COURSE TITLE	**PROMPT ENGINEERING & GENERATIVE AI FOR MECHANICAL ENGINEERS**
COURSE CODE	**01ME0107**
COURSE CREDITS	**1**

Objective:

1 To enable students to apply prompt engineering and generative AI techniques for problem-solving, data analysis, visualization, and smart view creation in mechanical engineering and interdisciplinary domains

Course Outcomes: After completion of this course, student will be able to:

1 Apply prompt engineering principles to generate mechanical engineering solutions using text, code, and visualization.

2 Apply AI-assisted techniques to create 2D/3D images and smart visual views of mechanical systems.

3 Analyze engineering datasets using generative AI for visualization, statistical insights, and simulation results.

4 Analyze the effectiveness of advanced prompting techniques in solving interdisciplinary engineering problems.

5 Evaluate risks, limitations, and ethical aspects of using prompt engineering in engineering applications.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	2	0	0	0	25	25

Contents : Unit	Topics	Contact Hours
Total Hours		

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Introduction to Prompt Engineering** What is a prompt? What is prompt engineering? Importance in research & engineering design. Rise of in-context learning & few-shot prompting. Illustrate with mechanical engineering example	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
2	**Elements & Structure of Prompts** Prompt components: Instruction, Context, Input, Output Deterministic vs. diverse responses Example: Write a program for basic mechanical system.	2
3	**Prompting for Engineering Tasks** Summarization: Thermodynamics & Mechanics topics Question Answering: Solving EME numerical problems step by step Classification: Materials (ductile, brittle) Role-playing: AI as welding inspector / CAD designer Code generation: Writing programs for mechanical formulas Reasoning: Kinematics chain-of-steps	2
4	**Structured Prompting Techniques** Few-shot prompting Chain-of-Thought (CoT) prompting Zero-shot CoT ("Let's think step by step") Example: Derive torque transmission in a clutch step-by-step	2
5	**Advanced Reasoning & Program-Aided Prompts** Self-Consistency prompting Generated Knowledge prompting Program-Aided Language Models (PAL) for code generation ReAct: Reasoning and tool interaction	2
6	**Data Analysis with Generative AI** Prompting for data cleaning, preprocessing, visualization Generating statistical summaries (mean, median, variance) Creating plots: line, bar, pie, scatter for mechanical datasets Integration with computational results Case Study: AI-generated plots of stress-strain curves	2
7	**Visualization Techniques in Engineering** 2D Visualization: Charts, graphs, contour maps (temperature, stress fields) 3D Visualization: CAD-style images, part rendering prompts Smart Views: exploded & cut-section views Text to Image generation Image-to-Text generation Example: Generate a 3D exploded view of Mechanical Systems	2
8	**Image & Model Generation** 2D image creation: Free-body diagrams, kinematic chains 3D image creation: Robotic arms, turbine blades Generative AI for mechanical sketches CAD-style prompts: sectional, orthographic, isometric, perspective Example: Create a 3D lathe machine image with labeled parts	2
9	**Smart View Creation for Mechanical Systems** AI-driven interactive visual explanations Visual storytelling: power flow in gear trains, torque in clutches Stepwise simulation views Case Study: Animated sequence	2
10	**Risks & Responsible AI Usage** Prompt injection Prompt leaking Jailbreaking Ethical considerations in engineering use cases Safe AI deployment in industry	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
11	**Interdisciplinary Applications of Prompt Engineering** Electrical/Electronic Integration: Incorporating circuits, sensors, and IoT devices into mechanical systems Computer Science Integration: Web page Development, software Development, App Development Biomedical Integration: Implementing mechanical design principles in prosthetics, implants, and medical devices.	4
12	**Capstone Project** Teams develop an AI-driven solution for an engineering problem (e.g., robotics, thermal systems, manufacturing). Deliverables: AI-generated code. 2D/3D image or smart view. Data visualization of system parameters. Ethical evaluation of AI use in the project.	4
Total Hours		**28**

Textbook :

1 Language Models are Few-Shot Learners , Brown, T. B. , ArXiv, 2020

2 Understanding Generative AI, Daniel Jeffries , Ex Libris Group, 2021

References:

1 How to Generate Text with Decoding Strategies , How to Generate Text with Decoding Strategies , Hugging Face, Hugging Face, 2023

2 OpenAI – Introduction to Prompt Engineering for Developers, OpenAI – Introduction to Prompt Engineering for Developers, OpenAI (as the organization), OpenAI Documentation, 2023

3 AI for Engineers: Data Analysis and Visualization, AI for Engineers: Data Analysis and Visualization, Jha, C. & Agarwal, A., AI Database, 2024

4 AI Superpowers: Generative AI Era, AI Superpowers: Generative AI Era, Kai-Fu Lee, AI Database, 2018

5 Generative AI for Data Visualization and Smart Views, Generative AI for Data Visualization and Smart Views, IBM Research, IBM Research, 2023

6 AI Docs – Prompt Engineering Concepts and Practice, AI Docs – Prompt Engineering Concepts and Practice, Microsoft Azure AI Documentation, Microsoft Azure AI Documentation, 2025

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	10.00	30.00	30.00	20.00	0.00

Instructional Method:

1 Pair Programming/Prompting
2 Case Studies & Prompt Deconstruction

Supplementary Resources:

1 https://www.coursera.org/learn/generative-ai-with-llms
2 https://github.com/openai/openai-cookbook
3 https://cognitiveclass.ai/courses/prompt-engineering-for-everyone
4 https://www.edx.org/learn/artificial-intelligence/ibm-introduction-to-prompt-engineering