

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>ME I Year Electronics (Sp. Digital Instrumentation) Semester- A</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>DIR1E1:Fuzzy Logic and Neural Network</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>
<b>Duration of Theory Paper: 3 Hours</b>							

### COURSE CONTENT

#### Unit I

**Introduction to Neural Networks:** Mathematical models of a Neuron, Network Architectures, Perceptron and MLP, Back-Propagation Algorithm, Characterizing Neural Network Architectures, Learning in Artificial Neural Networks; Supervised, Unsupervised and Competitive Learning paradigms; Learning rules and Functions, Hebbian Learning, Associative Memories, Self Organizing Maps, Computing with Artificial Neural Networks, Applications of Artificial Neural Networks, RBF and RCE neural networks LVQ, Solving optimization problems using neural networks. Stochastic neural networks, Boltzmann machine

#### Unit II

##### **Fuzzy sets, fuzzy logic and fuzzy inference, Rough sets.**

Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions. Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations. Propositional logic and Predicatelogic, fuzzy If – Then rules, fuzzy mapping rules and fuzzy implication functions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic

#### Unit III

Fuzzy neural networks Integration of fuzzy logic and neural networks, Fuzzy Hybrid neural, Computation of fuzzy logic inferences by hybrid neural net, Tuning fuzzy control parameters by neural nets, Fuzzy rule extraction from numerical data, Neuro-fuzzy classifiers, ANFIS, Applications of fuzzy neural systems, MATLAB based problems

#### Unit IV

Genetic algorithm : Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method

#### Unit V

Fuzzy controllers, Fuzzification and Defuzzification Methods , Fuzzy Inference Techniques, Computer vision, applications of fuzzy logic in pattern recognition and image processing. Applications of Neural networks in pattern recognition problems

#### **Text Books and References**

- [1] G J Klir and B Yuan, "Fuzzy Sets and Fuzzy Logic - Theory and Applications", Prentice-Hall, 1995.
- [2] Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications by S. Rajsekharan, Vijayalaxmi Pai
- [3] C. Bishop, "Neural Networks for Pattern Recognition", Oxford University Press, 1995.
- [4] D. Driankov, H. Hellendoorn and M Reinfrank, "An introduction to fuzzy control", Springer-Verlag, 1993
- [5] S. Haykin, "Neural Networks: A Comprehensive Foundation", Prentice Hall, 1999