GUJARAT TECHNOLOGICAL UNIVERSITY

INTRODUCTION TO ARTIFICIAL INTELLIGENCE
SUBJECT CODE: 2720510
SEMESTER: II

Type of course: Open Elective

Prerequisite: Data structure and algorithm (primitive, non-primitive, linear data structure (stack, queue, linked list, nonlinear data structure (tree, graph), hashing, File structure)

Rationale: How to provide intelligence to a machine is the subject matter. It consists of various game playing algorithms which involves huge search space. How effectively we use the methods so as to cut down the large search space. With various techniques like Machine Learning, Inference Logic, Soft computing techniques such as Fuzzy Logic, Genetic Algorithms, Neural Networks etc., one can find the optimal solution of varieties of Problems where search space is very high. This course enables to understand, analyze and apply such techniques for various applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Introduction:** What is artificial Intelligence? Major areas of Artificial Intelligence, Introduction to AI Problems and applications, Defining problems as a state space search, Production systems.	3	7.5
2	**Search techniques:** Breadth first search, Depth first search, Hill climbing, Best first search, A* algorithm, AO* Algorithm, Iterative Deepening Search, IDA*, Recursive Best First Search, Constraint Satisfaction and Heuristic Repair, Applications.	6	15
3	**Game Playing:** Introduction to Game playing, The Minimax Search Procedure, Alpha-Beta Procedure, The Search Efficiency of Alpha-Beta Procedure, Recent applications.	4	10
4	**Knowledge Representation:** Production rules, Predicate Calculus- Rules of Inference; Semantics and Deduction; Unification; Soundness and completeness of rules; Resolution; Resolution refutation, Semantic Nets, Frames, symbolic reasoning, statistical reasoning	4	10
5	**Learning:** Definition, Rote learning, learning by taking advice, learning in problem solving, learning from examples, induction	3	7.5
6	**Uncertain Reasoning:** Joint probability, Marginal probability, Probabilistic reasoning and	6	15

	Bayes Nets, forward reasoning versus backward reasoning, Certainty Factors, Fuzzy set theory, Fuzzy relation, fuzzification, Fuzzy value assignment methods, Inference and Composition methods- Min-Max composition, max product composition, Defuzzification methods, Applications and recent developments		
7	**Statistical Methods:** Frequency distributions, Data analysis, Expectations and moments, Co-relation and regression, Trend analysis, Seasonal effects, Cyclical fluctuation, Moving average, MSE, Predictions	3	7.5
8	**Expert Systems (ES):** Advantages and characteristics of Expert System, Knowledge engineering, Steps in Developing an Expert System, Mycin, ES Applications and recent developments.	4	10
9	**Connectionist Models:** Introduction to Neural Network, Activation functions, Supervised and Unsupervised Learning, Neuro Processing and Neural Network Learning, Learning, Learning rules, Single layer Perceptrons and Classification, Introduction to Multilayer Neural Networks, Neural Network Applications and recent developments.	6	15

Reference Books:
1) E. Rich, K. Knight, Artificial Intelligence, TMH.
2) N. J. Nilsson, Artificial Intelligence: A New Synthesis, Harcourt Publishers.
3) Tomthy Ross, Fuzzy Logic and Engineering Application, McGraw Hill International.
4) Giarratano, Expert System Principles and Programming.
5) Kishan Mehrotra, Elements of Artificial Neural Network.
6) E. Goldberg, Genetic Algorithms: Search and Optimization.
7) J. M. Jurada, Neural Networks.

Course Outcome:
After learning the course the students should be able to
1) Understand AI Problems and Apply Various Techniques for Engineering Problem Solving.
2) Solve Game Playing Problems.
3) Design Artificial Neural Network.
4) Understand how Expert System is designed and how Knowledge Engineering works.
5) Apply Fuzzy Logic for Problem Solving.
6) Apply Semantic Rules for reasoning and inference.
7) Apply Various Algorithms like Breadth First Search, Depth First Search, A*, Heuristic Search for various Applications

List of Experiments and Open Ended Problems:

1. Write a PROLOG program that list four addresses in a label form, each address should list a name, one-line address, city, state &ZIP code.

2. WAP to Create Database for Hobbies of Different Person.

3. Write a PROLOG program for diagnosis the childhood diseases.

4. Write a PROLOG program for Family Relationship.

5. To implement Breadth first search (BFS).

6. To implement Depth first search (DFS).

7. Write a PROLOG program Checking for Password.

    A) Give an opportunity to user to re-enter the password 'n' no. Of Times, on entering wrong password.

    B) Give an opportunity to user to re-enter the password three (03) Times, on entering wrong password.

8. Write a PROLOG program to implement Tower Of Hanoi Problem.

9. Write a PROLOG program to calculate the roots of quadratic equation Consider all possibilities real, equal, imaginary.

10. Write a PROLOG program for finding the average salary of an employee and for adding and deleting employees from the database.

11. Write a PROLOG program to solve Water-Jug Problem.

12. Write a PROLOG program to demonstrate the effective use of Cut and Fail.

13. Write a PROLOG program for Traveling Salesman Problem.

14. Write a PROLOG program for Monkey Banana Problem.

15. Write a PROLOG program N-QUEEN problem.

16. Write a PROLOG program based on list:-

    A) To find the length of a list.

    B) To find whether given element is a member of a list.

    C) To Append the list.

    D) To Reverse the list.

    E) To find the last element of a list.

    F) To delete the first occurrence of an element from a list.

17. Write a PROLOG program for Arithmetic Operations.

    A) To add the member of a given list.

    B) To check if a given year is a Leap Year or not.

    C) To find the Greatest Common Divisor.

    D) To find the Least Common Divisor.

    E) To find the factorial of a given number.

    F) To generate the Fibonacci series of a given number.

G) To convert an integer number into a string of equivalents binary

18. To simulate a multilayer Perceptron Network for XOR gate

Major Equipments: Desktop/Laptop & PROLOG language compiler

List of Open Source Software/learning website:

1) **www.nptel.ac.in**
2) **http://www.inf.ed.ac.uk/teaching/courses/aipp/material/aipp_coursenotes.pdf**

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.