

PEI104: INTELLIGENT TECHNIQUES AND APPLICATIONS

L	T	P	Cr
3	1	2	4.5

Course objective: To understand the concepts of Artificial Intelligence and Expert Systems, to enable to design Intelligent Controls

Overview of Intelligent techniques: Intelligent techniques, Concept of artificial intelligence.

Artificial Neural Networks: Artificial Neuron models, Types of activation functions, Neural network architectures, Neural Learning: Correlation, Competitive, Feedback based weight adaptation, Evaluation of networks, Quality of results, Generalizability, Computational resources, Supervised learning: Perceptrons, linear separability, Multilayer networks, Back propagation algorithm and its variants, Unsupervised learning, Winner–take all networks, Adaptive resonance theory, Self organizing maps, Hopfield networks, Boltzmann machines, Support Vector Machine, Typical application in identification, Optimization, Pattern recognition. Applications of ANN in Process control, Robotics and other industrial control methods.

Fuzzy Logic: Fuzziness vs probability, Crisp logic vs fuzzy logic, Fuzzy sets and systems, Operations on sets, Fuzzy relations, Membership functions, Fuzzy rule generation, De fuzzy controllers, Type–2 Fuzzy Logic Controllers, Multi–layer and other advanced Fuzzy Logic Models, Applications of Fuzzy Logic. Applications in Process control, Robotics and other industrial control methods.

Evolutionary Computation: Introduction to optimization problem, constraints, objective functions, unimodal/ multimodal problems, classical techniques/evolutionary computational techniques Genetic Algorithms and its Operators, variants of Genetic Algorithm and its use in Engineering Process Control.

Expert Systems: General Concepts of Expert System, basic building block of expert systems, knowledge base concepts, rule based expert system, computerized expert systems, industrial applications of expert systems.

Laboratory work: Experiments around Input and output using Fuzzy logic, Graphical analysis of various control systems using Fuzzy logic, Dynamical and optimal training for neural networks, Algorithms around GA.

Course learning outcome (CLO): After the completion of the course the students will be able to

1. Apply artificial intelligence and expert system concepts to control process.
2. Use of evolutionary computation algorithm to solve engineering problems.
3. Acquire knowledge about hybrid search techniques.
4. Apply intelligent techniques in process control, robotics and industrial control systems.

Recommended Books:

1. Narayana, Y., *Artificial Neural Networks, Prentice–Hall of India (1999)*.
2. Rich, E., and Knight, K., *Artificial intelligence, McGraw Hill (1991) 2nd ed.*

3. Ross, J. T., *Fuzzy Logic with Engineering Applications*, John Wiley (2004) 2nd ed.

Evaluation Scheme:

Evaluation Elements	Weightage (%)
MST	25
EST	40
Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	35