

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>