

# 22CS301 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Hours Per Week :

L	T	P	C
2	2	0	3



Source: <https://www.forbes.com/sites/bernardmarr/2020/08/03/3-important-ways-artificial-intelligence-will-transform-your-business-and-turbocharge-success/>

**PREREQUISITE KNOWLEDGE:** Probability and statistics.

## COURSE DESCRIPTION AND OBJECTIVES:

The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. In addition to this, student will understand the building blocks of AI such as search, knowledge representation, inference, logic and learning. This course enables the students to develop a small AI system for real time problems.

## MODULE-1

### UNIT-1

6L+6T+0P=12 Hours

#### INTELLIGENT SYSTEMS

Introduction, what is AI, Ethical implications & privacy issues of AI, Brief history of AI Agent, Agents and environments, Structure of agents, the concept of rationality, the nature of environments, Types of agents, Global and Local impact of AI on society.

### UNIT-2

10L+10T+0P=20 Hours

#### PROBLEM SOLVING

**State Space Problem; Searching:** Uniform search, Informed Search: Solving problems by searching: Heuristic functions, Hill climbing, Best First Search, A\* algorithm, AO\* algorithm, Searching game trees: Min Max Search, Alpha Beta pruning.

#### PRACTICES:

- In the classical vacuum cleaner problem, we have two rooms and one vacuum cleaner. There is dirt in both the rooms and it is to be cleaned. The vacuum cleaner is present in any one of these rooms. Find the solution, how we can reach to reach a state in which both the rooms are clean and are dust free.
- In this problem, three missionaries and three cannibals must cross a river using a boat which can carry at most two people, under the constraint that, for both banks, that the missionaries present on the bank cannot be outnumbered by cannibals. The boat cannot cross the river by itself with no people on board. Find the solution, how to solve the given problem.
- You are given two jugs, a 4-gallon one and a 3-gallon one, a pump which has unlimited water which you can use to fill the jug, and the ground on which water may be poured. Neither jug has any measuring markings on it. Find the solution, how can you get exactly 2 gallons of water in the 4-gallon jug?
- There is a farmer who wishes to cross a river but he is not alone. He also has a goat, a wolf, and a cabbage along with him. There is only one boat available which can support the farmer and either of the goat, wolf or the cabbage. So at a time, the boat can have only two objects (farmer and one other). But the problem is, if the goat and wolf are left alone (either in the boat or onshore), the wolf will eat the goat. Similarly, if the Goat and cabbage are left alone, then goat will eat the cabbage. The farmer wants to cross the river with all three of his belongings: goat, wolf, and cabbage. What strategy he should use to do so?
- Either place a block that doesn't have other blocks stacked on top of it on another block with the same behaviour, or on the table. The initial and the goal state are described by the exact position of each block. Find the solution, how to solve the given problem.

**SKILLS:**

- ✓ Analyze Intelligent systems.
- ✓ Apply problem solving techniques.
- ✓ Interface various knowledge representation.
- ✓ Create a dynamic planning.

- Given a 3×3 board with 8 tiles (every tile has one number from 1 to 8) and one empty space. The objective is to place the numbers on tiles to match the final configuration using the empty space. We can slide four adjacent (left, right, above, and below) tiles into the empty space. Find the solution, how to solve the given problem by using A\* search algorithm.
- The rules of tic-tac-toe on the 3×3 field are as follows. Before the first turn all the field cells are empty. The two players take turns placing their signs into empty cells (the first player places Xs, the second player places Os). The player who places Xs goes first, the another one goes second. Find the solution, how to solve the given problem where the winner is the player who first gets three of his signs in a row next to each other (horizontal, vertical or diagonal).
- In crypt arithmetic problem, the digits (0-9) get substituted by some possible alphabets or symbols. The task in crypt arithmetic problem is to substitute each digit with an alphabet to get the result arithmetically correct. Find the solution, how to solve the given problem, where we can perform all the arithmetic operations on a given crypt arithmetic problem.

**MODULE-2****UNIT-1****10L+10T+0P=20 hours****KNOWLEDGE REPRESENTATION AND PLANNING**

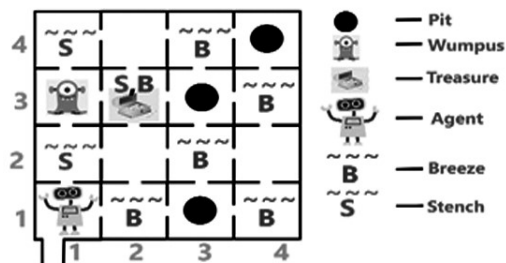
**Propositional logic:** Inference in propositional logic, Resolution, Forward chaining, Backward chaining, First order logic: Reasoning patterns in First order logic, Resolution, Forward chaining, Backward chaining, The planning problem: Planning with state space search, Partial order planning, Planning graphs.

**UNIT-2****6L+6T+0P=12 hours****LEARNING**

**Forms of learning:** Supervised Learning, Unsupervised learning, Reinforcement learning, Learning Decision Trees, Ensemble Learning, Expert system.

**PRACTICES:**

- With logic programming, compare expressions and find out unknown values.
- The Wumpus world is a cave with 16 rooms (4×4). Each room is connected to others through walkways (no rooms are connected diagonally). The knowledge-based agent starts from Room [1, 1]. The cave has – some pits, a treasure and a beast named Wumpus. The Wumpus cannot move but eats the one who enters its room. If the agent enters the pit, it gets stuck there. The goal of the agent is to take the treasure and come out of the cave. The agent is rewarded, when the goal conditions are met. The agent is penalized, when it falls into a pit or being eaten by the Wumpus. Some elements support the agent to explore the cave, like -The Wumpus's adjacent rooms are stench. -The agent is given one arrow which it can use to kill the Wumpus when facing it (Wumpus screams when it is killed). – The adjacent rooms of the room with pits are filled with breeze. -The treasure room is always glittery. Find the Wumpus presented room.



- you are on one side of a river with a wolf, a goat, and a cabbage. You want to transport all three to the other side of the river, but you can only transport one object at a time. You cannot leave the wolf and the goat alone, or the cabbage and the goat alone; you are the only thing keeping them from eating each other. How can you transport everything from one side of the river to the other? Formulate it in terms of a Planning Domain Definition Language (PDDL).

- Implement the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
- Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
- Implement k-nearest neighbors classification using python.
- Implement linear regression using python.
- Implement the naïve Bayesian classifier for a sample training dataset. Compute the accuracy of the classifier, considering few test data sets.

**COURSE OUTCOMES:**

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply AI search Models and Generic Search strategies for problem solving.	Apply	1	1,3
2	Inspect and analyze Logic for representing Knowledge and Reasoning of AI systems and Conduct investigation and implement project using AI learning techniques.	Analyze	1	2
3	Apply and evaluate the searching strategies to achieve the goal for a given situation..	Apply	2	6
4	Design different learning algorithms for improving the performance of AI systems.	Apply	2	4

**TEXT BOOK:**

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education, 2010.

**REFERENCE BOOKS:**

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press, 2013.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", 4th Edition, Pearson Education, 2008.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers. 2012.
4. Charles E. Harris, Jr., Michael S. Pritchard, Ray W. James, P.E., Elaine E. Englehardt, and Michael J. Rabins, "Engineering Ethics: Concepts and Cases", Cengage, Sixth Edition.