

Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCSC513	Artificial Intelligence	3	1	0	4

#### Course Objective

Course will introduce the basic principles in artificial intelligence, which covers blind and heuristic search strategies, simple knowledge representation schemes, introduction to constraint satisfaction problem (CSP) and use for general purpose heuristic for constraint propagation, genetic algorithm, rule-based system. Introduction to probabilistic reasoning, planning and learning with neural network models, areas of application, natural language processing, etc. will be explored. The PROLOG programming language will also be introduced.

#### Learning Outcomes

Understanding of the following: Problem as Search - Converting real world problems into AI search problems and explain important search concepts, such as the difference between informed and uninformed search, the definitions of admissible and consistent heuristics and completeness and optimality.

Understanding of various heuristic search techniques, Minimax search for game playing. Constraint Satisfaction - Formulation of real-world problem as CSP problem and solution for CSP using general purpose heuristics, Genetic Algorithm for optimization. Knowledge representation using First order logic, proofs in first order using techniques such as resolution, unification. Rule based system and logic programming using Prolog programming language, Planning techniques, Bayesian network and reasoning Fundamentals of learning using neural net, decision tree, naïve- Bayes, nearest neighbor, inductive learning, Fundamentals of NLP.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Artificial Intelligence Introduction, Brief History, Intelligent Agents, Types of agents, Problem solving by search: Problem Formulation, Concept of state space, Search, Representation, Introduction to Uninformed Search Techniques: Breadth First Search, Depth First Search, Depth First Search with Iterative Deepening, Uniform Cost Search	5	Learning the various definitions of AI, key topics in AI, foundations of AI, and history of AI; Learning the concept of intelligent; Learning to formulate problem, solve problem using state space search, Learning various strategies of uninformed search
2	Introduction to Informed/Heuristic search techniques: Greedy Best First Search, A* search, AO* search, Hill Climbing search, Simulated Annealing search, Adversarial Search: Minimax algorithm, Alpha-Beta Pruning	6	Learning the concept of informed/ heuristic search, adversarial search, and representative algorithms
3	Introduction to Constraint Satisfaction Problem (CSP): Constraint Graph, Binary and Higher order CSP, Backtracking Search, MRV heuristic, Degree heuristic, Least Constraining-value heuristic, Forward Checking, Arc Consistency, Min-Conflicts Algorithm	5	Learning various techniques for constraint satisfaction problems
4	Introduction to Genetic Algorithm (GA), GA Operations: Selection, Crossover, Mutation	3	Learning various concepts in the context of genetic algorithm
5	Introduction to Knowledge Representation and Logic: Propositional Logic (PL) and Reasoning with PL, Concept of Forward and Backward chaining, First Order Logic (FOL) and Reasoning with FOL, Introduction to Prolog, Rule-based representations	7	Learning various logic representation techniques, forward and backward chaining, Learning Prolog

6	Introduction to planning problem, Planning as search, Forward Search, Backward Search, STRIPS Planning --- Goal Stack Planning, Partial Order Planning --- Constraint Posting	5	Learning to formulate planning problems, casting planning problems as search problems, various planning techniques in the context of AI.
7	Introduction to Probabilistic Reasoning, Probabilistic reasoning with Bayesian Network	3	Learning various probabilistic techniques including Bayesian network and reasoning.
8	Introduction to the concept of learning, Neural Network Models, Naive-Bayes, Nearest Neighbor, Decision trees, Inductive Learning	6	Understanding various techniques of learning using NN, Decision tree and other methods.
9	Introduction to Natural Language Processing	2	Learning various techniques in NLP.
Total		42	

#### Text Books:

1. **Artificial Intelligence A Modern Approach**, by S. Russell. Norvig, PHI, Third Edition

#### Reference Books:

1. **Artificial Intelligence** by Kevin Knight, Elaine Rich, Third Edition
2. **Artificial Intelligence, Structures and Strategies for Complex Problem Solving** by George F Luger, Sixth Edition, Pearson
3. **Machine Learning** by Mitchell, Tom M., Indian Edition