DESCRIPTION OF THE COURSES

- Course code: ARR3219
- Course title: **APPLICATION OF ARTIFICIAL INTELLIGENCE METHODS IN CONTROL AND DIAGNOSTICS**
- Language of the lecturer: Polish

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*1*		*2*		
*Number of hours/semester**	*15*		*30*		
Form of the course completion	*Exam*		*Credit*		
ECTS credits	*2*		*2*		
Total Student's Workload	*60*		*60*		

- Level of the course (~~basic/~~advanced):
- Prerequisites: *.....Artificial intelligence methods.*
- Name, first name and degree of the lecturer/supervisor: Teresa Orłowska-Kowalska, prof. dr hab. inż.
- Names, first names and degrees of the team's members: Czesław Kowalski, dr hab. inż., Marcin Pawlak, dr inż.; Krzysztof Szabat, dr inż.
- Year:...I..... Semester:....2.....
- Type of the course (obligatory/~~optional~~):
- Aims of the course (effects of the course): *learn of possibilities of application of neural networks, fuzzy logic and genetic algorithms for solving control problems (particularly – for identification, state variable estimation, system control) and for diagnosis of electrical drives; practical application of artificial intelligence methods for solving technical problems.*
- Form of the teaching (traditional/~~e-learning~~):
- Course description:

Basic problems and structures of neural networks – repetition. Feedforward network, recurrent networks, Elman networks. Selforganising networks, basic applications. Neuro-fuzzy networks. Advanced learning methods of neural networks. Neural networks application for identification, modeling, state variable estimation and control. Neural state and parameter estimators of electrical machines and drives. Neural control systems, neural adaptive controllers, examples. Technical diagnosis methods; neural diagnosis systems, neural networks for faults detection. Selforganising Kohonen network and its application for faults recognition in electrical machines and drives; examples. Fuzzy logic – repetition. Fuzzy logic controllers and their design methods. Applications in control engineering using examples from the field of electrical drive control. Genetic algorithms applications for identification and optimization of electrical systems, for controllers adjustment; examples of applications.

- Lecture:

Particular lectures contents	*Number of hours*
1. Basic problems and structures of neural networks – repetition.	*2*
Feedforward network, recurrent networks, Elman networks.	*2*

2. *Selforganising networks, basic applications.* 3. *Neuro-fuzzy networks. Advanced learning methods of neural networks.* 4. *Neural networks application for identification, modeling, state variable estimation and control. Neural state and parameter estimators of electrical machines and drives. Neural control systems, neural adaptive controllers, examples.*	*3*
5. *Technical diagnosis methods; neural diagnosis systems, neural networks for faults detection. Selforganising Kohonen network and its application for faults recognition in electrical machines and drives; examples.*	*2*
6. *Fuzzy logic – repetition. Fuzzy logic controllers and their design methods. Applications in control engineering using examples from the field of electrical drive control.*	*2*
7. *Genetic algorithms applications for identification and optimization of electrical systems, for controllers adjustment; examples of applications.*	*2*

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:
  Laboratory exercises are based on the application of suitable software, like *Neural Network Toolbox* and *Fuzzy Logic Toolbox* for chosen examples of the application of neural networks, fuzzy-logic and genetic algorithms for modeling, identification, state variable estimation, control and diagnosis of dynamical systems.
- Project – the contents:
- Basic literature:
  1. Tadeusiewicz R., Sieci neuronowe, Akademicka Oficyna Wydawnicza, Warszawa, 1993
  2. Osowski S., Sieci neuronowe w ujęciu algorytmicznym, WNT Warszawa 1996
  3. R. Yager, D. Filev, Podstawy modelowania i sterowania rozmytego, WNT, 1995
  4. D. Rutkowska, M. Piliński, L. Rutkowski, Sieci neuronowe, algorytmy genetyczne i systemy rozmyte, PWN, 1997
  5. Neural Networks Toolbox for use with MATLAB®, User's Guide
  6. Fuzzy Logic Toolbox for use with MATLAB®, User's Guide
- Additional literature:
  1. Korbicz J., Obuchowicz A., Uciński D., Sztuczne sieci neuronowe. Podstawy i zastosowania. Akademicka Oficyna Wydawnicza PLJ, Warszawa 1994
  2. Żurada J., Barski M., Jędruch W., Sztuczne sieci neuronowe, PWN, 1996
- Conditions of the course acceptance/credition:
  Lecture – pass of the written test; Laboratory - presence and performing of all exercises, preparing reports.
  ***** - depending on a system of studies