GUJARAT TECHNOLOGICAL UNIVERSITY

COMPUTER ENGINEERING/INFORMATION TECHNOLOGY
ARTIFICIAL INTELLIGENCE
SUBJECT CODE: 2180703
SEMESTER: 8

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)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content

Sr No	Course Contents	Teaching hours	Weightage
1	**What is AI? :** The AI Problems, The Underlying Assumption, What Is An AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word.	2	4
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, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.	5	10
3	**Knowledge Representation Issues :** Representations And Mappings, Approaches To Knowledge Representation.	3	5
4	**Using Predicate Logic :** Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution.	4	8

5	**Representing Knowledge Using Rules :** Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.	4	8
6	**Symbolic Reasoning Under Uncertainty :** Introduction To Non-monotonic Reasoning, Logics For Non-monotonic Reasoning.	4	8
7	**Statistical Reasoning :** Probability And Bays' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic.	3	5
8	**Weak Slot-and-Filler Structures :** Semantic Nets, Frames.	3	5
9	**Strong Slot-and-Filler Structures :** Conceptual Dependency, Scripts, CYC	3	5
10	**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.	6	12
11	**Understanding:** What is understanding? , What makes it hard?, As constraint satisfaction	2	4
12	**Natural Language Processing :** Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking	5	8
13	**Connectionist Models :** Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.	4	6
14	**Introduction to Prolog :** Introduction To Prolog: Syntax and Numeric Function, Basic List Manipulation Functions In Prolog, Functions, Predicates and Conditional, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays, Miscellaneous Topics, LISP and Other AI Programming Languages.	8	12

Reference Books:

1 "Artificial Intelligence" -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill
2. Artificial Intelligence: A Modern Approach, 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 Outcome:

After learning the course the students should be able to

- Understand various search methods
- Use various knowledge representation methods
- Understand various Game Playing techniques
- Use Prolog Programming language using predicate logic

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

Open Ended Problems:

1. Describe major subfields and paradigms of AI.
2. What are the major challenges in the field of AI?
3. How AI can be used to develop a better search Engine?

Major Equipments: Computer/Prolog Language

List of Open Source Software/learning website:

1. http://www.journals.elsevier.com/artificial-intelligence/
2. https://www.technologyreview.com/s/534871/our-fear-of-artificial-intelligence/
3. http://www.sanfoundry.com/artificial-intelligence-mcqs-inductive-logic-unification-lifting-1/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides: which include videos, animations, pictures, graphics for better understanding theory and practical work. The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus can be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.