GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3734106
Semester – III
Subject Name: Artificial Intelligence

Type of course: Professional Elective Course

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	0	3	70	30	0	0	100

Sr. No.	Content	Total Hrs	% Weightage
1	**UNIT 1** What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word 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, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	7	16%
2	**UNIT 2** Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.	10	25%
3	**UNIT 3** Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory	7	17%
4	**UNIT 4** Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames.	6	10%

	Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC		
5	**UNIT 5** Game Playing: Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction	8	15%
6	**UNIT 6** Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.	8	17%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	20	10	10	10

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

Reference Books:

- Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
- Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
1	Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues	30%
2	Identify problems that are amenable to solution by AI methods.	25%
3	Understanding reasoning and fuzzy logic for artificial intelligence	20%
4	Understanding game playing and natural language processing.	25%

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 Heuristic Function)
5. Write a program to Implement A* Algorithm.
6. Write a program to solve N-Queens problem using Prolog.
7. Write a program to solve 8 puzzle problem using Prolog.
8. Write a program to solve travelling salesman problem using Prolog.
9. Convert following Prolog predicates into Semantic Net

```
cat(tom).
cat(cat1).
mat(mat1).
sat_on(cat1,mat1).
bird(bird1).
caught(tom,bird1).
like(X,cream) :– cat(X).
mammal(X) :– cat(X).
has(X,fur) :– mammal(X).
animal(X) :– mammal(X).
animal(X) :– bird(X).
owns(john,tom).
is_coloured(tom,ginger).
```

10. Write the Conceptual Dependency for following statements.
    (a) John gives Mary a book
    (b) John gave Mary the book yesterday

Major Equipment:

Computational lab or facility with the following software or their equivalent:

1. MATLAB
2. Python
3. Prolog Language

List of Open Source Software/learning website:

1. NPTEL Video lectures
2. http://www.journals.elsevier.com/artificial-intelligence/