	Fundamentals in AI and ML	Course Type	LTP
Course Code:	**CSA2001**	**Credits**	**4**
Prerequisite:	Probability, statistics, algebra, matrix, calculus, Programming knowledge		

Course Objectives:

1. To understand the various characteristics of Intelligent agents
2. To learn about the different search strategies in AI
3. To learn to represent knowledge in solving AI problems
4. To understand the different ways of designing software agents and Prolog
5. To learn the Machine Learning Techniques

Course Outcomes (CO):

Students will be able to

CO1: Explain the capabilities, strengths and limitations of various artificial intelligence and machine learning techniques

CO2: Explain various AI and machine learning algorithms and their applications.

CO3: Describe learning models and algorithms.

CO4: Analyze and Design problems using various AI techniques

CO5: Apply selected AI and machine learning algorithms to solve real world problems 5 Understand complex ideas and relate them to specific situations, the ability to evaluate available learning methods and select those appropriate to solve a given task.

CO6: Understand the Prolog Programming.

Correlation of COs with Pos

CO\PO	CKL	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PKL		3	5	6	5	6	3	3	3	NA	M	3	M	3	3	2
CO1	3	3	2	1		3							1	3	2	
CO2	3	3	2	2		3							1	3	2	
CO3	3	3	2	3		3							1	3	2	
CO4	3	3	2	2		3							1	3	2	
CO5	3	3	2	1		3							1	3	2	
CO6	4	2	2	2		2							2	2	2	

CO	Topics to be discussed	L. Hrs.
CO1	**Introduction to AI** Introduction to AI, History and Background, Impact on Foundations of Engineering, Future Directions, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents.	**12**
CO2	**Problem Solving Methods & Knowledge Representation** Problem solving Methods, Search Strategies- Uninformed - Informed, Adversarial Search, Local Search Algorithms, Knowledge representation- Proposition and first order predicate logic, Prolog Programming.	**12**

CO3	**From Classical Statistics to Machine Learning** Probability Theory, Linear Algebra, Convex optimization, Statistical Decision Theory, Probability for ML-Probability, axioms of probability, random variables, common distributions, mean, variance, joint distributions, and conditional distributions. Data Representations, Feature Learning, and Applications	**12**
CO4	**Machine Learning Basics** Brief Introduction to Machine Learning, Supervised Learning, Unsupervised Learning and Reinforcement Learning, Perspectives and Issues in Machine Learning. Brief Introduction to Classification, Clustering, Linear Regression and applications, Overfitting & Underfitting, Hyper-parameters and Validation Sets, Estimators, Bias and Variance, Bayesian Statistics, the curse of dimensionality.	**12**
CO5	**CASE STUDIES** Transfer Learning - Learning from pre-trained models, NLP and its applications, Face detection, Sentiment Analyzer, Reinforcement applications.	**10**
	Guest Lecture on Contemporary Topics	**2**
	Total Lecture Hrs:	**60**

Mode of Teaching and Learning: Flipped Classroom, Activity Based Teaching/Learning, Digital/Computer based models, wherever possible to augment lecture for practice/tutorial and minimum2 hours lectures by industry experts on contemporary topics

Mode of Evaluation and assessment: The assessment and evaluation components may consist of unannounced open book examinations, quizzes, student's portfolio generation and assessment, and any other innovative assessment practices followed by faculty, in addition to the Continuous Assessment Tests and Term End Examinations.

List of Experiments: (Only for LP and LTP courses)

1.	Study of facts, objects, predicates and variables in PROLOG.
2.	Study of Rules and Unification in PROLOG.
3.	Study of "cut" and "fail" predicate in PROLOG.
4.	Study of arithmetic operators, simple input/output and compound goals in PROLOG.
5.	Study of recursion in PROLOG.
6.	Study of Lists in PROLOG.
7.	Study of dynamic databases in PROLOG.
8.	Study of string operations in PROLOG. Implement string operations like substring, stringposition, palindrome etc.)
9.	Write a prolog program to maintain the family tree.
10.	Write a prolog program to implement all set operations (Union, intersection, complement.
11.	Write a prolog program to implement the Library Management System.

Text Books: 1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009. 2. Ethem Alpaydin, Machine Learning: The New AI, MIT Press-2016.	
Reference Books:	
1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill. 2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education. 3. Bratko, Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011. 4. Stephen Marsland, Machine Learning – An algorithmic perspective, Second Edition, 5. Chapman and Hall/CRC Machine learning and Pattern Recognition Series, 2014.	
Recommendation by the Board of Studies on	**11.05.2022**
Approval by Academic council on:	**29.11.2022**
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Reviewed by:	**Dr. PRADEEP KUMAR MISHRA**