DESCRIPTION OF THE COURSES

- Course code: **ARR2510**
- Course title: **ARTIFICIAL INTELLIGENCE IN ELECTRIC POWER SYSTEM CONTROL**
- Language of the lecturer: **Polish, English**

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	**2**		**1**		
*Number of hours/semester**	**30**		**15**		
Form of the course completion	**Test**		**Performed laboratory assignments**		
ECTS credits	**2**		**1**		
Total Student's Workload	**90**				

- Level of the course (basic/advanced): **advanced**
- Prerequisites: **PROGRAMMING IN C , ELECTRIC POWER SYSTEMS**
- Name, first name and degree of the lecturer/supervisor:
  dr. Robert Lis
- Names, first names and degrees of the team's members:
  Prof. Marian Sobierajski, Ph.D., D.Sc. Associate Professor
  Wilkosz Kazimierz, PhD, DSc./Professor
  dr. Robert Łukomski,
- Year: **1** Semester: **2 (the second-level study)**
- Type of the course (obligatory/optional): **optional**
- Aims of the course (effects of the course):

  The course presents the basic techniques of artificial intelligence such as: knowledge representation, reasoning, task planning, decision making, and acting under uncertainty.
- Form of the teaching (traditional/e-learning): **traditional**
- Course description:

  Methods utilizing state space search, heuristic information, logic and theorem proving, rule-based and semantic representations, and probabilistic methods such as Bayesian networks are discussed. Elements of machine learning are also covered.

- Lecture:

Particular lectures contents	*Number of hours*
1. Introduction: program, requirements, literature. Basic concepts and issues. Definition of artificial intelligence. Turing Test. History. Strong and weak artificial intelligence.	**2**
2. State space representation. Searching. Hill-climbing strategies. Utilizing heuristic information.	**2**
3. Graph searching. Breadth-first, depth-first, and best-first strategies.	**2**

A* algorithm. Properties.	
4. Constraint satisfaction problems, basic algorithms. Searching for games. Minimax algorithm. Alpha-beta cuts.	**2**
5. Representation in first order logic. Resolution theorem proving, refutation reasoning.	**2**
6. Utilizing incomplete and uncertain information. No monotonic logic. Truth maintenance systems.	**2**
7. Introduction to action planning, partial order and conditional planning. POP algorithm. Plan execution monitoring.	**2** **2**
8. Rule-based representation. Expert systems.	**2**
9. Probabilistic representation. Conditional probability. Bayes' rule.	**2**
10. Probabilistic belief networks: construction and utilization.	**2**
11. Simple decision making introduction. Utility functions. Value of information.	**2**
12. Sequential decision problems. Dynamic programming. Value Iteration. Policy iteration.	**2**
13. Introduction to machine learning. Concept learning. Version space method. Decision trees.	**2**
14. Reinforcement learning.	
15. Natural language communication. Parsing and semantic analysis. Simplified methods.	

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:

Familiarizing with real methods and algorithms of artificial intelligence in electric power system control and with solution of the problems (to which attention is paid at the lecture) related to them. Constraint satisfaction: Arc consistency, forward checking, backmarking, backjumping, conflict-directed backjumping, dynamic backtracking, dynamic variable ordering, and an overview of recent research.

- Project – the contents:
- Basic literature:

1. **S.J. Russell, P. Norvig, Artificial Intelligence A Modern Approach, Prentice-Hall, 2003.**
2. **P. Cichosz, Systemy uczące się, WNT, Warszawa 2000.**
3. **Mulawka J., Systemy ekspertowe, PWN, Warszawa 1997.**
4. **Masters T., Sieci neuronowe w praktyce, WNT, Warszawa 1996.**
5. **internet**

- Additional literature:

1. **Niederliński A., Mościński J., Ogonowski Z. , Regulacja adaptacyjna, PWN, Warszawa 1995.**
2. **Osowski S., Sieci neuronowe w ujęciu algorytmicznym, WNT, Warszawa 1996.**
3. **Kremens Z., Sobierajski M., Analiza systemów elektroenergetycznych, WNT, Warszawa 1996.**
4. **Cytkowski J., Algorytmy genetyczne, Politechnika Warszawska, 1996.**
5. **Tadeusiewicz R., Sieci neuronowe, WNT, Warszawa 1993.**

- Conditions of the course acceptance/credition:

Lectures: positive final test

Laboratory: positive evaluation of all performed assignments

* - depending on a system of studies