GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Semester: V
Subject Name: Fundamentals of Artificial Intelligence
Subject Code: 3154202

Type of course: Professional Core
Prerequisite: Data Structure & Algorithms
Rationale:

Artificial Intelligence is nowadays used in nontechnical and technical fields.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. In every branch of engineering, AI has been used to make systems more effective and dynamic. This course of Fundamentals of Artificial Intelligence is aimed to provide exposure about the fundamentals of AI techniques that will create knowledge base to pursue next level of courses in the Engineering branch of Artificial Intelligence & Machine Learning.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Contents:

Sr. No.	Content	Total Hrs
1	**Introduction: (**Scope of the Course) Introduction to AI, foundation of AI and history of AI intelligence, Applications of AI, Agents: Agents and Environments, the concept of rationality, the nature of environments, and structure of agents.	**04**
2	**Searching & Game Playing**: Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions**.**	**08**
3	**Knowledge Representation & Reasoning:** Knowledge Representations and Mappings, Approaches To Knowledge Representation, Representing Knowledge using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning. Symbolic Reasoning Under Uncertainty and Statistical Reasoning: Introduction to Non-Monotonic Reasoning, Logics for Nonmonotonic Reasoning Statistical Reasoning: Probability	**10**

	and Bays' Theorem, Certainty Factors and Rule- Base Systems, Bayesian Networks, Dempster-Shafer Theory.	
4	**Fuzzy Logic:** Introduction, Conventional set vs Fuzzy set, Operations of fuzzy set, Membership function, Fuzzy rules, Fuzzy inference, De-fuzzification, Application for control.	**08**
5	**Basics of Machine Learning:** Introduction, Types of Learning (supervised learning, unsupervised learning, and reinforcement learning), Hypothesis Space, Inductive Bias, Evaluation and Cross Validation, Linear Regression, Decision Trees, Learning Decision Trees, K-nearest Neighbour, Collaborative Filtering, Over-fitting, Methods to remove over-fitting problem	**09**
6	**Artificial Neural Networks:** Biological Neurons and Biological Neural Networks, Artificial Neural Networks, Activation Functions, Perceptron NN, Multilayer Perceptron NN, Back-propagation Neural Networks, Training Methods.	**08**
7	**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse and Pragmatic Processing, Text Analytics, Text pre-processing, Bag of Words, Word Cloud, Machine Translation, sentiment analysis.	**05**

Reference Books:

1. Artificial Intelligence -By Elaine Rich and Kevin Knight (2nd Edition) Tata Mcgraw-Hill.
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence 3e: A Modern Approach, 3rd Edition. Person
3. Machine Learning with Python for Everyone, Mark Fenner, Pearson
4. Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
5. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
6. Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications By S. Rajshekharan, G. A. Vijayalakshmi Pai, PHI
7. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International
8. Tom Mitchell, Machine Learning, TMH
9. AthemEalpaydin, Introduction to Machine Learning, PHI
10. Andries P. Engelbrecht, Computational Intelligence - An Introduction, Wiley Publication

Course Outcomes:

Sr. No	CO Statement	Marks % weightage
CO 1	Describe the concept, scope and application of AI.	10%
CO 2	Compare and contrast various the search technique procedures.	20%
CO 3	Illustrate various knowledge representation schemes.	20%
CO 4	Describe fundamentals of fuzzy systems.	15%
CO 5	Interpret and summarize various techniques of Machine Learning and Neural Networks.	25%
CO 6	Discuss basics of natural language processing.	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 A* Algorithm.
5. Write a program to implement mini-max algorithm for any game development.
6. Assume given a set of facts of the form father (name1, name2) (name1 is the father of name2).

   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).

7. Write a program to solve travelling salesman problem.
8. Implement a program for matching two strings using fuzzy logic in Python.
9. Write a program to implement linear regression in python.
10. Write a program to implement K-nearest Neighbour algorithm.
11. Write a program of Perceptron Training Algorithm.

12. Write a program for Back Propagation Algorithm.
13. Implement the program for text pre-processing in python.
14. Write a program to create word cloud using Python.
15. Write a program to demonstrate sentiment analysis in python.

List of Online Courses & Websites for materials:

1. https://nptel.ac.in/courses/106105077
2. https://www.coursera.org/learn/introduction-to-ai#about
3. https://ai.google/education/
4. https://www.javatpoint.com/artificial-intelligence-tutorial
5. https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/
6. https://www.tutorialspoint.com/artificial_intelligence/index.htm