COURSEPACK

SCHEME

The scheme is an overview of work-integrated learning opportunities and gets students out into the real world. This will give what a course entails.

Course Title	Prompt Engineering			Course Type				Theory	
Course Code	R1UD701T			Class				B. Tech. CSE VII[th] semester	
Instruction delivery	Activity	Credits	Credit Hours	Total Number of Classes per Semester				Assessment in Weightage	
	Lecture	3	3	Theor	Tutorial	Practica	Selfstudy	CI	SEE
	Tutorial	0	0						
	Practical	0	0						
	Self-study	0	0						
	Total	**3**	3	**45**	**0**	**0**	**0**	**50%**	**50%**
Names Course Instructors	**Course Lead:**	Dr. Saurabh Singh							
	Theory			**Practical**					
	Dr. Saurabh Singh Dr. Nitin Jain Dr. Avinash Dwivedi Dr. Raj Kumar Parida Mr. VinayDwivedi			NA					

COURSE OVERVIEW

This course explores the principles and techniques of prompt engineering, emphasizing its application in natural language processing and AI systems. Students will learn to design, refine, and optimize prompts to enhance model performance and achieve desired outcomes. Key topics include prompt formulation, prompt tuning, ethical considerations, and case studies in various domains. Through hands-on projects and practical assignments, students will develop skills in crafting effective prompts, evaluating their impact, and addressing challenges in prompt engineering. By the end of the course, students will be equipped to leverage prompt engineering for innovative solutions in AI-driven applications.

PREREQUISITE COURSE

PREREQUISITE COURSE REQUIRED	**NO**	
If, yes please fill in the Details	**Prerequisite course code**	**Prerequisite course name**
	NA	NA

COURSE OBJECTIVE

Equip students with the knowledge and skills to design and optimize effective prompts for natural language processing and AI applications. Enable understanding of prompt engineering principles and methodologies. Develop proficiency in evaluating and refining prompts to improve AI model performance. Foster the ability to address ethical considerations and challenges in prompt engineering. Encourage application of prompt engineering techniques through hands-on projects and real-world case studies. Prepare students to leverage prompt engineering for innovative solutions in various domains. Cultivate critical thinking and problem-solving skills in the context of AI-driven tasks and applications.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO No.	Course Outcomes
CO1	Understand the fundamentals of prompt engineering and the role of prompt engineers in Generative AI-powered systems and Natural Language Processing (NLP)
CO2	Use AI prompt libraries efficiently for organization, streamlined development, and enhanced collaboration.
CO3	Develop a deep knowledge of Large Language Models (LLMs) and their workings.

BLOOM'S LEVEL OF THE COURSE OUTCOMES

Bloom's taxonomy is a set of hierarchical models used for the classification of educational learning objectives into levels of complexity and specificity. The learning domains are cognitive, affective, and psychomotor.

. CO No.	Bloom's Level					
	Remember (KL1)	Understand (KL2)	Apply (KL3)	Analyse (KL4)	Evaluate (KL5)	Create (KL6)
CO1	✓	✓				
CO2			✓			
CO3				✓		✓

PROGRAM OUTCOMES (POs):

PO1: Apply the knowledge of Mathematics, Science, and Engineering fundamentals, and an engineering specialization to solution of complex engineering problems (**Engineering Knowledge)**

PO2: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (**Problem analysis**)

PO3: Design of solutions for complex engineering problems and design of system components or processes that meet the specified needs with appropriate considerations of public health and safety, and cultural, societal, and environmental considerations (**Design/development of solutions**)

PO4: Use research based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions (**Conduct investigations of complex problems**)

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling complex engineering activities with an understanding of limitations (**Modern tool usage**)

PO6: Apply reasoning within the contextual knowledge to access societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice (**The engineer and society**)

PO7: Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments (**Environment and sustainability**)

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (**Ethics**)

PO9: Function effectively as an individual independently and as a member or leader in diverse teams, and in multidisciplinary settings (**Individual and team work**)

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentation, make effective oral presentations, and give and receive clear instructions (**Communication**)

PO11: Demonstrate knowledge and understanding of engineering management principles and apply those to one's own work as a member and leader of a team to manage projects in multidisciplinary environments (**Project management and finance**)

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (**Life-long Learning**).

Program Specific outcomes (PSO's)

PSO1: Develop the ability to implement emerging techniques to plan, analyse, design, execute, manage, maintain and rehabilitate systems and processes in diverse area like structural, environmental, geotechnical, transportation and water resources engineering.

PSO2: Excel in research, innovation, design, problem solving using different software's and artificial intelligence and develop an ability to interact and work seamlessly in multidisciplinary environment.

COURSE ARTICULATION MATRIX

The Course articulation matrix indicates the correlation between Course Outcomes and Program Outcomes and their expected strength of mapping in three levels (low, medium, and high).

COs#/ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					1	2					2	1	
CO2	2	1	2			2							2	
CO3			3		2						3	1	1	3

Note: 1-Low, 2-Medium, 3-High

COURSE ASSESSMENT

S.No	Type of Course (T)	CIE			Total Marks		Final Marks CIE*0.5+SEE* 0.5
		IA-1	MTE	IA-2	CIE	SEE	
1	Theory	25	50	25	100	100	100

* Assignment, Quiz, Class test, SWAYAM/NPTEL/MOOCs and etc.

COURSE CONTENT

THEORY

Content
Unit 1: Introduction to Prompt Engineering Overview of Natural Language Processing, Evolution of Language Models, Introduction to Prompt Engineering, Prompt, Types of Prompts, Importance and Applications of Prompts, Principles of Effective Prompt Design, Common Pitfalls in Prompt Engineering, Case Studies of Prompt Engineering. Unit 2: Techniques and Strategies Heuristics for Prompt Design, Prompt Templates and Frameworks, Comparative Analysis of Different Techniques, Zero-shot Learning, One-shot Learning, Few-shot Learning, Role of Context in Prompting, Handling Ambiguities in Prompts, Addressing Biases in Prompts. Unit 3: Tools and Frameworks Overview of Popular Tools, Hands-on with OpenAI API, Using Hugging Face Transformers, Chatbots and Conversational Agents, Integration with Web Applications, Integration with Mobile Applications, Custom Tool Development, Leveraging Pre-trained Models, Future Trends in Prompt Engineering. Unit 4: Case Studies and Applications Case Study: Healthcare Applications, Case Study: Finance Applications, Case Study: Customer Service Applications, Applications in Academic Research, Collaboration between Academia and Industry, Ethics and Bias in Prompt Engineering, Creative Writing and Storytelling, Game Design and Interactive Fiction, Art and Music Generation. Unit 5: Practical Projects and Assessments Project Guidelines and Expectations, Team Formation and Topic Selection, Proposal Submission and Feedback, Development Milestones, Troubleshooting and Problem Solving, Peer Review and Collaboration, Project Presentations, Feedback and Assessment, Course Review and Future Directions.

LESSON PLAN FOR COMPREHENSIVE COURSES
FOR THEORY (15 weeks * 3 Hours = 45 Classes)
LESSON PLAN FOR THEORY COURSES

Lecture	Topic	Theory / Tutorial / Practical Plan	Skill	Competency
Unit 1: Introduction to Prompt Engineering				
1	Overview of Natural Language Processing (NLP)	Theory	KL1	CO1
2	Evolution of Language Models in NLP	Theory	Kl1	CO1
3	Introduction to Prompt Engineering: Concepts and Significance	Theory	Kl1	CO1
4	Understanding Prompts: Definition and Purpose	Theory	Kl2	CO1
5	Types of Prompts in NLP	Theory	Kl1	CO1
6	Importance and Applications of Prompts	Theory	Kl2	CO1
7	Principles of Effective Prompt Design	Theory	Kl2	CO1
8	Common Pitfalls in Prompt Engineering	Theory	KL3	CO1
9	Case Studies of Successful Prompt Engineering	Theory	Kl2	CO1
Unit 2: Techniques and Strategies				
10	Heuristics for Effective Prompt Design	Theory	KL1	CO1
11	Prompt Templates and Frameworks: An Overview	Theory	KL1	CO1
12	Comparative Analysis of Different Prompt Design Techniques	Theory	KL4	CO1,CO2
13	Zero-shot Learning: Concepts and Applications	Theory	KL3	CO2
14	One-shot Learning: Concepts and Applications	Theory	KL3	CO2
15	Few-shot Learning: Concepts and Applications	Theory	KL3	CO2
16	The Role of Context in Effective Prompting	Theory	KL2	CO1
17	Handling Ambiguities in Prompts	Theory	KL2	CO2
18	Addressing Biases in Prompts: Techniques and Strategies	Theory	KL4	CO2
Unit 3: Tools and Frameworks				
19	Overview of Popular Tools for Prompt Engineering	Theory	KL1	CO2
20	Hands-on Session with OpenAI API: Basic Usage	Theory	KL3	CO2
21	Advanced Techniques with OpenAI API	Theory	KL2	CO2
22	Introduction to Hugging Face Transformers	Theory	KL2	CO2

Lecture	Topic	Theory / Tutorial / Practical Plan	Skill	Competency
23	Advanced Usage of Hugging Face Transformers	Theory	KL2	CO2
24	Designing Prompts for Chatbots and Conversational Agents	Theory	KL6	CO3
25	Integration of Prompt Engineering with Web Applications	Theory	KL6	CO3
26	Integration of Prompt Engineering with Mobile Applications	Theory	KL6	CO3
27	Custom Tool Development for Prompt Engineering	Theory	KL6	CO3
28	Leveraging Pre-trained Models in Prompt Engineering	Theory	KL4	CO3
29	Future Trends in Prompt Engineering	Theory	KL4	CO3
Unit 4: Case Studies and Applications				
30	Case Study: Prompt Engineering in Healthcare Applications	Theory	KL1	CO3
31	Case Study: Prompt Engineering in Finance Applications	Theory	KL1	CO3
32	Case Study: Prompt Engineering in Customer Service Applications	Theory	KL1	CO3
33	Applications of Prompt Engineering in Academic Research	Theory	KL3	CO2
34	Collaboration between Academia and Industry in Prompt Engineering	Theory	KL3	CO2
35	Ethics and Bias in Prompt Engineering: Part 1	Theory	KL4	CO2
36	Ethics and Bias in Prompt Engineering: Part 2	Theory	KL4	CO2
37	Creative Writing and Storytelling Using Prompt Engineering	Theory	KL6	CO3
38	Game Design and Interactive Fiction with Prompt Engineering	Theory	KL6	CO3
39	Art and Music Generation through Prompt Engineering	Theory	KL6	CO3
Unit 5: Practical Projects and Assessments				
40	Project Guidelines and Expectations for Practical Projects	Theory	KL6	CO3
41	Team Formation and Topic Selection for Projects	Theory	KL6	CO3
42	Proposal Submission and Feedback for Projects	Theory	KL6	CO3
43	Key Development Milestones in Project Work: Part 1	Theory	KL6	CO3

Lecture	Topic	Theory / Tutorial / Practical Plan	Skill	Competency
44	Key Development Milestones in Project Work: Part 2	Theory	KL6	CO3
45	Troubleshooting and Problem Solving in Project Development	Theory	KL6	CO3
46	Importance of Peer Review and Collaboration in Projects	Theory	KL6	CO3
47	Project Presentations: Preparation and Execution	Theory	KL6	CO3
48	Feedback and Assessment of Project Work	Theory	-	-
49	Course Review: Summary and Reflection	Theory	-	-
50	Future Directions and Opportunities in Prompt Engineering	Theory	-	-

BIBLIOGRAPHY

Text Book

1. "Hands-On Natural Language Processing with Transformers: Building NLP Applications with Hugging Face" by Thomas Wolf, Lysandre Debut, Julien Chaumond, and Clement Delangue, 1st Edition, 2020, ISBN: 978-1800565791

References

1. "Transformers for Natural Language Processing: Build and Deploy State-of-the-Art Natural Language Processing Pipelines" by Denis Rothman, 2nd Edition, 2021, ISBN: 978-1801077651
2. "Deep Learning with Python" by Francois Chollet, 2nd Edition, 2021, ISBN: 978-1617296864
3. "Conversational AI: Build Better Chatbots, Voice Assistants, and Dialog Systems" by Andrew Freed, 1st Edition, 2021, ISBN: 978-1492072607

"Grokking Artificial Intelligence Algorithms" by Rishal Hurbans, 1st Edition, 2020, ISBN: 978-1617296185

Practice Problems

Unit 1: Introduction to Prompt Engineering

1. What is Natural Language Processing (NLP)?
2. Explain the evolution of language models in NLP.
3. Define prompt engineering and its significance.
4. What are the different types of prompts in NLP?
5. How are prompts applied in various domains?
6. Describe the principles of effective prompt design.
7. Identify common pitfalls in prompt engineering.
8. Analyze a case study where prompt engineering was pivotal.
9. How does prompt specificity impact model performance?
10. Discuss the importance of context in prompt design.

Unit 2: Techniques and Strategies

1. What are heuristics in the context of prompt design?
2. How can prompt templates be utilized in engineering prompts?
3. Compare zero-shot, one-shot, and few-shot learning techniques.
4. Explain the role of context in prompting.
5. How can ambiguities in prompts be handled?
6. Discuss strategies to address biases in prompts.
7. Provide an example of a prompt designed using zero-shot learning.
8. What are the benefits and limitations of one-shot learning?
9. How does few-shot learning enhance prompt effectiveness?
10. Explain the importance of comparative analysis in prompt design techniques.

Unit 3: Tools and Frameworks

1. List some popular tools used for prompt engineering.
2. How can the OpenAI API be used in prompt engineering?
3. Describe the use of Hugging Face Transformers in prompt engineering.
4. What are the key features of chatbots and conversational agents?
5. How can prompt engineering tools be integrated with web applications?
6. Discuss the integration of prompt engineering tools with mobile applications.
7. What are the steps involved in custom tool development for prompt engineering?
8. How can pre-trained models be leveraged in prompt engineering?
9. What are some future trends in prompt engineering?
10. Provide an example of a chatbot designed using prompt engineering techniques.

Unit 4: Case Studies and Applications

1. Describe a case study where prompt engineering was used in healthcare.
2. How has prompt engineering impacted finance applications?
3. Analyze a case study involving prompt engineering in customer service.
4. What are the applications of prompt engineering in academic research?
5. How can academia and industry collaborate in prompt engineering?

6. Discuss the ethical considerations in prompt engineering.
7. Provide an example of bias in prompt engineering and how it was addressed.
8. How can prompt engineering be applied in creative writing and storytelling?
9. What role does prompt engineering play in game design and interactive fiction?
10. Explain how prompts can be used for art and music generation.

Unit 5: Practical Projects and Assessments

1. What are the guidelines and expectations for practical projects in prompt engineering?
2. How should teams be formed and topics selected for projects?
3. What should be included in a proposal submission for a prompt engineering project?
4. Describe the key development milestones in a prompt engineering project.
5. How can troubleshooting and problem-solving be approached in prompt engineering?
6. What is the importance of peer review and collaboration in prompt engineering projects?
7. How should project presentations be structured and delivered?
8. What are the key components of feedback and assessment in prompt engineering projects?
9. How can students review their course experience and provide future directions?
10. What are some potential future directions for research and development in prompt engineering?