Course Code & Name	26CAPC8004 Generative AI		
Teaching Hours /week (L: T:P: R)	3:1:0:0	Credits	4
CIE Marks	40	ESE Marks	60
Course Type	Theory (PCC)	Exam Hours	3
Prerequisites (if any)	-		

Course Objectives:

1. To learn the fundamentals of Neural Networks and their various types.
2. To explore Generative AI models like AE, VAEs, and Transformers.
3. To analyze the limitations of traditional RNNS and LSTMs and know core generative models.
4. To discuss current trends and future directions in Generative AI research.

Course Outcomes (CO)

At the end of the course students should be able to:

Course Outcomes		Bloom's Knowledge Level (KL)
CO 1	Explain the foundations of Generative AI, probability concepts, and representation learning techniques.	K2
CO 2	Apply core generative architectures such as VAEs, GANs and Diffusion Models for AI-based applications.	K3
CO 3	Apply transformer-based generation techniques, Large Language Models and model training approaches.	K3
CO 4	Apply prompt engineering, RAG and Agentic AI concepts for practical Generative AI applications.	K3

Note: *K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	3	3	1	1	-	-	-	3
CO 2	3	3	3	2	-	-	1	3
CO 3	3	3	2	2	-	-	1	3
CO 4	3	3	3	3	-	-	2	3

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), - : No Correlation*

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE)

Attendance	Assignment/ Micro-project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
8	12	10	10	40 Marks

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

PART A	PART B	TOTAL
■ 2 Questions from each module. ■ Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	■ Each question carries 9 marks. ■ Two questions will be given from each module, out of which 1 question should be answered. ■ Each question can have a maximum of 3 subdivisions. **(4x9 = 36 marks)**	**60 Marks**

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Foundations of Generative AI:** AI, Machine Learning and Deep Learning. Generative vs Discriminative Models. Probability Distributions and Density Estimation . Latent Space Representations. Likelihood Maximization. Sampling Techniques – Monte Carlo Sampling and Temperature Sampling. Applications of Generative AI.	10
2	**Core Generative Architectures:** Autoencoders and Variational Autoencoders (VAEs). Generative Adversarial Networks (GANs). Diffusion Models. Introduction to Autoregressive Models and Energy-Based Models. Architecture and working principles of core	14

	generative models. Applications in image, text and multimedia generation.	
3	**Transformer-Based Generation and Model Training:** Tokenization and Byte Pair Encoding (BPE). Attention Mechanism and Transformer Architecture. Large Language Models (LLMs). Reinforcement Learning from Human Feedback (RLHF) – introductory concepts. Instruction Tuning and Fine Tuning. Base Models, Instruct Models and Chat Models.	**12**
4	**Practical Generative AI and Agentic AI:** Prompt Engineering Techniques. Retrieval Augmented Generation (RAG) – basic concepts. Introduction to Agentic AI. AI Agents and Autonomous Systems. Components of AI Agents. LLM-based agents and AI workflows. Multi-agent systems . Generative AI tools and frameworks. Real-world applications of Agentic AI in education, healthcare, business and software development. Deployment challenges and future trends in Generative AI , Autonomous AI systems.	**12**

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to GenerativeAI	Numa Dhamani	KindleEdition,	2024
2	Generative Deep Learning	Charu C AggarwalDavid Foster	O'Reilly Media	2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Generative Adversarial Networks Cook book: Over 100 recipes to build generative models using Python, Tensor Flow and Keras	JoshKalin	Packt	2016
2	Hands-On Large Language Models	Jay Alammar and Maarten Grootendorst	O'Reilly Media	2024

Web References/ Video Links (NPTEL, SWAYAM…)	
Sl.No	**Link ID**
1	https://elearn.nptel.ac.in/shop/iit-workshops/completed/leveraging-generative-ai-for-teaching-programming-course
2	https://elearn.nptel.ac.in/shop/iit-workshops/completed/introduction-to-language-models/?v=c86ee0d9d7ed

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Differentiate between generative and discriminative models with examples.
2. Explain latent space representations in Generative AI.
3. Describe probability distributions and density estimation in simple terms.
4. Explain likelihood maximization in generative models.
5. Describe Monte Carlo sampling and temperature sampling techniques.

Course Outcome 2 (CO2):

1. Explain the architecture and working of Autoencoders and VAEs.
2. Describe the Generator and Discriminator in GANs.
3. Explain diffusion models and their applications.

4. Describe autoregressive models with suitable examples.
5. Explain applications of generative models in image, text and multimedia generation.

Course Outcome 3 (CO3):

1. Explain Byte Pair Encoding (BPE) used in tokenization.
2. Describe the Transformer architecture and attention mechanism.
3. Explain the role of Large Language Models (LLMs) in Generative AI.
4. Describe RLHF and its importance in LLM training.
5. Differentiate Base Models, Instruct Models and Chat Models.

Course Outcome 4 (CO4):

1. Explain prompt engineering with suitable examples.
2. Describe Retrieval Augmented Generation (RAG).
3. Explain the components of AI agents in Agentic AI systems.
4. Describe LLM-based agents and AI workflows.
5. State applications and deployment challenges of Agentic AI systems.

Model Question Paper

Reg No.:_____ Name:_____

FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY

MCA S2 (R,S) Examination ……2026 (2026 Scheme)

Course Code: 26CAPC8004

Course Name: Generative AI

Max. Marks: 60 Duration: 3 Hours

PART A

	Answer all questions, each carries 3 marks.	***CO***	Marks
1	Differentiate between Artificial Intelligence, Machine Learning, and Deep Learning.	CO1	(3)
2	Explain backpropagation. Why is it essential for neural network training?	CO1	(3)
3	Write a short note on the architecture and applications of CNNs.	CO2	(3)

4	What are Variational Autoencoders (VAEs)? How do they differ from standard autoencoders?	CO2	(3)
5	What are the key components of a Generative Adversarial Network?	CO3	(3)
6	Write the main differences between DCGAN and StyleGAN.	CO3	(3)
7	What is prompt engineering? Give an example of its use in text generation.	CO4	(3)
8	Mention any two ethical challenges associated with Generative AI.	CO4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module I

9	Explain the structure and working of an Artificial Neural Network with a neat diagram.	CO1	(9)

OR

10	Describe the steps involved in training an artificial neural network. Discuss the role of activation functions and optimization algorithms.	CO1	(9)

Module II

11	Explain the architecture of an RNN and describe how LSTM overcomes the vanishing gradient problem.	CO2	(9)

OR

12	Describe the Transformer model architecture and explain how it differs from traditional sequence models.	CO2	(9)

Module III

13	Explain the working principle of a GAN. Discuss the training process and challenges involved.	CO3	(9)

OR

14	Describe diffusion models and their applications in image generation.	CO3	(9)

Module IV

15	Explain any three major real-world applications of Generative AI in detail (e.g., art, healthcare, finance).	CO4	(9)

OR

16	Discuss the role of frameworks and tools such as Hugging Face and Stable Diffusion in building Generative AI solutions.	CO4	(9)

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