GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Computer Engineering
Subject Code: 3170716
Semester – VII
Subject Name: Artificial Intelligence

Type of course: Regular

Prerequisite: Data Structures, Mathematics

Rationale: With the usage of Internet and World Wide Web increasing day by day, the field of AI and its techniques are being used in many areas which directly affect human life. Various techniques for encoding knowledge in computer systems such as Predicate Logic, Production rules, Semantic networks find application in real world problems. The fields of AI such as Game Playing, Natural Language Processing, and Connectionist Models are also important. Student should know some programming language for AI.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Contents:

Sr. No.	Content	Total Hrs
1	**Introduction :** The AI Problems, The Underlying Assumption, AI techniques, The Level of The Model, Criteria For Success	2
2	**Problems, State Space Search & Heuristic Search Techniques:** Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics and Issues in the Design of Search Programs, Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	6
3	**Knowledge Representation:** Representations And Mappings, Approaches To Knowledge Representation, Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions and Predicates, Resolution, Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning.	7
4	**Symbolic Reasoning Under Uncertainty:** Introduction To Nonmonotonic Reasoning, Logics For Non-monotonic Reasoning.	2
5	**Probabilistic Reasoning:** Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic	3
6	**Game Playing:** Overview, MiniMax Search Procedure, Alpha-Beta Cut-offs, Refinements, Iterative deepening.	2
7	**Planning:** The Blocks World, Components Of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems	3
8	**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking	3

9	**Connectionist Models:** Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.	4
10	**Expert Systems:** Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.	2
11	**Genetic Algorithms:** A Peek into the Biological World, Genetic Algorithms (GAs), Significance of the Genetic Operators, Termination Parameters.	4
12	**Introduction to Prolog:** Introduction, Converting English to Prolog Facts and Rules, Goals, Prolog Terminology, Variables, Control Structures, Arithmetic Operators, Matching in Prolog, Backtracking, Cuts, Recursion, Lists.	4

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**20**	**10**	**05**	**05**

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. "Artificial Intelligence" -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
2. "Artificial Intelligence: A Modern Approach" -By Stuart Russel, Peter Norvig, PHI
3. "Introduction to Prolog Programming" -By Carl Townsend.
4. "PROLOG Programming For Artificial Intelligence" -By Ivan Bratko(Addison-Wesley)
5. "Programming with PROLOG" –By Klocksin and Mellish.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the search technique procedures applied to real world problems	25
CO-2	Understand and use various types of logic and knowledge representation schemes.	30
CO-3	Understand various Game Playing techniques and apply them in programs.	15
CO-4	Gain knowledge in AI Applications and advances in Artificial Intelligence	20
CO-5	Use Prolog Programming language using predicate logic	10

Sample List of Experiments:

1. Write a program to implement Tic-Tac-Toe game 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 Single Player Game (Using any Heuristic Function)
5. Write a program to Implement A* Algorithm.
6. Write a program to implement mini-max algorithm for any game development.
7. Assume given a set of facts of the form father(name1,name2) (name1 is the father of name2).
8. Define a predicate brother(X,Y) which holds iff X and Y are brothers.

Define a predicate cousin(X,Y) which holds iff X and Y are cousins.
Define a predicate grandson(X,Y) which holds iff X is a grandson of Y.
Define a predicate descendent(X,Y) which holds iff X is a descendent of Y.
Consider the following genealogical tree:

```
father(a,b).
father(a,c).
father(b,d).
father(b,e).
father(c,f).
```

Say which answers, and in which order, are generated by your definitions for the following queries in Prolog:

```
?- brother(X,Y).
?- cousin(X,Y).
?- grandson(X,Y).
?- descendent(X,Y).
```

9. Write a program to solve Tower of Hanoi problem using Prolog.
10. Write a program to solve N-Queens problem using Prolog.
11. Write a program to solve 8 puzzle problem using Prolog.
12. Write a program to solve travelling salesman problem using Prolog.

List of Open Source Software/learning website:

https://nptel.ac.in/courses/106/105/106105077/
http://www.journals.elsevier.com/artificial-intelligence/