

Year: B. Tech IV (Semester VII)

Subject Name: Advances in Artificial Intelligence

Subject Code: BTAI14704

Type of course: Professional Elective Course

Prerequisite (if any): Basics of Artificial Intelligence

Rationale: A course on Advances in Artificial Intelligence is crucial in the era of the rapid evolution of AI based technology and products. This course aims to impart knowledge regarding latest and emerging developments in the field of AI encompassing Explainable AI, Generative AI, AI-integrated next generation computing. It also covers the ethical aspects of AI based system development and its responsible usage.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	0	3	60	25	15	-	-	100

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Contents	Total Hrs
1	Responsible and Ethical AI Definition of Responsible AI, Ethical AI Principles, Trust and Fairness in AI Systems, Responsibility and Liability in AI Systems, Examples – Driving using Autonomous Vehicle, Mis-targeting by an Autonomous Weapon; Strict Liability, Complex Liability: The Problem of Many Hands, Risks in the Business of AI, Privacy Issues with AI, Ethical Issues related to - AI Enhancement, Robots, Healthcare, Autonomous Vehicles, Military Uses of AI	15
2	eXplainable Artificial Intelligence (XAI): Introduction, AI vs. Explainable AI, The goal of XAI, Black Box v v/s Gray Box /s White Box Models, The XAI nomenclature, Transparency, interpretability and explainability, Overview of Explainable AI Algorithms-Self-Interpretable Models, Post-Hoc Explanations, Evaluating Explainable AI Algorithms-Meaningfulness, Explanation Accuracy, Knowledge Limits, Risks associated with the implementation of XAI, Use Cases of Explainable AI (XAI) Across Various Sectors, challenges of XAI	10

3	Generative AI: Introduction to Generative AI, use cases in various domains, introduction to Large Language Models (LLM), an overview of popular LLM architectures, introduction to GPT (Generative Pre-trained Transformer) and its significance, Architecture and working of GPT models, Overview of GPT variants and their use cases, Ethical Considerations in Generative AI, overview of Generative Adversarial Networks (GAN), OpenAI APIs	12
4.	Prompt Engineering: Prompt Engineering example-ChatGPT, Elements of a Prompt, Types Prompts-Role-Playing Prompts, Chain-of-Thoughts Prompts, Meta-Prompts, Multilingual Prompts, Prompting Techniques	04
5.	AI-integrated Next Generation Computing Edge AI, AI-integrated EV, AIOps, Human-centered AI, AI and Quantum Computing (QuAI), AI and the Internet of Things (AIoT), AI in Cyber Security	04

Suggested Specification table with Marks (Theory): (For B.Tech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	30	10	05	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

Sr No	Title of book /article	Author(s)/ Editors	Publisher and details like ISBN	Year of publication
1.	An Introduction to Ethics in Robotics and AI (SpringerBriefs in Ethics)	Christoph Bartneck Christoph Lütge Alan Wagner Sean Welsh	Springer ISBN 978-3-030-51109-8	2021
2.	Explainable AI: Interpreting, Explaining and Visualizing Deep Learning	W. Samek, G. Montavon, A. Vedaldi, L. K. Hansen, K-R Müller	Springer ISBN: 978-3-030-28954-6	2019
3.	Explainable AI for Practitioners	Michael Munn, David Pitman	O'Reilly	2022
4.	Generative AI in Action	Amit Bahree	Manning Publications ISBN : 9781633436947	2024

5.	Prompt Engineering: The Future Of Language Generation	Michael Ferguson	ISBN 9798215852880	2023
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Note: Refer latest editions of all books

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain the need for ethical policies in the development of responsible AI Systems	30
CO-2	Describe Explainable AI approaches and methods that allow humans to interpret and trust the results created by an AI model	20
CO-3	Describe the LLM, GPT, and GAN models and architecture for generative AI systems	30
CO-4	Apply prompt engineering concepts to real-world problems with ChatGPT	10
CO-5	Identify challenges and opportunities for leveraging AI in next generation computing	10