STUDY MODULE DESCRIPTION FORM

Name of the module/subject **(-)Optimization and control in environmental engineering**		Code **1010102221010512020**
Field of study **Environmental Engineering Second-cycle**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 2**
Elective path/specialty **Heating, Air Conditioning and Air Protection**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **2** Classes: **-** Laboratory: **1** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences**		ECTS distribution (number and %) **100 4%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic terms of control engineering and informatics
2	**Skills**	Student skills to describe the dynamic characteristics of objects and processes
3	**Social competencies**	He has a needs of continously of knowledge actualization

Assumptions and objectives of the course:

To teach the proper formulation of optimization problems with one or multicriteria ones.

The pesentation of new directions in the field of processes control in environmental engineering. Preparation for effective cooperation with computer and control engineers for automation

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student knows basic terms utilized in optimization problems - [K2_W01]
2. Student understands the neccessity aplication of optimization and control in environmental engineering - [K2_W01, K2_W07]
3. Student utilizes the mathematical modeling and simulation methods - [K2_W07]
4. Student knows possibilities to utilization of computer tools for monitoring and control - [K2_W07]

Skills:

1. Student formulates the optimization tasks with one or multi criteria - [K2_U09]
2. Student describes the demands for SCADA systems for objects and processes in environmental engineering - [K2_U10]
3. Student describes the proper action of devices and processes in algorithmic way - [K2_U08, K2_U09]

Social competencies:

1. STUDENT: undestands the neccessity of interdisciplinary group colaboration - [K2_K03]
2. He aprobates the neccessity of complex processes automation - [K2_K07]
3. He understands the improtance of new information technology in environemtal engineering - [K2_K01]

Assessment methods of study outcomes

Lecture: written test of knowledge

Laboratory exercises: activity of exercises realization, evaluation of preparation to the problem solving, written exercises protocols

Course description

Optimization problems and its technical applications. Formulation of optimization problems with one criterion. Multicriteria optimization problems. Optimization methods (analytical and numerical approach). Simplex method. Nonlinear optimization.

Computer control systems: classification, Programmable Logic Controllers (PLC), microcontrollers, embedded systems. Process monitoring (examples of solutions). Control of water treatment and wastewater treatment processes. Air conditioning control (examples of solutions). Intelligent building systems (BMS).

Basic bibliography:

1. G. Olsson, G. Piani: Computer in automation and control. Prentice Hall, New York 1995. 2.
2. Poradnik eksploatatora oczyszczalni ścieków, Dymaczewski Z., Sozański M.M., (red.), Wyd. PZiTS, Poznań 2011 r.
3. G. Olsson, G. Piani: Computer in automation and control. Prentice Hall, New York 1995. 2.
4. Poradnik eksploatatora oczyszczalni ścieków, Dymaczewski Z., Sozański M.M., (red.), Wyd. PZiTS, Poznań 2011 r.

Additional bibliography:

1. Olsson G., Newell B., Wastewater Treatment Systems - Modelling, Diagnosis and Control, IWA Publ. 1999
2. T. Łukaszewski, A. Urbaniak, Informatyka w ochronie środowiska, Wyd. P.P., Poznań 2001.
3. Olszanowski A., Sozański M.M., Urbaniak A., Voelkel A. (red.), Remediacja i bioremediacja zanieczyszczonych wód i gruntów oraz wykorzystanie modelowania i technik informatycznych w inżynierii środowiska, Wyd. PP, Poznań 2001
4. Olsson G., Newell B., Wastewater Treatment Systems - Modelling, Diagnosis and Control, IWA Publ. 1999
5. T. Łukaszewski, A. Urbaniak, Informatyka w ochronie środowiska, Wyd. P.P., Poznań 2001.
6. Olszanowski A., Sozański M.M., Urbaniak A., Voelkel A. (red.), Remediacja i bioremediacja zanieczyszczonych wód i gruntów oraz wykorzystanie modelowania i technik informatycznych w inżynierii środowiska, Wyd. PP, Poznań 2001

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in laboratory exercises	15
3. Preparation to laboratory exercises and its reporting	25
4. Preparation for exam	20

Student's workload

Source of workload	hours	ECTS
Total workload	90	4
Contact hours	45	2
Practical activities	15	2