CH/CE/ME151 AI TOOLS AND APPLICATIONS LABORATORY

L	T	P	C	Int	Ext
-	1	3	2.5	40	60

Semester I [First Year]

COURSE OUTLINE:

* This course introduces first-year engineering students to the practical use of Artificial Intelligence tools across problem-solving, data analysis, content creation, and coding.
* Students gain hands-on experience with generative AI, prompt engineering, AI-assisted data visualization, and productivity/coding copilots through weekly lab practice.
* The course emphasizes responsible and ethical AI use alongside technical competence, and serves as a foundation for AI-assisted work in higher-semester courses across all branches.
* By the end, students will be able to independently select, apply, and evaluate AI tools for academic and engineering tasks.

COURSE OBJECTIVES:

1. To familiarize students with the landscape of AI tools and their underlying working principles.
2. To develop competence in prompt engineering for effective interaction with generative AI systems.
3. To enable students to apply AI tools for data analysis, visualization, and interpretation.
4. To train students in using AI-assisted tools for coding, writing, and productivity tasks.
5. To instill awareness of ethical, legal, and societal considerations in AI tool usage.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

CO	Course Outcome	RBTL
CO1	recall the categories, capabilities, and limitations of major AI tools (text, image, code, data).	Remember (BL1)
CO2	explain the principles of prompt engineering and how generative AI models process instructions.	Understand (BL2)
CO3	apply AI tools to solve first-year engineering problems in analysis, writing, and coding tasks.	Apply (BL3)
CO4	analyze AI-generated outputs for accuracy, bias, and reliability before use.	Analyze (BL4)
CO5	evaluate the ethical, academic-integrity, and societal implications of AI tool use, justifying appropriate usage choices.	Evaluate (BL5)

CO - PO / PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	3	-	-	-	-	-	2	-	-
CO2	2	2	-	-	2	-	-	-	-	-	-	-	-
CO3	-	2	2	-	3	-	-	2	2	-	-	-	-
CO4	-	3	-	2	2	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	3	3	1	-	-	2	-	-

UNIT I

Introduction to AI and the AI Tools Landscape

1. What is AI, Machine Learning, and Generative AI - basic definitions and how they relate to one another.

2. Core categories of AI tools: conversational/text, code assistants, data-analysis tools, image-generation tools, and writing/productivity tools.

3. How large language models process and generate responses (conceptual, non-mathematical overview).

4. Criteria for selecting the right AI tool for a given task - accuracy needs, cost, data sensitivity, and output format.

5. Setting up accounts and workspaces; understanding free-tier versus paid-tier capabilities and limitations.

Widely Used AI Tools by Application

Category	Example Tools	Typical Application
Conversational / General-Purpose AI	ChatGPT, Claude, Gemini, Perplexity	Writing, research, coding help, file / data analysis, cited web search
AI Coding Assistants	GitHub Copilot, Cursor, Claude Code	In-IDE code completion, AI-native editing, multi-file agentic coding
Data Analysis Tools	ChatGPT (Advanced Data Analysis), Microsoft Copilot in Excel, Julius AI	Upload a dataset, generate statistics / charts, spreadsheet formulas via natural language
Image Generation	Midjourney, DALLÂ·E 3, Stable Diffusion / Flux	Illustrations, concept art, design mockups
Writing & Productivity	Grammarly, Gamma, Fathom, Notion AI	Grammar / style checking, slide generation, meeting summaries, task automation
Audio, Video & Presentation (optional)	ElevenLabs, Runway/Sora, Synthesia	Text-to-speech, AI video generation, script-to-video presentations

Unit Learning Outcomes:

Identify the categories of AI tools available and select an appropriate tool for a given academic or engineering task.

Practical Examples for In-Class Explanation:

1. Live comparison of the same general engineering query (e.g., "explain the engineering design process") answered by two different AI chatbots, highlighting differences in response style and accuracy.

2. Walkthrough of an AI tool's interface - settings, conversation history, file upload, and model selection - using a common platform.

Exercise / Practice Problems:

1. Create accounts on two AI platforms and compare their responses to a simple engineering question (e.g., "explain the difference between analysis and design").

2. Prepare a one-page comparison chart of five AI tools by category and primary use case.

3. Write a short reflection identifying one task in your daily academic life where an AI tool could help.

UNIT II

Prompt Engineering and Generative AI Tools

1. Anatomy of a good prompt - context, clear instruction, desired format, and constraints.

2. Zero-shot, few-shot, and chain-of-thought prompting techniques and when to use each.

3. Role-based and context-setting prompts (e.g., asking the AI to respond as a reviewer, tutor, or domain expert).

4. Iterative prompt refinement - diagnosing a poor AI response and rewriting the prompt to fix it.

5. Using generative AI for brainstorming, summarizing, and drafting technical content.

Unit Learning Outcomes:

Construct clear, well-structured prompts using zero-shot, few-shot, and chain-of-thought techniques to obtain reliable AI output.

Practical Examples for In-Class Explanation:

1. Refine a vague prompt (e.g., "explain project scheduling") into a precise one step-by-step, showing output improvement at each stage.

2. Demonstrate few-shot prompting by providing examples to guide the AI toward a specific output format (e.g., a formatted comparison table).

Exercise / Practice Problems:

1. Write three versions of a prompt (basic, detailed, role-based) for the same task and compare outputs.

2. Use an AI tool to summarize a one-page technical article and verify the summary against the original.

3. Draft a chain-of-thought prompt to solve a multi-step numerical/logical problem (e.g., a unit-conversion or estimation problem) and check the reasoning.

UNIT III

AI Tools for Data Analysis and Visualization

1. AI-assisted spreadsheet and dataset analysis using natural-language commands.

2. Natural-language querying of datasets to extract summary statistics and insights.

3. AI tools for generating charts, graphs, and visual summaries from tabular data.

4. Interpreting AI-generated statistical summaries correctly and recognizing their limitations.

5. Identifying and correcting errors or misinterpretations in AI-generated data analysis.

Unit Learning Outcomes:

Use AI tools to clean, summarize, and visualize a dataset via natural-language commands, and identify errors in AI-generated analysis.

Practical Examples for In-Class Explanation:

1. Upload a small dataset (e.g., class attendance or survey data) to an AI tool and generate a summary-statistics report and chart using natural-language commands.

2. Show an example where an AI tool misinterprets data (e.g., treats a numeric code as text), and demonstrate how to verify and correct it.

Exercise / Practice Problems:

1. Use an AI tool to clean and summarize a small sample dataset (e.g., class attendance or marks data).

2. Generate three different chart types from the same dataset using AI prompts and justify which is most appropriate.

3. Cross-check one AI-generated statistical claim manually and report any discrepancy found.

UNIT IV

AI Tools for Coding, Writing, and Productivity

1. AI coding assistants - code generation, explanation, and debugging support for simple programs.

2. AI writing assistants for reports, emails, and technical documentation.

3. AI tools for scheduling, note-taking, and meeting/lecture summarization.

4. AI-assisted presentation and slide-outline generation from a topic prompt.

5. Integrating AI tools into an efficient day-to-day academic and engineering workflow.

Unit Learning Outcomes:

1. Apply AI coding assistants and writing tools to complete and refine a simple technical task.

2. Integrate multiple AI tools into a coherent workflow.

Practical Examples for In-Class Explanation:

1. Use an AI coding assistant to generate a simple program (e.g., a temperature converter), then intentionally introduce a bug and have the AI debug it.

2. Generate a presentation outline and speaker notes from a topic prompt using an AI writing/productivity tool.

Exercise / Practice Problems:

1. Use an AI coding tool to write and debug a simple program for a given problem statement.

2. Draft a formal email or short report using an AI writing assistant, then manually edit it for accuracy and tone.

3. Generate a slide outline for a 5-minute seminar topic using an AI tool and refine it.

UNIT V

Ethics, Reliability, and Emerging Trends

1. Bias and hallucination in AI outputs, and techniques for detecting and fact-checking them.

2. Academic integrity and appropriate citation of AI assistance in coursework and submissions.

3. Data privacy and security considerations, including obligations under India's Digital Personal Data Protection Act, 2023 (DPDP Act), when uploading personal or institutional data.

4. Copyright and intellectual property considerations in AI-generated text and image content.

5. Emerging trends â€” multimodal AI and AI agents - and their implications for future engineering practice.

Unit Learning Outcomes:

Evaluate AI-generated output for hallucination, bias, and copyright concerns, and apply ethical and data-privacy principles to AI tool use.

Practical Examples for In-Class Explanation:

1. Show a documented case of AI hallucination (a fabricated fact or citation) and demonstrate how to fact-check it.

2. Walk through an example of properly citing AI assistance in an academic submission per institutional guidelines.

3. Walk through a worked example of checking whether AI-generated text or image output raises a copyright/IP concern (e.g., close paraphrasing of a source).

Exercise / Practice Problems:

1. Identify and document a hallucination or bias instance produced by an AI tool on a factual query.

2. Draft an "AI usage declaration" for a hypothetical assignment, citing tools and extent of use appropriately.

3. Review the data-handling/privacy policy of one AI tool used in this course and identify one DPDP Act, 2023 compliance consideration relevant to student data.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Marr, B. (2024). Generative AI in practice: 100+ amazing ways generative artificial intelligence is changing business and society. Wiley.

2. Mollick, E. (2024). Co-intelligence: Living and working with AI. Portfolio/Penguin.

REFERENCE BOOK(s):

1. Selwyn, N. (2022). Education and technology: Key issues and debates (3rd ed.). Bloomsbury.
2. Susskind, R., & Susskind, D. (2022). The future of the professions: How technology will transform the work of human experts (Updated ed.). Oxford University Press.
3. Russell, S., & Norvig, P. (2021). Artificial intelligence: A modern approach (4th ed.). Pearson.

WEB RESOURCES:

1. Google. (n.d.). Google AI essentials. Grow with Google. https://grow.google/ai-essentials/
2. OpenAI. (n.d.). OpenAI documentation and guides. https://platform.openai.com/docs
3. Anthropic. (n.d.). Prompt engineering overview. Claude Docs. https://docs.claude.com/en/docs/build-with-claude/prompt-engineering/overview
4. AICTE. (2025). AICTE inputs on Artificial Intelligence â€" Year of AI initiative. https://www.aicte.gov.in/downloads/initiatives/AICTE%20inputs%20on%20Artificial%20Intelligence%20-comprehensive.pdf
5. Ministry of Electronics and Information Technology, Government of India. (2023). Digital Personal Data Protection Act, 2023. https://www.meity.gov.in/content/digital-personal-data-protection-act-2023