INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

APPLIED ARTIFICIAL INTELLIGENCE ALGORITHMS LABORATORY								
IV Semester: CSE (AI & ML)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACAD04	**Core**	0	0	2	1	40	60	100
Contact Classes: NIL	**Tutorial Classes: NIL**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Python Programming								

I. COURSE OVERVIEW:

Applied Artificial Intelligence (Applied AI) refers to the practical implementation and utilization artificial intelligence (AI) technologies to solve real-world problems and address specific challenges in various domains. The objective of this laboratory course for applied artificial intelligence (AI) typically aims to provide students with hands-on experience in applying AI techniques. Applications provide a foundation for the implementation of applied artificial intelligence across various industries, addressing specific challenges and delivering practical solutions the scope and applications of applied AI will vary based on the specific needs and challenges within different industries and sectors.

II. COURSES OBJECTIVES:

The students will try to learn:

I	The suitability of different search algorithms, unification strategies, and knowledge representation Techniques for given problems.
II	The practical applications of forward chaining in expert systems, decision support, and fundamental probability concepts essential for Bayesian inference.
III	The minimax algorithm as a basic approach for decision-making in two-player zero-sum games, Strategic considerations and algorithmic implementations clearly.
IV	The essential aspects of setting up AI environments, implementing local communication protocols and ensuring secure message verification in the context of AI agents

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO1	Develop programming skills by implementing algorithms related to local search, basic search, and unification through arithmetic design and coding.
CO2	Utilize coding techniques to model and solve problems in AI, emphasizing practical implementation of theoretical concepts.
CO3	Make use of the Bayesian network inference techniques to solve real-world problems in diverse domains, including healthcare, finance, and decision support.
CO4	Demonstrate a comprehensive understanding of fuzzy logic and its application in control systems.
CO5	Identify intelligent agents to address specific challenges in practical domains, demonstrating the versatility of AI techniques.
CO6	Solve techniques for encoding and decoding messages exchanged between AI agents, addressing considerations such as data serialization, compression, and encryption.

IV. COURSE CONTENT:

Week – 1: Local Search Technique-Hill climbing algorithm

Implement the Hill Climbing algorithm in Python for solving a simple optimization problem. Consider a function f(x) where x is a real-valued variable. The goal is to find the value of x that maximizes or minimizes the function. Provide a step-by-step explanation of your implementation and demonstrate its effectiveness on a specific function.

Week – 2: Unification

Implement a unification algorithm in Python and apply it to solve problems in natural language processing. Consider a scenario where you have a set of sentences with variables and constants, and the goal is to find a consistent assignment of values to variables that satisfies the given set of sentences.

Week – 3: Knowledge representation

Implement a resolution-based inference engine in Python for solving problems in knowledge representation and reasoning. Assume you have a knowledge base represented as a set of logical statements or rules, and the task is to infer new information using resolution.

Week – 4: Bayesian Network Inference

Implement a Bayesian Network inference algorithm for making predictions about the likelihood of diseases given observed symptoms. Use a standard inference method like Variable Elimination or Junction Tree.

Week – 5: Forward Chaining Algorithm

Develop a forward chaining algorithm that iteratively applies rules to the current set of facts in the Knowledge base, deducing new facts. Continue this process until no more new facts can be derived.

Week – 6: Game Playing Algorithm

Implement the Minimax algorithm along with Alpha-Beta Pruning for a simple two-player game. Demonstrate the effectiveness of these algorithms in optimizing the search process by comparing the number of nodes expanded with and without alpha-beta pruning.

Week – 7: Iterative deepening

Implement the iterative deepening mechanism, where the algorithm repeatedly performs depth-first searches with increasing depth limits until the goal node is reached.

Week – 8: Object Recognition

Implement a recognition algorithm that classifies the structural elements based on extracted features.
You may use machine learning classifiers or rule-based systems.

Week – 9: Fuzzy Control System

Develop a simulation environment that models the room's temperature dynamics and the user's preference
Changes over time.

Week – 10: AI Application-Early Image Processing

Implement a basic image enhancement technique, such as histogram equalization or contrast stretching.
Explain how this operation improves image quality.

Week – 11: AI Application-Object Recognition by Appearance

Implement a template matching algorithm to locate instances of the template in the sample image. You can use techniques like normalized cross-correlation.

Week – 12: AI Agents: Environment Setup

Implement an environment where agents can interact. This could be a grid-based world, a simulated environment, or any suitable scenario.

Week – 13: AI Agents-Local Communication protocol
Develop a local communication protocol that allows agents to exchange information with nearby agents. Consider message passing or shared memory approaches.

Week – 14: AI Agent-Message Verify
Implement a communication mechanism that allows agents to exchange information about the verification process. Agents may share their findings, challenges, and confidence levels.

V.TEXT BOOKS:

1. Stuart Russel,Peter Norving,"AI-A Modern Approach", Pearson Education, 2nd edition, 2007.
2. Chen G, "Introduction to Fuzzy sets, Fuzzy logic, and Fuzzy Control Systems", CRC Press LLC, 2001.

VI. REFERENCE BOOKS:

1. Dan W.patterson, "Introduction to AI and ES", Pearson Education, 2007.
2. Peter Jackson, "Introduction to Expert Systems", Pearson Education, 3rd edition, 2007.
3. Stuart Russel,Peter Norvig, "AI-A Modern Approach", Pearson Education, 2nd edition2007.
4. K Sudareswaran, "A Learner"s guide to Fuzzy logic systems", 2nd edition, 2020.
5. G.Luger,W.A. Stubblefield," Artificial Intelligence", Third Edition ,Addition-Wesley Longman,1998.
6. Sandipan dey"Hands-On Image Processing with Python", January 1st 2018.

VII. ELECTRONICS RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs52/preview
2. https://ece.iisc.ac.in/~parimal/2019/ml.html
3. https://www.geeksforgeeks.org/fuzzy-logic-introduction/
4. https://www2.eecs.berkeley.edu/
5. https://www.analyticsvidhya.com/blog/2018/12/guide-convolutional-neural-network-cnn/
6. https://cs.nyu.edu/~mohri/mlu11/

VIII. MATERIALS ONLINE

1. Course Template
2. Lab Manual