Intelligent Systems and Control

Course No: 46332
Course type: Lecture
Credit: 3
Course Status: Elective Specialized Course
Prerequisite: Automatic Control (BSc.), Advance Control (MSc) or Supervisor Approval

Aim/Scope/Objectives: This course intends to give the required knowledge to MSc. & Ph.D. students for simulation, prediction, identification, control, and optimization of different complex nonlinear systems using intelligent systems. This course also covers training over the Phyton programming to implements the different projects.

Course Outline:

1- Part one: Artificial Neural Networks
   1-1- Comparison the learning methods in man and machine
   1-2- Pattern recognition
   1-3- Basic neuron
   1-4- Multi-Layered Perceptron (MLP)
   1-5- Recurrent Multilayer Perceptron (RMLP)
   1-6- Systems identification and modeling
   1-7- Intelligent control systems
      1-7-1- Classical intelligent controllers
      1-7-2- Emotional Learning Based Intelligent Controllers (ELIC)
   1-8- Deep Neural Networks (DNN)

2- Part two: Nature Inspired Optimization Algorithms
   2-1- Introduction to optimization
   2-2- Simulated Annealing (SA)
   2-3- Genetic Algorithms (GA)
      2-3-1- Binary genetic algorithms
      2-3-2- Continuous genetic algorithms
      2-3-3- Applications of genetic algorithms in engineering
   2-4- Ant Colony Optimization (ACO)
   2-5- Particle Swarm Optimization (PSO)

Grading: 40% Final exam, 20% Homework by Phyton, 40% Research Project

References:
- IEEE papers about applications of intelligent systems in identification, control, and optimization of complex MIMO plants.