

COURSE: GENERATIVE AI

TABLE 1	
OVERALL COURSE OBJECTIVE:	<ul style="list-style-type: none">● fundamentals of generative AI, its historical evolution, and its significance across various domains, including applications in text, language, images, and vision.● implementing and utilizing popular generative models such as Autoencoders, Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs), and autoregressive models for generating text, images, and vision tasks.● developing applications using Gemini on Google Cloud Platform (GCP), including creating app architectures, designing LLM-connected models, and building VPC networks for different use cases.● integrating Gemini with Streamlit for building GenAI apps, deploying them on Cloud Run, and utilizing the Vertex AI Gemini API for function calling and Python SDK for application development.● Explore advanced topics in generative AI, including multimodal generative AI, time series and sequence generation, ethics, fairness, and responsible AI considerations, along with practical implementation of MLOps for managing generative AI models effectively.

**LEARNING
OUTCOME:**

- Explore generative AI concepts, including various models such as Autoencoders, GANs, and VAEs, enabling students to effectively generate text, images, and other types of data.
- implement generative AI models using Python and relevant libraries, as well as deploying applications on cloud platforms like Google Cloud Platform (GCP) using Gemini for streamlined development.
- Build generative models through guided exercises and projects, enabling the creation of innovative solutions in real-world scenarios.
- evaluate and analyze diverse use cases and applications of generative AI in fields such as art, music, healthcare, finance, and more.
- Integrate generative AI with Streamlit and other tools to build interactive and user-friendly applications, leveraging Google Cloud services for deployment and scaling.
- implement ethical considerations and fairness in generative AI, ensuring responsible AI practices and compliance with industry standards and regulations.

- Apply advanced generative AI techniques such as multimodal models, time series, and sequence generation to solve complex problems across various domains.

- Utilize MLOps principles to manage, deploy, and maintain generative AI models, ensuring efficient workflows and continuous improvement in model performance.

TABLE 2: MODULE WISE COURSE CONTENT AND OUTCOME				
SL.NO	MODULE NAME	MODULE CONTENT	MODULE LEARNING OUTCOME	DURATION (HRS)
1	Introduction to Generative AI	Introduction to generative AI-Brief history and evolution- Importance and applications in various domains- Overview of popular generative models	fundamentals, evolution, and significance of generative AI. Recognize its importance and applications in various fields.	4
2	Generative AI for Text, Language, Images, and Vision	Introduction to Natural Language Processing (NLP)- Text Generation with Transformers- Language Translation with Google Translate- Introduction to Computer Vision- Image Generation with Generative Adversarial Networks (GANs)	Natural Language Processing (NLP) and text generation with Transformers. Explore language translation with Google Translate and fundamentals of computer vision. Learn image generation with GANs	4

3	Introduction to Gemini for Google Cloud	<p>Overview of Google Cloud Platform (GCP) - Gemini for Application Developers- Develop an app with Gemini assistance - Introduction to Gemini for Cloud Architects - Creating GKE clusters with Gemini - Architect web apps with Gemini-Introducing Gemini for Data Scientists and Analysts - Designing an LLM connected model with Gemini - Introducing Gemini for network engineers</p>	<p>overview of Google Cloud Platform (GCP). Learn how to use Gemini for application development and develop an app with its assistance. Explore Gemini for cloud architects, including creating GKE clusters and architecting web apps. Discover how Gemini supports data scientists, analysts, and network engineers. Design an LLM-connected model.</p>	4
4	Develop GenAI Apps with Gemini and Streamlit & Generative AI for Design and Optimization	<p>Getting Started with the Vertex AI Gemini API with cURL-Introduction to Function Calling with Gemini-Getting Started with the Vertex AI Gemini API and Python SDK-Deploy a Streamlit App Integrated with Gemini Pro on Cloud Run-Develop GenAI Apps with Gemini and Streamlit- Introduction to Design Optimization Learning-Hands-on Lab</p>	<p>Get started with the Vertex AI Gemini API using cURL and learn function calling with Gemini. Explore the Vertex AI Gemini API and Python SDK. Deploy a Streamlit app integrated with Gemini Pro on Cloud Run. Develop GenAI apps with Gemini and Streamlit. Understand design optimization, generative design with evolutionary algorithms, and optimization with reinforcement learning. Apply concepts in hands-on lab sessions.</p>	4

5	Advanced Generative AI Topics	Introduction to Multimodal Generative AI- Generative AI for Time Series and Sequences-Ethics and Fairness in Generative AI-Responsible AI for Developers: Interpretability for Generative AI-Hands-on Lab	Understand multimodal generative AI and its applications. Learn about generative AI for time series and sequences. Explore ethics and fairness in generative AI. Understand responsible AI practices for developers, focusing on interpretability and transparency.	4
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TABLE 3: OVERALL COURSE LEARNING OUTCOME ASSESSMENT CRITERIA AND USECASES		
LEARNING OUTCOME	ASSESSMENT CRITERIA	USECASES
<p>fundamentals, evolution, and significance of generative AI. Recognize its importance and applications in various fields.</p>	<ul style="list-style-type: none"> • Demonstrate proficiency in utilizing Gemini for application development, including the successful creation of an application with Gemini's assistance, highlighting understanding of its features and capabilities. • Showcase comprehension of Gemini's applicability across various domains, such as cloud architecture, data science, security, and DevOps, through practical hands-on lab sessions and the ability to apply Gemini in relevant scenarios. 	<p>Lab 1: Generative AI with Vertex AI: Prompt Design</p> <p>Objective: Understand prompt design best practices and explore various text generation use cases using the Vertex AI SDK, including ideation, question-answering, text classification, text extraction, and text summarization.</p> <p>Lab 2: Get Started with Vertex AI Studio</p> <p>Objective: This lab guides participants through Vertex AI Studio, exploring cutting-edge generative AI models. Participants will analyze images, design prompts, and generate conversations using</p>

		<p>Gemini multimodal directly on the Google Cloud console. The objective is to provide hands-on experience with Vertex AI Studio and unlock the potential of generative AI models.</p> <p>Lab 3: Getting Started with the Vertex AI Gemini API and Python SDK</p> <p>Objective: This lab introduces participants to the Vertex AI Gemini API and Python SDK for interacting with generative AI models. Participants will learn to use the Gemini 1.0 Pro and Gemini 1.0 Pro Vision models to generate text from various prompts, including text, images, and video. By the end of the lab, participants will have practical experience in leveraging the Vertex AI Gemini API for multimodal generative AI tasks.</p> <p>Lab 4: Prompt Design in Vertex AI: Challenge Lab</p> <p>Objective: Design structured prompts for image analysis and tagline generation using the Gemini model in Vertex AI Studio, tailored to the marketing needs of Cymbal Direct's new outdoor gear product line. Experiment with</p>
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		different prompt configurations to generate descriptive text options and catchy taglines, iterating to refine the results and achieve desired outcomes. Explore and modify Python code exported from Vertex AI Studio to customize prompts and test generative AI models in Jupyter Notebooks.
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<ul style="list-style-type: none"> • Natural Language Processing (NLP) and text generation with Transformers. Explore language translation with Google Translate and fundamentals of computer vision. Learn image generation with GANs. 	<ul style="list-style-type: none"> • Evaluate the learner's comprehension of NLP and text generation with Transformers, as well as language translation using Google Translate. • Assess the learner's proficiency in computer vision basics, including GANs for image generation and CNNs for image classification, and their ability to apply these concepts in creating image captioning models during hands-on labs. 	<p>Lab 1: Getting Started with Vector Search and Embeddings</p> <p>Objective: Create and deploy a custom vector search index using Vertex AI Embeddings for text, including generating text embeddings and saving them in a JSON file, as well as setting up a Cloud Storage bucket to store the embeddings. Explore the vector search notebook and public demo, familiarizing yourself with various use cases and functionalities of vector search, such as semantic search and querying the index for relevant results.</p> <p>.</p> <p>Lab 2: Explaining an Image Classification Model with Vertex Explainable AI</p> <p>Objective: Serve predictions with explanations for a custom image classification model trained on Vertex AI by deploying the model to an endpoint and visualizing feature attributions using Integrated Gradients.</p>
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<ul style="list-style-type: none"> overview of Google Cloud Platform (GCP). Learn how to use Gemini for application development and develop an app with its assistance. Explore Gemini for cloud architects, including creating GKE clusters and architecting web apps. Discover how Gemini supports data scientists, analysts, and network engineers. Design an LLM-connected model. 	<ul style="list-style-type: none"> Demonstrate proficiency in utilizing Gemini for application development, including the successful creation of an application with Gemini's assistance, highlighting understanding of its features and capabilities. Showcase comprehension of Gemini's applicability across various domains, such as cloud architecture, data science, security, and DevOps, through practical hands-on lab sessions and the ability to apply Gemini in relevant scenarios. 	<p>Lab 1: Develop an app with Gemini</p> <p>Objective: In this lab, you learn how to perform the following tasks: Create a cloud-based application development environment by using Cloud Workstations. Explore various Google services that you can use to deploy an app by asking Gemini context-based questions. Prompt Gemini to provide templates that you can use to develop a basic app in Cloud Run. Create, explore, and</p>
		<p>Lab 2: Provision Cloud Infrastructure with Gemini</p> <p>Objective: In this lab, you'll utilize Gemini to: Enable Gemini. Explore various Google services applicable for deploying an app to GKE by posing context-based questions. Prompt Gemini to generate commands necessary for deploying a basic app to a GKE cluster. Engage Gemini to explain and produce shell commands for creating, exploring, and modifying the GKE cluster.</p> <p>Lab 3: Analyze data</p>

		<p>with Gemini assistance</p> <p>Objective: In this lab, you'll</p> <ol style="list-style-type: none"> 1. Utilize Gemini to inquire about Google Cloud data analytics products and use cases. 2. Engage Gemini to generate SQL queries in BigQuery and build an ML model for forecasting future periods. <p>Lab 4: Gemini for Data Scientists</p> <p>Objective: In this lab, you'll:</p> <ol style="list-style-type: none"> 1. Utilize Colab Enterprise Python notebooks in BigQuery Studio and work with BigQuery DataFrames. 2. Employ Gemini to generate code from natural language prompts and build a K-means clustering model with visualization. 3. Utilize the text-bison model for devising marketing campaign strategies and perform project resource cleanup.
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<ul style="list-style-type: none"> • Vertex AI Gemini API using cURL and learn function calling with Gemini. Explore the Vertex AI Gemini API and Python SDK. Deploy a Streamlit app integrated with Gemini Pro on Cloud Run. Develop GenAI apps with Gemini and Streamlit. Understand design optimization. 	<ul style="list-style-type: none"> • Demonstrate proficiency in using the Vertex AI Gemini API through cURL commands and function calling, showcasing understanding of API functionalities and integration with Python SDK for enhanced development capabilities. • Exhibit the ability to deploy a Streamlit application integrated with Gemini Pro on Cloud Run, highlighting practical implementation skills and understanding of how Gemini enhances application development and functionality. 	<p>Lab 1: Getting Started with the Vertex AI Gemini API with cURL</p> <p>Objective: Learn to interact with the Vertex AI Gemini API using cURL commands, focusing on the Gemini Pro and Gemini Pro Vision models. Install the Python SDK and use cURL commands to perform tasks such as generating text from text prompts, analyzing images, and processing videos. Explore the capabilities of the Gemini Pro model for natural language tasks and the Gemini Pro Vision model for multimodal prompts.</p> <p>Lab 2: Introduction to Function Calling with Gemini</p> <p>Objective: Learn to utilize function calling with the Vertex AI Gemini API to enhance generative text model responses. Explore the Gemini Pro and Gemini Pro Vision models to generate function calls from text prompts, enabling structured output from unstructured inputs. Install the Vertex AI SDK for Python and use cURL commands to interact with the Gemini API, focusing on tasks such as generating text, analyzing images,</p>
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		<p>and processing videos. Explore various use cases, including structured Google Store queries, geocoding addresses with a maps API, and entity extraction from log data.</p> <p>Lab 3: Getting Started with the Vertex AI Gemini API and Python SDK</p> <p>Objective: Learn to use the Vertex AI Gemini API and Python SDK to interact with the Gemini 1.0 Pro (gemini-1.0-pro) and Gemini 1.0 Pro Vision (gemini-1.0-pro-vision) models. Tasks include installing the Vertex AI SDK for Python, generating text from text prompts using the Gemini 1.0 Pro model, and generating text</p>
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		<p>from text and image prompts as well as video files using the Gemini 1.0 Pro Vision model.</p> <p>Lab 4: Deploy a Streamlit App Integrated with Gemini Pro on Cloud Run</p> <p>Objective: Learn to integrate the Vertex AI Gemini API with applications, build a sample application using the Streamlit framework, and deploy it on Google Cloud Run. This involves setting up</p>
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		<p>the application locally, including cloning the repository and running the Streamlit application in Cloud Shell, and then deploying the application to Cloud Run.</p> <p>Lab 5: Develop GenAI Apps with Gemini and Streamlit: Challenge Lab</p> <p>Objective: Successfully complete a challenge lab by integrating the Vertex AI Gemini API with applications, building a sample application using the Streamlit framework, and deploying it on Google Cloud Run. Tasks include testing a prompt with cURL, writing Streamlit framework and prompt Python code, testing the application, modifying the Dockerfile, pushing the Docker image to the Artifact Registry, and deploying the application to Cloud Run.</p>
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<ul style="list-style-type: none"> • multimodal generative AI and its applications. Learn about generative AI for time series and sequences. Explore ethics and fairness in generative AI. Understand responsible AI practices for developers, focusing on interpretability and transparency. 	<ul style="list-style-type: none"> • Demonstrate comprehension of multimodal generative AI concepts and their diverse applications across various domains, showcasing awareness of how these models integrate text, images, and other modalities to generate creative outputs. • Acquire knowledge of generative AI techniques tailored for time series and sequences, illustrating understanding of how these models can be applied in forecasting, anomaly detection, and other time-dependent tasks. • Explore the ethical implications and considerations surrounding generative AI, including fairness, bias, interpretability, and transparency, while also gaining insights into responsible AI practices for developers and the importance of incorporating these principles into generative AI development workflows. 	<p>Lab 1: Multimodality with Gemini</p> <p>Objective: Complete a lab demonstrating various multimodal use cases of the Gemini API, including generating text from text, image(s), and video prompts. Tasks include opening the notebook in Vertex AI Workbench, navigating to the generative-ai folder, and running through the notebook cells to understand how to use the Gemini Pro Vision model. This includes scenarios such as image understanding across multiple images, understanding screens and interfaces, understanding entity relationships in technical diagrams, recommendations based on multiple images, identifying similarity/differences between images, generating a video description, extracting tags of objects throughout a video, asking questions about a video, and retrieving extra information beyond the video.</p> <p>Lab 2: Using Gemini for Multimodal Retail Recommendations</p> <p>Objective: Complete a lab</p>
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		<p>demonstrating the use of the Gemini Pro Vision model for retail recommendation systems. Tasks include opening a notebook in Vertex AI Workbench, navigating to the generative-ai folder, and running through notebook cells to understand how to use the Gemini Pro Vision model for visual understanding and recommendation generation. Specifically, you'll learn how to describe a room in detail from its image, recommend furniture pieces based on built-in knowledge, and generate recommendations from a provided list of furniture items.</p> <p>Lab 3: Inspect Rich Documents with Gemini Multimodality and Multimodal RAG: Challenge Lab</p>
		<p>Objective: Complete a lab utilizing Gemini Multimodality and Multimodal RAG to inspect rich documents. Tasks involve exploring and analyzing rich documents using multimodal techniques provided by Gemini, such as text, image, and video processing.</p>