Course Outline

Programme	**Generative AI & Designing LLM Products**
Batch	2023-25
Core/ Elective	Elective
Course Code	To be filled by the academic office
Title	To be filled by the academic office
Course Credits	To be filled by the academic office
Term	4
Academic Year	2024-25
Course Pre-requisite(s)	Students require knowledge of working with pandas and numpy (please see this link below to help you prepare yourself for the course)
Course Instructor	Ashok Kumar Harnal & Prof Amarnath Mitra
Course Instructor Email	ashok@fsm.ac.in/amarnath.mitra@fsm.ac.in
Course Instructor Phone (Office)	
Student Consultation Hours	9am to 3pm
Office location	

1. Course Overview

Generative AI has the potential of automating numerous tasks efficiently. Some examples are improving customer interactions through enhanced chat and search experiences, summarizing social media comments, indicating toxicity or positivity in social media about product(s) or business, helping IT and software companies in automated code generations. This course is about developing basic familiarity with techniques of Natural Language Processing, understanding Large Language Models, working with them and developing unique LLM business applications.

We begin with Neural Networks, how they work and are used in analytics. We then learn and experiment with word-to-vector transformation. We work with HuggingFace transformers to solve numerous NLP tasks. We use streamlit to build NLP and image related webApps and host them on cloud. We learn how to install an end-to-end fully secure, private, and feature rich LLM web-interface. Students will undertake projects to develop their unique knowledge products on such LLMs.

For enterprising students, we show how easy it would be setup one's own unit in the domain of GenAI. On the way we also demonstrate (and warn) that LLMs have biases and there is a need to discover them as also overcome them.

Students are expected to have laptops with minimum 16GB of RAM preferably with NVIDIA Graphics card. Laptop RAM is cheap and students are strongly advised to upgrade to 16GB or more.

2. Course Learning Outcomes (CLOs)

CLO1: To understand and work with Generative AI models

CLO2: To use langchain and other tools in different business and industry environment.
CLO3: To be able to plan and design LLM products as per business requirements.

3. Mapping of CLOs with PLOs

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6
CLO1	E					
CLO2		E				
CLO3						R

(I - Introduce, E - Emphasis, R - Reinforce)

4. Pedagogy

5. Evaluation Components

Component	Description	Weight	CLO
 github site	Utmost importance needs to be given in maintaining a good and properly arranged github site. Students are expected to upload their projects here and also have a fairly comprehensive Readme.md file describing the work.	5%	CLO1, CLO2 and CLO3
Quizzes	There will be two quizzes conducted consisting of MCQ (s).	10%	CLO1 and CLO2
Class Participation	Student's regularity in class, level of preparedness for each class and his/her participation in the class discussions will form the basis of evaluation for this component.	10%	CLO1
Mid-term Examination	Students will be evaluated in mid-term based on two-projects followed by viva.	20%	CLO1, CLO2, and CLO3
Group Project & Presentation	A group project on any real world problem taken from Kaggle.	15%	CLO2
End-term Examination	The end-term question paper would be practical oriented. Students will be evaluated based upon the analysis they perform on the given problem.	40%	CLO1, CLO2, and CLO3

Recommended Web Resources (RWR):

i. Neural network and Deep Learning by Michael Nielsen. An excellent but free book at this link.
ii. A Comprehensive Overview of Large Language Models by Humza Naveeda, Asad Ullah Khana and others, arXiv Journal
iii. GenAI use cases and applications
iv. Generative AI: Creating machines more human-like
v. 2023 Kaggle AI Report
vi. NLP Course HuggingFace

vii. Hands on Machine Learning with Scikit Learn Keras and TensorFlow 2nd Edition-2019--Aurélien Geron

Learning numpy & pandas:

Students (other than from BDA stream) who would like to prepare for this course are advised to go through two of these simple lessons on *python* and on *pandas* on Kaggle. Course link on numpy is here.

Session Plan

Session No.	Topic	Readings/ Cases	Learning Outcomes
Module:1: Generative AI Concepts and Simple Models			
1-2	Introduction to Artificial Neural Networks	Web Resource (i): Wikipedia Perceptron.	Knowledge of working of perceptron; MLP structures and concept of activation functions *[CLO1 and CLO2]*
3-4	Word-to-vector transformation	Chris McCormick blog ; Word embedding visual inspector	Getting familiar with word embedding and experimenting with them. *[ClO1, CLO2]*
5-6	General architecture of Transformers--BERT Text classification	HuggingFace Transformer models. HuggingFace Encoders and Decoders videos Sentiment analysis using transformers.	Students learn how to perform text classification using transformers to a business problem. *[CLO1, CLO2 and CLO3]*
7-8	Zero-shot classification and Few-shot learning	Zero-shot image classification. Few-shot classification example	Students learn one of the important classification techniques. *[CLO1 and CLO2]*
9-10	Streamlit for developing LLM webApps	Building powerful generative AI apps. Hosting streamlit webapp in streamlit spaces	Students learn how to use Streamlit to develop production oriented WebApps. *[CLO1, CLO2 and CLO3]*
Module:2: Designing LLM products			
11-12	Ollama and anythingLLM installation	About ollama. Students install fully functional, production oriented, totally private, secure and feature rich chatbot.	Students install and experiment with complete installation of working on an LLM. *[CLO1 and CLO2]*
13-14	Embedding, vector databases and search	FAISS: library for efficient search; chroma vector database	Students learn to work on vector databases and FAISS similarity search. *[CLO1, CLO2 and CLO3]*
15	Biased LLMs and Ethics	Regulating LLMs and GenAI	Students experiment with evaluating how ethical LLM models are and how to get over any biases..*[CLO2]*

16-17	Prompt Engineering	LLM prompting guide; AI Prompt Engineering isn't the Future (HBR) .	Prompt engineering is important for getting relevant replies from chatbots. Students learn to frame appropriate prompots. *[CLO2 and CLO3]*
18-20	Developing LLM applications using langchain	Getting started with Langchain; langchain and ollama; pdf chatbots with langchain and ollama	Students learn how to apply pre-trained deep learning networks to real world problems. *[CLO1, CLO2 and CLO3]*

1. **Rubrics**

A. RUBRICS FOR QUIZ & CLASS PARTICIPATION (CLO1)

Competency goals	**Below Expectations 0-4 points**	**Meets Expectations 5-7 points**	**Exceeds Expectations 8-10 points**
Contributory	Contributes his suggestions in planning a project	Identifies steps as to how a project is to be planned and evaluated.	Identifies steps as to how a project is to be planned and evaluated. Further proposes alternatives for some of the steps.
Broad understanding of GenAI operations	Understands how to apply ML to business operations. the roles,	Understands how to apply GenAI to business operations and can also define data requirements.,	Understands how to apply ML to business operations and can also define data requirements. The student has ideas about necessary organizational changes and policies to be formulated.

B. RUBRICS FOR GROUP PROJECTS AND END-TERM & MID-TERM QUESTIONS ON CLO2 and CLO3

Competency goals	**Below Expectations 0-4 points**	**Meets Expectations 5-7 points**	**Exceeds Expectations 8-10 points**
Projects Selection and execution	Makes a good selection of projects and is able to plan execution steps	Makes a good selection of projects, is able to plan the steps, coordinates tasks among team members and is able to implement his part of the projects.	Makes a good selection of projects, is able to plan the steps, coordinates tasks among team members, is able to implement his part of the projects and also make effective presentation..

Technological Competency	Applies basic tools and techniques for problem-solving.	Applies basic and advanced tools and techniques for problem-solving.	Applies basic and advanced tools and techniques for problem-solving & decision making, and shows openness to learn the functions, purposes, and limitations of new tools and technology.

For official use: -

As Benchmarked with course content in previous year, the contents of this course: **(Please mark the right option below)**

(a) Is totally new ☐

(b) Has not changed at all ☐

(c) Has undergone less than/equal to 20% change ☐

(d) Has undergone more than 20% change ☐

Course Faculty: _____

Case Requisition Format

Programme: PGDM Batch-32, PGDM(IB) Batch-17, PGDM(FM) Batch-06 & PGDM(BDA) Batch-03

S. No.	Title, Author & Publication details	Product No.	No. of Pages	Total registration	No. of cases required for Students	Visiting faculty copy (if required)

1						
2						
3						
4						
5						

Faculty Guidelines for Case requisition:
You can procure maximum of 05 cases in full credit course & 03 cases in a half credit course.

Course Faculty **Area Chair**

Professor-in-charge (AACSB)

Manager (Academics-I)

Dean (Academics)