

# GENERATIVE AI: PRINCIPLES, MODELS, AND APPLICATIONS

ARTIFICIAL  
INTELLIGENCE

THE AI FUTURE IS HERE

Generative AI can be utilized to convey the general scope of creative possibilities or address more specific use cases and applications

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# Generative AI: Principles, Models, and Applications

## Course Overview

This course, offered by **Fusions Cloud Pvt Ltd**, is tailored to introduce learners to the fascinating domain of Generative AI. Participants will be equipped with both foundational and advanced concepts, practical implementation skills, and an understanding of ethical considerations within this rapidly evolving field. The course spans **8–12 weeks**, integrating both theoretical knowledge and hands-on experience to ensure a comprehensive understanding of Generative AI, from its core principles to its real-world applications.

## Modules and Weekly Breakdown

### Module 1: Introduction to Generative AI

#### Week 1

- **Overview of AI and Machine Learning:**
  - Understand the definitions of AI, machine learning, and deep learning.
  - Explore types of machine learning: Supervised, Unsupervised, and Reinforcement Learning.
  - Gain an overview of Generative AI (GenAI).
- **Applications of Generative AI:**
  - Discover text generation (e.g., GPT).
  - Learn about image generation (e.g., GANs, DALL·E).
  - Explore music and code generation.
  - Understand video and multimodal applications.

### Module 2: Foundations of Generative Models

## Week 2

- **Probability and Statistics for Generative AI:**
  - Delve into Bayesian inference.
  - Learn about maximum likelihood estimation.
  - Study sampling methods (e.g., MCMC).
- **Introduction to Generative Models:**
  - Define generative models.
  - Compare discriminative vs. generative models.

## Week 3

- **Variational Autoencoders (VAEs):**
    - Understand the theory behind VAEs.
    - Explore encoder-decoder structures.
    - Learn about latent variable modeling.
    - Examine applications and use cases.
  - **Generative Adversarial Networks (GANs):**
    - Study the architecture: Generator vs. Discriminator.
    - Explore loss functions: Adversarial loss.
    - Understand challenges: Mode collapse, instability.
    - Learn about applications: Image generation, data augmentation.
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## Module 3: Deep Dive into Text Generation Models

### Week 4

- **Recurrent Neural Networks (RNNs):**
  - Understand sequence modeling.
  - Learn the limitations of RNNs.
- **Long Short-Term Memory (LSTM) and GRU:**
  - Gain a deep understanding of LSTMs.
  - Explore applications in text generation.

### Week 5

- **Transformers:**
    - Introduction to the Attention Mechanism.
    - Study Transformer architecture: Self-Attention, Multi-Head Attention.
    - Compare Encoder-Decoder vs. Transformer models.
  - **Language Models (GPT, BERT):**
    - Explore GPT-2 and GPT-3.
    - Learn about training and fine-tuning.
    - Delve into transfer learning and pretrained models.
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## Module 4: Image Generation and Multimodal Models

## Week 6

- **Deep Convolutional Networks (CNNs):**
  - Use CNNs for image feature extraction.
  - Generate images with CNNs.
- **GANs for Images:**
  - Study DCGAN (Deep Convolutional GAN).
  - Explore CycleGAN for image-to-image translation.
  - Learn about StyleGAN for high-quality images.

## Week 7

- **Diffusion Models for Image Generation:**
    - Introduction to Diffusion Models.
    - Understand denoising score matching.
    - Explore stable diffusion and DALL·E 2.
  - **Text-to-Image Models:**
    - Overview of CLIP (Contrastive Language-Image Pretraining).
    - Learn about DALL·E 2 advancements.
    - Discover practical applications in creative fields.
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## Module 5: Advanced Topics in Generative AI

### Week 8

- **Multimodal Models (Text, Image, and More):**
  - Merge vision and language.
  - Study Vision-Language Transformers (e.g., CLIP, Flamingo).
  - Explore applications in robotics and content creation.

### Week 9

- **Self-Supervised Learning in Generative AI:**
    - Learn about pretext tasks and representation learning.
    - Discover applications in large language models and vision models.
  - **Ethical Implications and Bias in Generative AI:**
    - Understand bias in generative models.
    - Address challenges and solutions for ethical AI deployment.
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## Module 6: Practical Implementation and Case Studies

### Week 10

- **Building a Text Generation System:**
  - Fine-tune GPT models on custom datasets.

- Engage in hands-on practice: Generate creative content, summarize text, or build a chatbot.

## Week 11

- **Building an Image Generation System:**

- Implement GANs for creating art or images.
- Train and fine-tune GAN models.
- Engage in hands-on practice: Create a custom image generation system.

## Week 12

- **Deploying Generative AI Models:**

- Learn best practices for deploying GenAI models.
- Scale models on cloud platforms (AWS, GCP, Azure).
- Case Study: Deploy a generative AI model (e.g., automated content generation, AI-powered design tools).

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# Assessments and Projects

- **Assignments:**

- Weekly hands-on coding exercises using PyTorch or TensorFlow.
- Implement basic generative models (GANs, VAEs).
- Fine-tune pretrained models for specific tasks.

- **Final Project:**

- Build a complete Generative AI system (e.g., personalized text generator, image-to-image translation system, or multimodal chatbot).
- Present and demonstrate your model in a real-world context (e.g., creative content generation, recommendation systems).

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# Prerequisites

- Basic Python programming skills.
- Familiarity with machine learning frameworks (e.g., PyTorch, TensorFlow).
- Basic understanding of neural networks and deep learning concepts.

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# Learning Outcomes

- Master foundational and advanced concepts in Generative AI.
- Gain proficiency in implementing and fine-tuning generative models.
- Understand and apply ethical considerations in AI deployment.
- Acquire hands-on experience in building and deploying generative systems.

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# Course Details

- **Duration:** 8–12 weeks
  - **Format:** Online (Live sessions and pre-recorded lectures)
  - **Assessment:** Quizzes, assignments, and a capstone project
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## Enrollment Information

For more details and to enroll, visit the **Fusions Cloud** website or contact the enrollment team at [enroll@fusionscloud.com](mailto:enroll@fusionscloud.com).