

Branch Name:	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Program Code:	ET114
Course Title:	AI and ML Essentials
Course Code:	1ET1140101T
Pre-requisite Course:	Basic knowledge of mathematics and programming

Course Objectives:

1. To introduce the fundamental principles, historical evolution, and classical reasoning approaches of AI, including logic, knowledge representation, and inference mechanisms.
2. To develop an understanding of probabilistic reasoning through Bayes' theorem, Bayesian inference, and Bayesian networks for reasoning under uncertainty.
3. To familiarize students with evolutionary algorithms, genetic programming, and nature-inspired optimization strategies for solving complex problems.
4. To impart foundational knowledge of supervised, unsupervised, semi-supervised, and reinforcement learning, along with model evaluation, visualization, and classical ML algorithms.
5. To introduce neural network fundamentals, deep learning architectures, NLP techniques, and generative models, along with associated ethical considerations.

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Introduction to Artificial Intelligence (AI): Historical Development of AI, Early AI Concepts, Key Milestones in AI Development, Influential AI Contributors, Logical Approach to AI, Propositional Logic and First-Order Logic, Boolean Algebra and Predicate Logic, Knowledge Representation, Rule-Based Systems, Knowledge-Based Systems, Inference Engines, Case-Based Reasoning, Applications of AI	7	15
2	Probabilistic Approaches to AI: Probability Concepts in AI, Discrete and Continuous Probability Distributions, Bayes' Theorem, Bayesian Inference, Markov Chain Monte Carlo (MCMC), Bayesian Networks, Structure and Representation, Directed Acyclic Graphs (DAGs), Conditional Probability Tables (CPTs), Inference in Bayesian Networks, Learning in Bayesian Networks	6	15
3	Evolutionary Intelligence: Evolutionary Algorithms, Genetic Algorithms, Selection Operators, Crossover and Mutation, Evolutionary Strategies (ES), Self-Adaptation, Types of ES, Applications of Evolutionary Intelligence, Optimization Problems, Traveling Salesman Problem (TSP), Genetic Programming for Symbolic Regression, Genetic Programming (GP), Tree-Based Representations, Evolution of Computer Programs	7	15

4	Introduction to Machine Learning: Basics of Machine Learning, Types of Learning, Data Labelling, Rewards and Policies, Model Evaluation Metrics, Data Visualization in ML, Supervised Learning, Linear Regression, Logistic Regression, Decision Trees and Random Forests, Tree Splitting Criteria, Ensemble Learning, Unsupervised Learning, K-Means Clustering, Agglomerative Clustering, Principal Component Analysis (PCA), Feature Selection and Feature Extraction, Reinforcement Learning, Markov Decision Process (MDP), Model Selection, Overfitting and Underfitting	8	20
5	Neural Networks and Deep Learning: Neural Networks and Deep Learning Perceptron, McCulloch-Pitts Neuron, Activation Functions, Feedforward Neural Networks, Deep Learning, Stochastic Gradient Descent (SGD), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), Sequence Generation, Transfer Learning, Fine-Tuning Pretrained Models, Domain Adaptation	7	15
6	Natural Language Processing (NLP): NLP Basics, Text Preprocessing, Word Embeddings, Word Vectors and Vector Similarity, NLP Applications, Text Generation, Generative Models for Text and Images	4	10
7	Generative Intelligence: Generative Intelligence Concepts, Prompts and Prompt Engineering, IBM Watsons, Generative AI with Large Language Models (LLMs), Introduction to Generative Models, Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), Encoder-Decoder Networks, Latent Variable Sampling, Applications of Generative Models, Ethical Considerations in Generative AI	6	10

Reference Books:

1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson India.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer India.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, Pearson / MIT Press (India Edition).
4. Daphne Koller & Nir Friedman, Probabilistic Graphical Models: Principles and Techniques, MIT Press (India).
5. Richard S. Sutton & Andrew G. Barto, Reinforcement Learning: An Introduction, MIT Press (Indian Edition).
6. Lane, Howard & Hapke, Natural Language Processing in Action, Manning / Dreamtech India.
7. David Foster, Generative Deep Learning, O'Reilly Media (India).

Course Learning Outcomes (CLO): At the end of the course, the students will be able to:

Sr No.	CLO	Description	Bloom's Taxonomy Level
1	CLO1	Students will be able to explain core AI foundations and apply logical reasoning and knowledge-based inference techniques to simple AI problems.	Understand (2)
2	CLO2	Students will be able to construct and analyze Bayesian models, perform inference, and apply probabilistic methods to uncertain decision-making scenarios.	Apply (3)
3	CLO3	Students will be able to apply evolutionary strategies, genetic algorithms, and genetic programming to optimize solutions across varied problem domains.	Apply (3)

4	CLO4	Students will be able to select, implement, and evaluate appropriate ML models—including regression, classification, clustering, and dimensionality reduction techniques—based on problem requirements.	Evaluate (5)
5	CLO5	Students will be able to implement basic neural and deep learning models, apply NLP methods, interpret generative techniques such as GANs/VAEs, and evaluate ethical implications in AI systems.	Evaluate (5)

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CLO1	H	H	M	M	L	L	L	M	L	M		M	H	M	H
CLO2	H	H	M	H	M		L	M	L	M			H	H	H
CLO3	H				M				L	M				H	H
CLO4			H	H	H		L		M			H		H	H
CLO5	H		H	H	H	M	M	H	M			H	H	H	H
CLO6	M	L	L	L	L	H	H	M	L	M		M	L	M	M

H: High, M: Medium, L: Low. PO/PSO mapping is not specified in the source syllabus.