

GENERATIVE AI

Course Code	23CS4702B	Year	IV	Semester	I
Course Category	Professional Elective-V	Branch	CSE	Course Type	Theory
Credits	3	L – T – P	3-0-0	Prerequisites	ML, Deep Learning
Continuous Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the history, fundamental types, ethical considerations, and broad applications of Generative AI models across text, image, and autonomous agent domains.	L2
CO2	Apply transformer-based language models, prompt engineering strategies, and Retrieval-Augmented Generation techniques to design and evaluate text generation solutions.	L3
CO3	Apply agentic AI concepts including planning, reasoning, memory management, tool integration, and multi-agent collaboration to build and evaluate basic autonomous systems.	L3
CO4	Apply generative models including GANs, diffusion models, neural style transfer, and reinforcement learning agents to synthesize and evaluate images, paintings, and music content.	L3

Syllabus		
Unit No.	CONTENTS	Mapped CO
I	Introduction to Gen AI: Historical Overview of Generative modelling, difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models: GANs, VAEs, autoregressive models and Vector quantized Diffusion models. Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI,	CO1, CO2
II	Generative Models for Text: Language Models Basics, Building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms. Generation of Text Models: BERT and GPT models, Autoencoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval	CO1, CO2, CO3

	Augmented Generation, Multimodal LLM, Issues of LLM like hallucination, bias.	
III	Agentic AI Architecture: Reactive vs. deliberative agents, hybrid architectures, autonomy. Planning, Reasoning & Decision-Making: Goal formulation, planning algorithms, utility theory. Memory, Tool Use & Environment Interaction: Short/long-term memory, vector stores, API integration. Multi-Agent Systems & Collaboration: Communication, coordination, emergent behavior.	CO1, CO3
IV	Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures Introduction to Transformer-based Image Generation: CLIP, Visual Transformers, Issues of Image Generation models like Mode Collapse and Stability.	CO1, CO4
V	Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, Muse GAN,	CO1, CO4

Learning Resources	
Text Books	
1. Denis Rothman, “Transformers for Natural Language Processing and Computer Vision”, Third Edition, Packt Books, 2024	
Reference Books	
1. David Foster, “Generative Deep Learning”, O’Reily Books, 2024. 2. Altaf Rehmani, “Generative AI for Everyone”, BlueRose One, 2024. 3. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016 4. Hands-On Generative AI with Transformers and Diffusion Models, Omar Sanseviero, Pedro Cuenca, Apolinário Passos, Jonathan Whitaker, O’Reilly Media, 2024	
E-Resources & other digital material	
• https://huggingface.co/docs • https://docs.langchain.com • https://github.com/openai/openai-cookbook • https://deepmind.google • https://www.kdnuggets.com/agent-ai-a-self-study-roadmap • https://github.com/Yash-Kavaiya/Agentic-AI-for-Beginners • https://github.com/Yash-Kavaiya/Agentic-AI-for-Beginners	