**19EE42E4-NEURAL NETWORKS AND FUZZY LOGIC**

**(EEE)**

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Basic knowledge of coding, Matrix operations and Probability theory. | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Objectives** | Students undergoing this course are expected to learn: | |
| 1. The basics of Neural Networks. 2. The learning rules 3. The fuzzification and defuzzification   4. About Fuzzy sets and Fuzzy Logic theory.  5. The applications in Electrical Engineering.  6. To design of fuzzy systems. | |
| **Course Outcomes** | After completing the course the student will be able to: | |
| **CO1** | Understand the principles of neural networks and fuzzy Logic fundamentals. |
| **CO2** | Describe the learning rules. |
| **CO3** | Acquire knowledge in supervised learning. |
| **CO4** | Enumerate about unsupervised learning rules. |
| **CO5** | Explain the concept of classical and fuzzy sets, fuzzification and defuzzification. |
| **CO6** | Design the fuzzy systems |
| **Course Content:** | **UNIT-I**  **Artificial Neural Networks**: Introduction to neural networks, biological neurons, artificial neurons, Mc-culloch, pitts model, neuron modeling for artificial neural systems, feed forward network, feedback network, perceptron network, supervised and unsupervised Learning.  **UNIT-II**  **Learning Rules**: Hebbain learning rule, perceptron learning rule, delta learning, winner take all learning rule, oustar learning rule.  **UNIT-III**  **Supervised Learning:** Perceptron, exclusive OR problem, single layer preceptron network  **Multilayer Feed Forward Networks:** linearly non-separable pattern classification, delta learning rule for multi perceptron layer, error back propagation algorithm, training errors, ADALINE, introduction to Radial Basis Function Networks (RBFN)  **UNIT- IV**  **Unsupervised Learning:** Hamming net, Max net, winner take all learning, counter propagation network, feature mapping, self organizing feature maps. applications of neural algorithms, elementary aspects of applications of character recognition, neural network control applications, process identification.  **UNIT-V**  **Fundamentals of Fuzzy Logic and Fuzzy Sets**: Definition of fuzzy set, fuzzy set cardinality, operations of fuzzy sets, union, intersection, complement, cartesian product, algebraic sum, definition of fuzzy relation, properties of fuzzy relations, fuzzy composition.  **UNIT-VI**  **Design of Fuzzy Systems:** Components of fuzzy systems, functions of fuzzification, rule base patterns, inference mechanisms.  **Methods of defuzzification:** Centre of gravity method, mean of maxima method, weighted average method, height method.  Design of fuzzy systems for temperature setting of storage water heater, fuzzy system for control of air conditioner. | |
| **Text books**  **&**  **Reference books:** | **Text books:**  1.“Introduction to artificial neural systems”, by KacelM.Jurada, Jaico Publications,1st Edition,1992.  2. “Fuzzy set theory and its applications”, by Zimmerman K.J. Kluwer Academic Publishers, 4th Edition, 2001.  **Reference books:**  1. “Fuzzy logic with engineering applications”, by Timothy Ross, Wiley publishers, 4th Edition, 2016.  2. “Foundations of neural networks, Fuzzy Systems, and Knowledge Engineering”, by Nikola K. Kasabov, MIT press, Cambridge, London,  2nd Edition, 1996. | |
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