SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech III (Semester V)

Subject Name: Search Algorithms in Artificial Intelligence **Subject Code:** BTAI13501
Type of course: Professional Core course
Prerequisite (if any): Data Structures

Rationale: Search algorithms are one of the most important areas of Artificial Intelligence. This course aims to cover different categories of popular search algorithms and their characteristics which helps students in AI problem solving.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments / projects / open book tests / closed book tests) CA2: Sincerity in attending classes / class tests / timely submissions of assignments / self-learning attitude / solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work / Quality of work submitted / Active participation in lab sessions / viva on practical skills learned in course.

Contents:

Sr. No.	Contents	Total Hrs
1.	**Introduction to Artificial Intelligence –** Definition of AI, The foundations of AI, The History of AI, Intelligent Agents, Concept of Rationality, Task Environments, Types of Agents, Applications of AI	04
2.	**Problem Representation and Uninformed Search –** Defining a problem as state space search, Example problems: Water Jug Problem, 8-puzzle, 8-queens problem, Tower of Hanoi problem, Uninformed Search strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Criteria for comparing search algorithms	08
3.	**Heuristics Search Strategies-** Informed Search, Heuristic function, Greedy-Best-First Search, A* Search, Iterative-deepening A* , Recursive best-first search, memory-bounded A*, Heuristic function characteristics: Admissibility, consistency	08
4.	**Local Search Algorithms-** Hill-climbing search , limitation of hill climbing search :local and global maxima, Ridge, plateau, Types of hill climbing algorithms: stochastic hill climbing, Random-restart hill climbing, Simulated annealing, Local beam search, Genetic algorithms, AND-OR search	08

5.	**Adversarial Search-** Multiplayer game environments, zero-sum games, minimax tree (or game tree), the minimax-algorithm, Alpha-beta pruning, Expectimax Search, cutting-off search, quiescence search, horizon effect, forward pruning	**08**
6.	**Solving Constraint Satisfaction Problems-** Defining Constraint Satisfaction Problems, Example problems: Map coloring, Job-shop scheduling, Cryptarithmetic Problems, Constraint Propagation, local consistency, Node Consistency, Arc Consistency, Path Consistency, Global constraints, Sudoku example, Backtracking Search for CSPs, Variable and Value Ordering- minimum remaining heuristics, degree heuristics, least-constraining-value, forward checking**,** Maintaining Arc Consistency, chronological backtracking, backjumping, Tree-CSP-Solver algorithms, cycle cutset.	**09**

Suggested Specification table with Marks (Theory): (For B. Tech only)

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	15	30	5	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

Sr. No.	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**
1.	Artificial Intelligence: A Modern Approach (Third Edition)	Stuart J. Russell, Peter Norvig	Pearson
2.	Artificial Intelligence	Elaine Rich And Kevin Knight	Tata McGraw-Hill
3.	Artificial Intelligence: A New Synthesis	Nils J Nilsson	Morgan Kaufmann Publications

Note: Students should refer to the latest editions of books

Course Outcomes:

Sr. No.	**CO statements**	**Marks % weightage**
CO-1	Analyze the characteristics of any complex task environment and formulate the problem as state space search.	20%
CO-2	Apply different uninformed, heuristic search and local search techniques to solve various real time problems.	40%
CO-3	Understand adversarial search concepts and apply them in game playing programs.	15%
CO-4	Learn about constraints satisfaction problem solving concepts.	25%

List of Open learning website:

- NPTEL online course: Artificial Intelligence Search Methods For Problem Solving https://nptel.ac.in/courses/106106126
- NPTEL online course: Introduction to Artificial Intelligence https://nptel.ac.in/courses/106102220

List of Open Source Software:

- Python
- WEKA machine learning tool

List of Suggested Experiments:

1. Select a problem statement relevant to AI and formulate the problem and give PEAS description.
2. Write a Program to Implement Water-Jug problem
3. Write a Program to Implement Breadth First Search.
4. Write a Program to Implement Depth First Search.
5. Implement 8-puzzle using suitable a heuristic search technique.
8. Implement hill climbing Algorithm
9. Write a program to Implement A* Algorithm.
10. Write a program to Implement 4 Queen problem
11. Write a program to Implement Tower of Hanoi problem
12. Write a program to implement Tic-Tac Toe Game using mini-max algorithm
13. Implement map coloring problem using constraint propagation algorithms