

PEI104: INTELLIGENT CONTROL TECHNIQUES AND APPLICATION

L	T	P	Cr
3	0	2	4.0

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

Overview of Intelligent control techniques and Expert Systems: Intelligent control techniques, Concept of artificial intelligence, General Concepts of Expert System

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, unimodel/ multimodel problems, classical techniques/evolutionary computational techniques Genetic Algorithms and its Operators, variants of Genetic Algorithm and its use in Engineering Process Control.

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.

Minor Project:

1. Case studies related to application of artificial intelligence to process control.
2. Application of neural network to pattern recognition and classification.
3. Application of fuzzy logic to pattern recognition and classification.
4. Application of fuzzy logic to process control.
5. Application of ANN/ fuzzy logic techniques to system identification and control.
6. Application of evolutionary algorithms to controller design.

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

1. Apply artificial intelligence and expert system concepts.
2. Apply fuzzy logic control to process.
3. Use evolutionary computation applications.
4. Acquire knowledge about hybrid techniques
5. 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:

S.No	Evaluation Elements	Weightage (%)
1.	MST	25
	EST	40
	Sessionals (May include Assignments/ Projects/ Tutorials/ Quizes/ Lab Evaluations)	35