& Code		course			criteria	of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Machine Intelligence (INGE7C)	04	02	-	02	Course admission eligibility	Basics of statistics

Learning Objectives

The Learning Objectives of this course are as follows:

- To apply machine intelligence techniques in applications which involve perception,
- reasoning and learning.
- To acquire knowledge of real-world knowledge representation
- To use different machine learning techniques to design AI machine and enveloping
- applications for real world problems.

Learning Outcomes

After successful completion of the course, students will be able to:

- Apply machine intelligence techniques in applications which involve perception,
- reasoning and learning
- Acquire knowledge of real-world knowledge representation
- Use different machine learning techniques to design AI machines and enveloping applications for real world problems.

SYLLABUS OF GE

UNIT – I **(8 hours)**

Components of AI, Human Intelligence vs. Machine Intelligence, Knowledge Acquisition, Representation and Organization, Structured Knowledge Representation using Semantic Networks and Frames, Expert System , and Functions of Expert Systems.

UNIT – II **(8 hours)**

Structure and Function of a Single Neuron, Artificial Neuron Models, Types of Activation Functions, Neural Network Architectures, Neural Learning, Supervised Learning, Unsupervised Learning and Application Areas of Neural Networks.

UNIT – III **(8 hours)**

Introduction to Fuzzy Logic, Fuzzy Sets and Systems, Membership Functions and Fuzzification, Knowledge and Rule-Based Systems, Decision-Making Logic and Inference Systems, Defuzzification and Applications of Fuzzy Logic.

UNIT – IV **(8 hours)**

Genetic Algorithm (GA) Concepts, GA Operators and Techniques, Applications of Genetic Algorithms and Hybrid Systems.

Practical component: **(60 hours)**

1. Simulate simple AI components like perception (input gathering), learning (pattern recognition), and reasoning (decision making).
2. Build a decision tree for a simple classification task. Implement depth-first search (DFS) to explore the tree.
3. Use a dataset to implement a basic machine learning model (e.g., k-NN or Decision Tree) that simulates human-like decision-making.
4. Compare the results of a machine learning model (e.g., classification) with human decisions on the same dataset, and analyze the differences.
5. Implement an expert system with a knowledge base for medical diagnosis. Simulate decision-making based on user inputs.
6. Create a semantic network and frames to represent and query knowledge. Visualize relationships between concepts.
7. Develop a basic expert system, focusing on constructing the knowledge base and implementing a simple inference engine.
8. Implement forward and backward chaining inference methods to derive conclusions from a knowledge base.
9. Implement a rule-based fuzzy logic expert system for decision-making, such as diagnosing conditions based on input parameters.
10. Create a model of a single artificial neuron, focusing on inputs, weights, and activation functions (e.g., Sigmoid).
11. Implement and visualize common activation functions (Sigmoid, ReLU, Tanh). Compare their output behaviors.
12. Build and simulate a basic feedforward neural network. Implement simple tasks like classification.
13. Train a neural network using the backpropagation algorithm. Use it to classify a simple dataset.
14. Implement basic fuzzy logic operators (AND, OR, NOT), applying them to sample fuzzy sets and visualizing the results.
15. Implement a genetic algorithm (GA) to solve an optimization problem, such as function maximization or finding optimal parameters for a model.

Essential/recommended readings

1. Timothy J. Ross, Fuzzy logic with Engineering Applications , McGraw Hill, New York, 4th Edition (2016),**Published by** Wiley
2. S. Rajasekaran, G. A. VijayalakshmiPai Neural Networks, Fuzzy Logic And Genetic, 2017, Published by PHI Learning.

Suggestive readings

1. Algorithm: Synthesis and Applications, PHI Learning Pvt. Ltd., 2003, 1st Edition.
2. Martin T. Hagan, Howard B. Demuth, Mark H. Beale, Neural Network Design,PWS Publishing Company, Thomson Learning, 1st Edition 4. N.P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press, 1st Edition

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time

GENERIC ELECTIVE COURSE-: Robotics (INGE8A)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Robotics (INGE8A)	04	02	-	02	Course admission eligibility	Basic programming.

Learning Objectives

The Learning Objectives of this course are as follows:

- After completion of this course students should be well versed in programming a microcontroller.
- They should be able to use various sensors and make the microcontroller respond to the external environment.
- Students would be in a position to make a rudimentary robot which is capable of moving along a predetermined path, follow a drawn line and equivalent applications.

Learning Outcomes

After successful completion of the course, students will be able to:

- Understand the history, concepts and key components of robotics technologies.
- Understand the control systems related to robotics.
- Analyze of various robot sensors, Actuators and their perception principles that enable a robot to analyses their environment