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

COURSE CONTENT

ARTIFICIAL INTELLIGENCE FOR AEROSPACE ENGINEERING								
V Semester: AE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AAED14	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		
Prerequisite: Nil								

I. COURSE OVERVIEW:

This course on Artificial Intelligence (AI) for Aerospace Engineering deals with the automation of the aircraft, drones, launch vehicles and other flight systems. In the sky, the big use of AI is for autonomous aircraft. Manufacturers building drones and small planes often spend a great deal of efforts on vision system, and employ AI in sensors and feedback systems that monitor data necessary for successful flight, including weather and air traffic control. The learner of this course will have gained the skills and knowledge necessary to apply AI on autonomous aircraft design using CAE and CAM techniques in solving engineering and manufacturing challenges, making well-prepared for a successful career in this dynamic and evolving field.

II. COURSE OBJECTIVES:

The students will try to learn:

1. The Artificial Intelligence and learn the methods of solving problems.
2. The range of AI algorithms and techniques for optimization, classification, clustering, and probabilistic reasoning, while understanding key concepts and distinctions in AI methodologies.
3. The Artificial Intelligence and learn the methods of searching techniques problems
4. Application in various situations using AI techniques in areas like Human-Machine Interaction, and Control Systems to solve industrial and engineering challenges.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1	Understand the foundation, history, and scope of Artificial Intelligence with Machine Learning concepts such as decision tree representation, basic decision tree learning algorithms.
CO 2	Apply various AI problem solving algorithms for optimization with probabilistic reasoning.
CO 3	Apply knowledge-based reasoning techniques and logical frameworks to build intelligent agents capable of making informed decisions and inferences.
CO 4	Apply first order logic inference mechanisms, including forward and backward chaining, to design logical agents capable of decision making in structured environment like the Wumpus World.
CO 5	Apply advanced learning techniques and probabilistic models in AI for analyzing, data, recognizing patterns.
CO 6	Apply AI techniques and models in Human-Machine interaction to address industrial and engineering problems.

IV. COURSE CONTENT:

Module – I: INTRODUCTION

Introduction–Definition – Foundation, History and scope of AI - Future of Artificial Intelligence –. Introduction to Machine Learning, Decision Tree Representation, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning.

Module – II: PROBLEM SOLVING METHODS: BASIC AI ALGORITHMS

Cost Function, Gradient Descent, Linear Regression, Logistic Regression, Bayes Theorem and Bayesian Learning, Maximum Likelihood and Least-Squared Error Hypothesis, Bayes Optimal Classifier, Naive Bayes Classifier, Learning to Classify Text, Bayesian Belief Network, K-Means clustering, EM Algorithm, Gaussian mixture model, Difference between Generative and Discriminative approaches

Module – III: LOGICAL AGENTS

Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving, Horn clauses and definite clauses, Reasoning with Horn Clauses, Syntax and Semantics of First-Order Logic, Propositional vs. First-Order Inference, Forward Chaining, Backward Chaining

Module – IV: PROBABILISTIC MODELS AND LEARNING TECHNIQUES IN AI

Latent Dirichlet Allocation, PCA, Hidden Markov model, Conditional Random Fields, Maximum-Entropy Markov Models, k-Nearest Neighbor, Support Vector machine, Reinforcement Learning.

Module – V: APPLICATIONS OF AI

Human Machine Interaction, Predictive Maintenance and Health Management, Fault Detection, Dynamic System Order Reduction, Image based part classification, Process Optimization, Material Inspection, AI practices in aerospace applications.

V. TEXT BOOKS:

5. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, ThirdEdition, 2009.
6. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi,2006.

VI. REFERENCE BOOKS:

7. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008.
8. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press,2009.
9. I. Bratko, "Prolog: Programming for Artificial Intelligence", Addison-Wesley Educational Publishers Inc., 4th Edition, 2011
10. Peter Jackson, "Introduction to Expert Systems", Pearson Education, 3rd Edition, 2007.

VII. ELECTRONICS RESOURCES:

11. https://nptel.ac.in/courses/112106286.
12. https://akanksha.iare.ac.in/index?route=course/details&course_id=33.
13. https://akanksha.iare.ac.in/index?route=course/details&course_id=31.
14. https://akanksha.iare.ac.in/index?route=course/details&course_id=1293.

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper - II
9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation