Generative AI Foundation Course

30-Session Complete Syllabus (Weekend Program)

Presented by CodeYAA Network *Your Gateway to AI Excellence*

Course Overview

Duration: 30 Sessions (1 hour each, weekends only - 15 weeks)
Target Audience: Complete beginners with no AI/ML experience
Format: Live interactive sessions with hands-on coding
Tools: Free & open-source resources only

Learning Objectives

By the end of this course, students will:

- Understand AI/ML fundamentals and Generative AI concepts
- Build practical applications using LLMs and GenAI tools
- Master prompt engineering and AI tool integration
- Create end-to-end AI-powered applications
- Understand AI ethics and responsible AI development

Course Structure

Phase 1: AI & Machine Learning Foundations (Sessions 1-8)

Session 1: Introduction to Artificial Intelligence

Topics Covered:

- What is AI? History and evolution
- Types of AI: Narrow vs General AI
- AI vs ML vs Deep Learning
- Real-world AI applications

Hands-on Exercises:

- Explore AI demos online (ChatGPT, DALL-E, etc.)
- Set up Google Colab account
- Install Python basics in Colab

Mini-Project:

- Create a simple "AI Timeline" presentation
- Test different AI tools and document findings

Session 2: Machine Learning Fundamentals

Topics Covered:

- What is Machine Learning?
- Types: Supervised, Unsupervised, Reinforcement Learning
- Basic ML workflow: Data → Training → Prediction
- Common ML algorithms overview

Hands-on Exercises:

- Load and explore a dataset in Colab
- Use pandas for basic data manipulation
- Visualize data with matplotlib

Mini-Project:

- Analyze a simple dataset (house prices/iris dataset)
- Create basic visualizations

Session 3: Deep Learning Basics

Topics Covered:

- Neural networks introduction
- How neurons work
- Deep learning vs traditional ML
- Applications of deep learning

Hands-on Exercises:

- Build a simple neural network with TensorFlow
- Train a basic image classifier
- Experiment with different architectures

Mini-Project:

- Create a digit recognition model using MNIST dataset

Session 4: Natural Language Processing (NLP) Fundamentals

Topics Covered:

- What is NLP?
- Text preprocessing techniques
- Tokenization, stemming, lemmatization
- Bag of words, TF-IDF

Hands-on Exercises:

- Text preprocessing with NLTK
- Build a simple text classifier
- Sentiment analysis basics

Mini-Project:

- Create a basic sentiment analyzer for movie reviews

Session 5: Introduction to Transformers

Topics Covered:

- Evolution from RNNs to Transformers
- Attention mechanism explained simply
- Transformer architecture overview
- Why transformers revolutionized NLP

Hands-on Exercises:

- Use pre-trained BERT model from Hugging Face

- Text classification with transformers
- Compare traditional NLP vs transformer results

Mini-Project:

- Build a news article classifier using BERT

Session 6: Understanding Language Models

Topics Covered:

- What are language models?
- N-gram models vs neural language models
- Training process of language models
- Evaluation metrics (perplexity, BLEU)

Hands-on Exercises:

- Train a simple character-level language model
- Generate text with different temperature settings
- Explore GPT-2 small model on Hugging Face

Mini-Project:

- Create a simple text generator for poetry/stories

Session 7: Hugging Face Ecosystem

Topics Covered:

- Hugging Face platform overview
- Models, datasets, and spaces
- Transformers library basics
- Model Hub navigation

Hands-on Exercises:

- Explore Hugging Face Model Hub
- Load and use different pre-trained models

- Create your first Hugging Face Space

Mini-Project:

- Deploy a simple model demo on Hugging Face Spaces

Session 8: Setting Up Development Environment

Topics Covered:

- Development tools for AI projects
- Git/GitHub for version control
- Virtual environments
- Package management

Hands-on Exercises:

- Set up local Python environment
- Install key libraries (transformers, langchain, etc.)
- Create GitHub repository
- Basic Git commands

Mini-Project:

- Set up complete development environment
- Create first AI project repository

Phase 2: Generative AI Deep Dive (Sessions 9-16)

Session 9: Introduction to Generative AI

Topics Covered:

- What is Generative AI?
- Types: Text, Image, Audio, Video, Code generation
- Generative vs Discriminative models
- Key breakthroughs in GenAI

Hands-on Exercises:

- Try different generative AI tools
- Compare outputs from various models
- Understand model capabilities and limitations

Mini-Project:

- Create comparison report of different GenAI tools

Session 10: Large Language Models (LLMs) Deep Dive

Topics Covered:

- What are LLMs?
- GPT family evolution (GPT-1 to GPT-4)
- Other major LLMs (Claude, Gemini, LLaMA)
- How LLMs are trained

Hands-on Exercises:

- Access and compare different LLMs
- Understand model parameters and sizes
- Explore open-source LLMs on Hugging Face

Mini-Project:

- LLM comparison study with different prompts

Session 11: Google Gemini API Integration

Topics Covered:

- Google Gemini overview and capabilities
- Multimodal features
- API setup and authentication
- Rate limits and best practices

Hands-on Exercises:

- Set up Gemini API key

- Make first API calls
- Text generation and analysis
- Image understanding with Gemini

Mini-Project:

- Build a multimodal chatbot using Gemini API

Session 12: OpenAI Alternatives & Open Source LLMs

Topics Covered:

- Open source LLM landscape
- Ollama for local LLM deployment
- Mistral, LLaMA, Code Llama
- Running LLMs locally vs cloud

Hands-on Exercises:

- Install and run Ollama
- Deploy local LLM (Mistral 7B)
- Compare local vs cloud performance
- Resource management for local LLMs

Mini-Project:

- Create offline AI assistant using local LLM

Session 13: Prompt Engineering Fundamentals

Topics Covered:

- What is prompt engineering?
- Types of prompts: zero-shot, few-shot, chain-of-thought
- Prompt design principles
- Common prompt engineering mistakes

Hands-on Exercises:

- Practice different prompting techniques
- A/B test prompt variations
- Create prompt templates
- Use prompt engineering tools

Mini-Project:

- Build a prompt library for different use cases

Session 14: Advanced Prompt Engineering

Topics Covered:

- Advanced techniques: ReAct, Tree of Thoughts
- Prompt chaining and decomposition
- Role-based prompting
- Prompt injection and safety

Hands-on Exercises:

- Implement chain-of-thought reasoning
- Create complex multi-step prompts
- Build role-based AI assistants
- Test prompt security

Mini-Project:

- Create an AI tutor with advanced prompting

Session 15: Text Generation Applications

Topics Covered:

- Content creation use cases
- Text summarization techniques
- Article writing and editing
- Creative writing applications

Hands-on Exercises:

- Build text summarizer
- Create content generation pipeline
- Implement different writing styles
- Quality evaluation methods

Mini-Project:

- Automated blog post generator

Session 16: Code Generation with AI

Topics Covered:

- AI-assisted programming
- Code generation models (CodeT5, StarCoder)
- Best practices for AI coding
- Limitations and ethical considerations

Hands-on Exercises:

- Use GitHub Copilot alternatives
- Generate code with LLMs
- Code review with AI
- Debug code using AI assistance

Mini-Project:

- AI-powered code documentation generator

Phase 3: Advanced GenAI Applications (Sessions 17-24)

Session 17: Introduction to LangChain

Topics Covered:

- LangChain framework overview
- Components: LLMs, Prompts, Chains, Agents
- Installation and setup

- Basic concepts and terminology

Hands-on Exercises:

- Install LangChain
- Create first LangChain application
- Build simple prompt templates
- Chain multiple operations

Mini-Project:

- Create a question-answering system with LangChain

Session 18: LangChain Chains and Agents

Topics Covered:

- Different types of chains
- Sequential and parallel chains
- Agent types and tools
- Custom tool creation

Hands-on Exercises:

- Build complex chains
- Create AI agent with tools
- Implement memory in chains
- Custom tool development

Mini-Project:

- Build a research assistant agent

Session 19: Retrieval Augmented Generation (RAG)

Topics Covered:

- What is RAG and why it's important
- RAG architecture and components

- Vector databases introduction
- Embedding models

Hands-on Exercises:

- Set up vector database (Chroma/FAISS)
- Create embeddings for documents
- Implement basic RAG pipeline
- Query and retrieve relevant information

Mini-Project:

- Build a document Q&A system using RAG

Session 20: Advanced RAG Implementation

Topics Covered:

- Advanced RAG techniques
- Hybrid search strategies
- RAG evaluation and optimization
- Handling different document types

Hands-on Exercises:

- Implement advanced RAG with LangChain
- Process PDFs, web pages, and structured data
- Optimize retrieval quality
- A/B test different RAG configurations

Mini-Project:

- Enterprise knowledge base chatbot

Session 21: Multimodal AI Applications

Topics Covered:

- Text-to-image generation

- Image-to-text (OCR, captioning)
- Audio processing with AI
- Multimodal model integration

Hands-on Exercises:

- Generate images with Stable Diffusion
- Image analysis with vision models
- Speech-to-text and text-to-speech
- Build multimodal applications

Mini-Project:

- Create visual storytelling app

Session 22: AI Agents and Automation

Topics Covered:

- What are AI agents?
- Agent types: reactive, deliberative, hybrid
- Multi-agent systems
- Automation workflows

Hands-on Exercises:

- Build autonomous agents
- Create agent communication systems
- Implement task delegation
- Monitor agent performance

Mini-Project:

- Automated social media management agent

Session 23: Fine-tuning and Model Customization

Topics Covered:

- When to fine-tune vs prompt engineering
- Fine-tuning techniques (LoRA, QLoRA)
- Dataset preparation
- Evaluation and deployment

Hands-on Exercises:

- Prepare fine-tuning dataset
- Fine-tune small language model
- Compare base vs fine-tuned performance
- Deploy custom model

Mini-Project:

- Fine-tune model for specific domain

Session 24: AI-Powered Web Applications

Topics Covered:

- Building AI web apps with Streamlit
- API development for AI services
- User interface design for AI apps
- Deployment strategies

Hands-on Exercises:

- Build Streamlit applications
- Create REST APIs for AI models
- Implement user authentication
- Deploy to cloud platforms

Mini-Project:

- Full-stack AI application with web interface

Phase 4: Ethics, Safety & Advanced Topics (Sessions 25-28)

Session 25: AI Ethics and Responsible AI

Topics Covered:

- AI ethics principles
- Bias detection and mitigation
- Fairness in AI systems
- Privacy and data protection

Hands-on Exercises:

- Analyze models for bias
- Implement fairness metrics
- Create ethical AI guidelines
- Privacy-preserving techniques

Mini-Project:

- Audit an AI system for ethical compliance

Session 26: AI Safety and Security

Topics Covered:

- AI safety challenges
- Prompt injection attacks
- Model robustness
- Safe AI deployment practices

Hands-on Exercises:

- Test model robustness
- Implement safety filters
- Create secure AI APIs
- Monitor AI system behavior

Mini-Project:

- Build secure AI application with safety measures

Session 27: Latest Trends in GenAI (2025)

Topics Covered:

- Current state of GenAI industry
- Emerging models and techniques
- Future predictions and trends
- Career opportunities in AI

Hands-on Exercises:

- Explore cutting-edge models
- Experiment with new techniques
- Research latest papers
- Industry trend analysis

Mini-Project:

- Create trend report on GenAI developments

Session 28: Performance Optimization & Scaling

Topics Covered:

- Model optimization techniques
- Caching strategies
- Load balancing for AI services
- Cost optimization

Hands-on Exercises:

- Optimize model inference speed
- Implement caching systems
- Load testing AI applications
- Cost analysis and optimization

Mini-Project:

- Optimize existing AI application for production

Phase 5: Capstone Project (Sessions 29-30)

Session 29: Capstone Project Planning & Development

Topics Covered:

- Project planning methodology
- Requirements gathering
- Architecture design
- Implementation strategies

Hands-on Exercises:

- Define capstone project scope
- Create project architecture
- Set up development environment
- Begin implementation

Capstone Project Options:

1. AI-powered customer service chatbot with RAG
2. Multimodal content creation platform
3. Automated research assistant
4. AI-driven code review system
5. Personalized learning assistant

Session 30: Project Presentation & Course Wrap-up

Topics Covered:

- Project demonstration
- Code review and feedback
- Deployment best practices
- Career guidance and next steps

Activities:

- Present capstone projects

- Peer review and feedback
- Discuss deployment strategies
- Plan continued learning path
- Course completion certificates

Final Deliverables:

- Complete end-to-end AI application
- Project documentation
- Deployment guide
- Presentation slides

Required Tools & Resources

Free Platforms & APIs:

- Google Colab (Primary development environment)
- Hugging Face (Models and datasets)
- Google Gemini API (Free tier)
- Ollama (Local LLM deployment)
- GitHub (Version control and deployment)
- Streamlit Community Cloud (App deployment)

Python Libraries:

python

```
# Core ML/AI libraries
tensorflow
torch
transformers
langchain
streamlit
pandas
numpy
matplotlib

# Vector databases
chromadb
faiss-cpu

# API libraries
requests
fastapi
uvicorn

# Utility libraries
python-dotenv
pydantic
```

Datasets:

- Hugging Face datasets
- Kaggle public datasets
- Custom datasets for projects

Assessment Strategy

Continuous Assessment (70%):

- Weekly mini-projects (40%)
- Hands-on exercises completion (20%)
- Participation and engagement (10%)

Final Assessment (30%):

- Capstone project (25%)

- Project presentation (5%)

Prerequisites

- Basic computer skills
- No prior AI/programming experience required
- Enthusiasm to learn and experiment

Expected Outcomes

Upon completion, students will have:

- Built 15+ mini-projects
- Completed 1 comprehensive capstone project
- Gained hands-on experience with 10+ AI tools/platforms
- Developed a portfolio of AI applications
- Understanding of AI ethics and responsible development

Support Resources

- Course Discord community
- Weekly Q&A sessions
- Project mentorship
- Career guidance sessions
- Resource library and templates

Course Developed by CodeYAA Network
Empowering the Next Generation of AI Developers

This syllabus is designed to take complete beginners from zero AI knowledge to building production-ready GenAI applications in just 30 weekend sessions. Each session builds upon the previous one, ensuring a smooth learning progression with practical, hands-on experience throughout.