NATIONAL UNIVERSITY OF ENGINEERING

COLLEGE OF INDUSTRIAL AND SYSTEMS ENGINEERING

SYSTEMS ENGINEERING PROGRAM

ST414 – ARTIFICIAL INTELLIGENCE

I. GENERAL INFORMATION

CODE	: ST414 Artificial Intelligence
SEMESTER	: 9
CREDITS	: 3
HOURS PER WEEK	: 4 (Theory - Practice)
PREREQUISITES	: ST124 Simulation, ST214 Data Bases Administration
CONDITION	: Compulsory

II. COURSE SUMMARY

The course prepares the student in the theoretical-practical applications related to the study of artificial intelligence with emphasis on two areas such as artificial neural networks and fuzzy logic. The topic related to artificial neural networks, their study includes the development of algorithms with supervised learning and their applications, while the fuzzy logic comprises the study of the diffuse inference of Mamdani and inference of Sugeno applied to the design of the control systems diffuse.

III. COMPETENCES

The student:

1. Solves artificial intelligence problems using artificial neural networks and fuzzy logic.
2. Solve diffuse inference algorithms of Mamdani and Sugeno in applications to control systems.
3. Solves model identification algorithms based on neural networks for linear invariant linear systems and nonlinear systems.
4. Uses MATLAB and LabVIEW simulation software tools to solve computational algorithms based on artificial intelligence and their real-time applications.
5. Designs intelligent control systems using artificial neural networks and fuzzy logic.

IV. LEARNING UNITS

1. NEURONAL MODEL / 6 HOURS

History of artificial intelligence / Areas of artificial intelligence / Areas of artificial intelligence / Perception and action / Implementation of basic systems with artificial intelligence / Basic fundamentals of neural networks / Historical events of neural networks / Biological neuronal network / Model of neuronal networks An artificial neural network / Types of activation functions / Applications.

2. SUPERVISED LEARNING / 12 HOURS

Logical unit threshold and vectors. Neural Network Perceptron / Perceptron Limitations / Algorithms with Supervised Learning / Error Correction Algorithm / Red Adaline / Widrow Hoff Algorithm / Gradient Based Algorithms / LMS Algorithm / Reverse Propagation Algorithm / Multilayer Neural Networks (MLP) / Ability Of generalization of a network / reverse propagation algorithm.

3. APPLICATIONS WITH NEURONAL NETWORKS / 8 HOURS

Multilayer Perceptron as a Pattern Classifier / Nonlinear Functional Approach / Neural Model Identification of Linear and Nonlinear Systems / Functional Approximation of a NARMAX Model Using Recurrent Neural Networks / Design of Neural Control by Adaptive Interaction.

4. DIFFUSE INFERENCE / 6 HOURS

Introduction to diffuse logic / Methodologies used in diffuse control / Differences between a diffuse and non-diffuse set / Crisp sets and diffuse set / Membership functions / Elementary operators for fuzzy logic / Fuzzy relations / Approximate reasoning theory / Fuzzifier, Machine of Diffuse inference and Defuzzifier / Mamdani Reasoning / Takagi-Sugeno Reasoning / Diffuse Inference Algorithm.

5. DESIGN OF DIFFUSE CONTROLLER / 8 HOURS

Basic structures of a fuzzy controller / Obtaining the rule base / Fuzzy controller types / Representation using 2D characteristics / Influence of membership functions in the base

Rules / Representation using 3D features / Diffuse proportional controller design / Diffuse controller design type PI, PD, PID / Diffuse baseline control / Applications.

V. LABORATORIES AND PRACTICAL EXPERIENCES

Lab 1: Classification of Patterns
Laboratory 2: Identification through neural networks
Laboratory 3: Reading a thermistor using neural networks
Laboratory 4: Mamdani and Sugeno diffuse inference
Laboratory 5: Approaching nonlinear functions
Laboratory 6: Designing a fuzzy controller

VI. METHODOLOGY

The course is developed in sessions of theory, practice and computer lab. In theory sessions, the teacher presents concepts, and applications. In practical sessions, various problems are solved and their solution is analyzed. In the laboratory sessions, there are two aspects: first, the use of Matlab and LabVIEW simulation software to solve problems and analyze their solution. In all the sessions the active participation of the student is promoted.

VII. EVALUATION FORMULA

Evaluation System F

VIII. BIBLIOGRAPHY

1. Liu Xing. Neural Networks and Identification, Prediction and Control. Springer-Verlag, London Limited, 1997.
2. Madan Gupta, Liang Jim, Noriyasu Homma. Static andDynamicNeural Networks, John Wiley & Sons 2003.
3. Jhon Yen and Reza Langari. “Fuzzy Logic: Intelligence, Control, and Information”. Prentice Hall Upper Saddle River, New Jersey, 1999.
4. Li-Xin Wang. “A Course in Fuzzy System and Control”. Prentice Hall, 1997.