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CS031901 ***Artificial Intelligence*** **L-T-P-Cr: 3-0-2-4**

Pre-requisites: The students are expected to be fluent in basic linear algebra, probability, algorithms, and machine learning. Students are also expected to have programming and software engineering skills to work with data sets using Python, numpy, and sklearn.

Objectives/Overview:

- To introduce an overview of artificial intelligence (AI) principles and approaches
- To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.
- To introduce the concepts of decision-making theories.
- To introduce the role of machine learning in AI.

Course Outcomes – After completing this course, students should be able to:

CO-1. *Recall* problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.

CO-2. *Define* and *formulate* a given problem in the language/framework of different AI production rule methods and knowledge based system designing.

CO-3. *Design* and *develop* basic AI algorithms (e.g., standard search algorithms or dynamic programming) and performance *comparison* of the searching techniques.

CO-4. *Analyze* and design an empirical evaluation of different planning strategies on a problem formalization, and state the conclusions that the evaluation supports.

CO-5. *Distinguish* between the supervised, and unsupervised Machine learning techniques, uncertain knowledge and decision making problems.

CO-6. *Determine* an expert system with learning logical programming skills.

Course Outcomes–Cognitive Levels–Program Outcomes Matrix –

[H: High relation (3); M: Moderate relation (2); L: Low relation (1)]

Course Outcomes	Program Outcomes											
	PO-1 (Engineering knowledge)	PO-2 (Problem analysis)	PO-3 Design/development of solutions)	PO-4 (Conduct investigations of complex problems)	PO-5 (Modern tool usage)	PO-6 (The engineer and society)	PO-7 (Environment and sustainability	PO-8 (Ethics)	PO-9 Individual and team work)	PO-10 Communication)	PO-11 (Project management and finance)	PO-12 (Life-long learning)
CO-1	3	3	3	3	2	3			3	3	1	3
CO-2	3	3	3	3	2	3		1	3	3	1	3
CO-3	3	3	3	3	3	3			3	3	1	3
CO-4	3	3	3	3	2	3			3	3	1	3
CO-5	3	3	3	3	3	3	2	1	3	3	1	3
CO-6	3	3	2	1	3	1	1	1	3	3	2	2

UNIT I: Intelligent Agents **Lectures: 5**

Reactive, deliberative, goal-driven, utility-driven, and learning agents. Artificial Intelligence programming techniques.

UNIT II: Problem-solving through Search **Lectures: 5**

Forward and backward, state-space, blind, heuristic, problem-reduction, A*, AO*, local search, hill climbing algorithm, adversarial search and game playing, minimax algorithm, alpha-beta pruning, constraint satisfaction problem, sample applications.

UNIT III: Knowledge Representation and Reasoning **Lectures: 6**

ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications

UNIT IV: Planning **Lectures: 3**

Planning as search, partial order planning, construction and use of planning graphs

UNIT V: Representing and Reasoning with Uncertain Knowledge **Lectures: 5**

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

UNIT VI: Decision-Making **Lectures: 5**

Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

UNIT VII: Fuzzy Logic Systems **Lectures: 5**

Crisp sets, fuzzy sets, fuzzy logic control, fuzzy inference processing, fuzzy hedges, alpha cut threshold, neuro-fuzzy systems.

UNIT VIII: Artificial Immune Systems **Lectures: 5**

The phenomenon of immunity, immunity and infection, innate immune system, adaptive immune system, recognition, clonal selection, immune network theory, and mapping immune systems to practical applications.

UNIT IX: Expert Systems **Lectures: 3**

Representation using domain knowledge, expert system shells, explanation, knowledge acquisition, and case studies of expert systems.

Text/Reference Book:

1) *Artificial intelligence and intelligent systems* by N. P. Padhy, Published 2005 by Oxford University Press, Tom Mitchell, McGraw Hill, 1997
2) *Artificial Intelligence: A Modern Approach*, 3rd Edition, by Stuart Russell and Peter Norvig.
3) *Machine Learning*, Tom Mitchell, McGraw Hill, 1997.
4) *Artificial Intelligence,* 3rd Edition, by Elaine Rich, Kevin Knight, Shivashankar B Nair.