset Preparation, Designing a Use Case: Healthcare Assistant / HR Chatbot / E-Commerce Bot, Developing Task Flow with Prompts, Tools, Memory and Retrieval, Evaluation Metrics for Chatbots (Accuracy, Coherence, Engagement), Ethical Considerations and

Safety Filters, Packaging and Documentation of the Project, Deployment and Final Demo, Mock Interviews and Peer Evaluation, Industry Trends in Chatbots and GenAI.	
TOTAL: 45 PERIODS	
OUTCOMES: **Students able to**	
CO1	Understand the components and design principles of modern AI chatbots
CO2	Apply prompt engineering to develop dynamic, multi-turn conversations
CO3	Integrate memory, retrieval, and external tools in chatbot workflows
CO4	Deploy fully functional chatbots with real-world applications and UI interfaces
CO5	Address safety, evaluation, and optimization in production chatbot systems
TEXT BOOKS:	
7.	Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, 2022
8.	Jason D. Brown, Designing Bots: Creating Conversational Experiences, O'Reilly Media, 2017
9.	Peter Warden, TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers, O'Reilly Media, 2020
REFERENCES:	
7.	Emily Bender and Alexander Koller, Computational Linguistics and Natural Language Processing, Morgan & Claypool Publishers, 2020
8.	Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press, 2019
9.	Cathy Pearl, Designing Voice User Interfaces: Principles of Conversational Experiences, O'Reilly Media, 2016