SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech III (Semester VI)

Subject Name: Artificial Intelligence and Applications **Subject Code:** BTIT13602
Type of course: Professional Core Course
Prerequisite (if any): Data Structures, Discrete Mathematics

Rationale: This course of Artificial Intelligence and Applications is aimed to impart knowledge to develop intelligent systems and create algorithms capable of human-like solutions. This is achieved through the study of Search algorithms, knowledge representations, reasoning and logic programming, natural language processing etc.

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 AI :** Definition of AI, AI Problems, Task domain of AI – Mundane tasks, Formal tasks, Expert tasks; brief history of AI, Turing test, Ethics and Risks of developing AI based systems,	03
2.	**Problem Representation and State Space Search –** Defining a problem as state space search, Analyzing a Problem based on its characteristics; Example problems: Water Jug Problem, N-queens problem, 8-puzzle, Tic-Tac-Toe, Travelling Salesman Problem, Missionaries and Cannibals etc.; Production Systems	04
3.	**Search strategies:** Uninformed Search**:** Breadth-first search, Depth-first search, Heuristic function, Greedy-Best-First Search, A* Search, Hill-climbing search , limitation of hill climbing search :local and global maxima, Ridge, plateau, Simulated annealing, Local beam search, Problem reduction, AND-OR search, Means-Ends- Analysis, solving constraint satisfaction problems	07
4.	**Adversarial Search:** Overview, Multiplayer game environments, zero-sum games, minimax tree (or game tree), the minimax-algorithm, Alpha-beta pruning, Expectimax Search, cutting-off search, quiescence search	04

5.	**Knowledge Representation and Reasoning:** Knowledge representation - Issues and Approaches; Propositional logic, Inference and Deduction, Predicate logic, Unification, Resolution by refutation, Rule based systems, Forward Versus Backward Reasoning, Non-monotonic reasoning.	**04**
6.	**Prolog Programming:** Introduction, Syntax, Variables, Control Structures, Arithmetic Operators, representing facts and rules, matching in prolog, negation as failure, search strategy in prolog, backtracking, cut fail and repeat predicate, basic List manipulation operations	**04**
7.	**Probabilistic and Statistical Reasoning:** Acting under Uncertainty, The Basic Probability notation, inference using full joint distributions, Independence, Bayes' Rule and its Use, the semantics of Bayesian Networks, Conditional Independence, Markov blanket, Dempster-Shafer theory; Representing vagueness: Fuzzy sets, Membership function of fuzzy set, operations on fuzzy set, fuzzy inference system ; Applications in fuzzy logic: Design of fuzzy temperature controller, fuzzy washing machine	**06**
8.	**Expert Systems:** Representing and using domain knowledge, Expert system shells, explanation, knowledge Acquisition, Limitations of expert systems. Expert Systems case studies – MYCIN, CaDet (Cancer Decision Support Tool), DXplain (clinical support system)	**05**
9.	**Natural Language Processing:** Introduction, Steps in NLP: Morphological analysis, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing; Applications of NLP- AI based search engines, spell checking, machine translation, chatbots etc.	**04**
10.	**Common Sense Reasoning:** Representing Qualitative Information, Reasoning with Qualitative Information, Common Sense Ontologies, Memory Organization, Case based Reasoning	**04**

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	20	25	5	0	0

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.	Knowledge Representation and Reasoning	Ron Brachman and Hector Levesque	Morgan Kaufmann
2.	Artificial Intelligence: A Modern Approach	Stuart J. Russell, Peter Norvig	Pearson
3.	Artificial Intelligence	Elaine Rich And Kevin Knight	Tata McGraw-Hill

4.	Introduction to Artificial Intelligence and Expert Systems	Dan W. Patterson	PHI Learning
5.	Fuzzy Logic: An Introductory Course for Engineering Students	Enric Trillas, Luka Eciolaza	Springer
6.	Introduction to Turbo PROLOG	Carl Townsend	BPB Publications
7.	PROLOG Programming For Artificial Intelligence	Ivan Bratko	Addison-Wesley

Note: Students should refer to the latest editions of books

Course Outcomes:

Sr. No.	CO statements	Marks % weightage
CO-1	Analyse the characteristics of any complex problem formulate the problem as state space search.	10%
CO-2	Apply different uninformed, heuristic search and adversarial techniques to solve to various real time problems.	25%
CO-3	Examine knowledge representation issues, reasoning, formulate predicates-rules for real life problem solving	20%
CO-4	Apply reasoning approaches to handle uncertain knowledge	15%
CO-5	Demonstrate use rule based knowledge representation in developing Expert Systems	10%
CO-6	Ability to implement various list manipulation programs using Prolog	20%

List of Open learning website:

- NPTEL online course: An Introduction to Artificial Intelligence
  - (https://nptel.ac.in/courses/106102220)
- NPTEL online course: Artificial Intelligence: Introduction
  - (https://nptel.ac.in/courses/106106126)

List of Open Source Software:

- Python NLTK
- Prolog
- WEKA

List of Suggested Experiments:

1 Implement the Water Jug Problem.
2 Write a program to implement BFS (for 8 puzzle problem or Water Jug problem or any AI search

problem).

3 Write a program to implement DFS (for 8 puzzle problem or Water Jug problem or any AI search problem)
4 Write a program to Implement A* Algorithm
5 Write a program to implement a single player game (using a rule based system)
6 Write a Program to implement a two player game (using adversarial search)
7 Write Prolog Program to Explore basic Prolog syntax and structure.
8 Write Prolog Program to Explore operators and input output.
9 Write a Prolog Program to Explore Cut, Fail and Repeat predicates.
10 Write a PROLOG program for defining various facts about kinship relations
11 Write prolog programs for following list operations
   (a) Check the membership of an item in a given list.
   (b) Find the size of a list
   (c) Find the nth element of a given list.
   (d) Find the last element of a given list.
   (e) Delete an element in a given list.
   (f) Append two given lists.
   (g) Reverse a given list.
12 Write a program to implement an expert system for medical diagnosis.
13 Explore NLTK and write program to demonstrate basic NLTK functions.
14 Implement a Bayesian Classifier for the given dataset. (WEKA)
15 Design and simulate a Fuzzy temperature controller