

Semester V

Course Code	Course Title	Credits	Lectures /Week
USCS501	Artificial Intelligence	2	3
<p>About the Course: This course provides an introduction to the field of Artificial Intelligence (AI) and explores various topics related to intelligent agents, problem-solving, knowledge representation, reasoning, machine learning, and probabilistic models. The course covers both theoretical concepts and practical applications of AI techniques. Students will gain a solid foundation in AI and develop the skills to design and implement intelligent systems.</p>			
<p>Course Objectives:</p> <ul style="list-style-type: none"> • Understand the foundations, history, and state of the art of AI. • Learn about intelligent agents, their environments, and the structure of agents. • Explore different problem-solving strategies, including uninformed and informed search techniques. • Gain knowledge of knowledge representation and reasoning methods, and apply them to solve complex problems. • Develop an understanding of machine learning techniques, including classification, regression, and ensemble learning. 			
<p>Learning Outcomes: After successful completion of this course, students would be able to</p> <ul style="list-style-type: none"> • Demonstrate knowledge of the foundations and key concepts in the field of AI. • Analyze and design intelligent agents for specific environments. • Apply problem-solving techniques and algorithms to find solutions to different types of problems. • Construct knowledge representation models and use reasoning techniques to derive new knowledge. • Implement machine-learning algorithms and evaluate their performance for classification and regression tasks. 			
Unit	Topics	No of Lectures	
I	<p>Introduction to AI and Intelligent Agents</p> <p>What Is AI: Foundations, History and State of the Art of AI</p> <p>Intelligent Agents: Agents and Environments, Nature of Environments, Structure of Agents.</p> <p>Problem Solving by searching: Problem-Solving Agents, Uninformed Search Strategies, Informed (Heuristic) Search Strategies</p>	15	
II	Knowledge Representation, Reasoning, and Machine Learning	15	

	<p>Knowledge Representation and Reasoning: Knowledge Representation and different forms, Reasoning, Planning, Uncertainty in Knowledge Fuzzy Logic & Fuzzification</p> <p>Machine Learning: Forms of Learning, Parametric & Non-Parametric Models, Classification, Regression, Regularization, Decision Trees, SVM, Artificial Neural Networks, Ensemble Learning, Boosting, K-NN, Gradient Descent</p>	
III	<p>Probabilistic Models, Unsupervised Learning, and Reinforcement Learning</p> <p>Probabilistic models: Statistical Learning, Learning with Complete Data, Naive Bayes Classifier, Learning with Hidden Variables: The EM Algorithm</p> <p>Unsupervised Learning: Concept of Unsupervised learning,, Association Rule Mining</p> <p>Reinforcement learning: Concept of Reinforcement learning, Q-Learning, Hidden Markov Model</p>	15
<p>Textbook(s):</p> <ol style="list-style-type: none"> 1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2010. <p>Additional Reference(s):</p> <ol style="list-style-type: none"> 1. Artificial Intelligence: Foundations of Computational Agents, David L Poole, Alan K. Mackworth, 2nd Edition, Cambridge University Press ,2017. 2. Artificial Intelligence, Kevin Knight and Elaine Rich, 3rd Edition, 2017 3) The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2013 		

Course Code	Course Title	Credits	Lectures /Week
USCSP501	Artificial Intelligence – Practical	1	3
1	Breadth First Search & Iterative Depth First Search <ul style="list-style-type: none"> • Implement the Breadth First Search algorithm to solve a given problem. • Implement the Iterative Depth First Search algorithm to solve the same problem. • Compare the performance and efficiency of both algorithms. 		
2	A* Search and Recursive Best-First Search <ul style="list-style-type: none"> • Implement the A* Search algorithm for solving a pathfinding problem. • Implement the Recursive Best-First Search algorithm for the same problem. • Compare the performance and effectiveness of both algorithms. 		
3	Decision Tree Learning <ul style="list-style-type: none"> • Implement the Decision Tree Learning algorithm to build a decision tree for a given dataset. • Evaluate the accuracy and effectiveness of the decision tree on test data. • Visualize and interpret the generated decision tree. 		
4	Feed Forward Backpropagation Neural Network <ul style="list-style-type: none"> • Implement the Feed Forward Backpropagation algorithm to train a neural network. • Use a given dataset to train the neural network for a specific task. • Evaluate the performance of the trained network on test data. 		
5	Support Vector Machines (SVM) <ul style="list-style-type: none"> • Implement the SVM algorithm for binary classification. • Train an SVM model using a given dataset and optimize its parameters. • Evaluate the performance of the SVM model on test data and analyze the results. 		
6	Adaboost Ensemble Learning <ul style="list-style-type: none"> • Implement the Adaboost algorithm to create an ensemble of weak classifiers. • Train the ensemble model on a given dataset and evaluate its performance. • Compare the results with individual weak classifiers. 		
7	Naive Bayes' Classifier <ul style="list-style-type: none"> • Implement the Naive Bayes' algorithm for classification. • Train a Naive Bayes' model using a given dataset and calculate class probabilities. • Evaluate the accuracy of the model on test data and analyze the results. 		
8	K-Nearest Neighbors (K-NN) <ul style="list-style-type: none"> • Implement the K-NN algorithm for classification or regression. • Apply the K-NN algorithm to a given dataset and predict the class or value for test data. • Evaluate the accuracy or error of the predictions and analyze the results. 		

9	<p>Association Rule Mining</p> <ul style="list-style-type: none">• Implement the Association Rule Mining algorithm (e.g., Apriori) to find frequent itemsets.• Generate association rules from the frequent itemsets and calculate their support and confidence.• Interpret and analyze the discovered association rules.
10	<p>Demo of OpenAI/TensorFlow Tools</p> <ul style="list-style-type: none">• Explore and experiment with OpenAI or TensorFlow tools and libraries.• Perform a demonstration or mini-project showcasing the capabilities of the tools.• Discuss and present the findings and potential applications.