

Subject Code	Subject Name	Credits
22CS011	GENERATIVE AI	04

Course Objectives:

1. Understand the fundamentals of deep learning and its applications.
2. Describe large language models and their architectures.
3. Apply principles and techniques of prompt engineering.
4. Explore Langchain and its components.
5. Explain diffusion models and their use in generative AI.

Learning Objectives:

On successful completion of the course, students will be able to:

1. Comprehend the fundamentals and rise of deep learning
2. Apply knowledge of large language models in various NLP tasks
3. Develop and utilize prompt engineering techniques
4. Implement Langchain architecture for generative AI applications
5. Apply diffusion models to progressively refine noise into high-quality images and videos.

Unit 1 – Deep Learning (12 hrs.):

Rise of Deep Learning: AI vs ML vs DL, Need for DL, Power of Neural Networks, Tools for sequence models: RNNs, Transformers, attention, Deep vision by CNNs, Deep Generative Modeling, Responsible and ethical use of Deep Learning tools.

Unit 2 – LLM (12 hrs.):

Large Language Models (LLMs): History of NLP, Tokenization and embeddings, Positional encoding of Transformers, Text generation process, LLM model architecture: BERT, GPT, Training LLMs: Base, Instruction Tuned, Fine Tuning, Limitations of LLMs, API calling of OpenAI, Hugging Face, Google, Meta models.

Unit 3 - Prompt Engineering (12 hrs.):

Prompt Engineering: System-user-assistant format, Principles of prompting, chaining prompts, using delimiters to avoid prompt injections, Iterative prompt development, Zero and few shots prompting, Chain- of-thoughts prompting, Program-aided language prompting, ReAct prompting, Building a chatbot using prompt engineering

Unit 4 - Langchain (12 hrs.):

Langchain: Langchain architecture, LangChain Expression Language, Runnable interface, Chat models, Prompt templates, Example selectors, Output parsers, Chat history, Document loaders, Text splitters, embedding models, Vector stores, Retrievers, Agents, Callbacks, RAG using langchain and chromadb

Unit 5 - Diffusion Models (12 hrs.):

Diffusion Models: Variational Autoencoder, Generative Adversarial Networks, Diffusion Process: Forward - Noising, Reverse Denoising, Stable Diffusion models- U-Net, Text encoder, Video generation- generating images from natural language using Hugging Face API, Beyond images: molecular design

Reference Books:

1. I.Imran Bashir, 'Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained', Birmingham – Mumbai: Packt, 2nd Edition Kindle, 2018.
2. Narayanan A, Bonneau J, Felten E, Miller A, and Goldfeder S, 'Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction', Princeton University Press, 2016.
3. Anders Brownworth, 'Anders Brownworth Technology and Disruption', January 2019. [Accessed May 24, 2019].
4. Juan Navarro, Biztribution, 'Get Started with Hyperledger Fabric', April 24, 2019. [Accessed May 24, 2019].
5. Bob Dill, David Smits, 'Zero to Blockchain - An IBM Redbooks course', November 2017. [Accessed May 24, 2019].