STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Elements of Control Engineering**		Code **1010134281010510286**
Field of study **Environmental Engineering Extramural First-**	Profile of study (general academic, practical) **(brak)**	Year /Semester **4 / 8**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **part-time**	

No. of hours				No. of credits
Lecture: **10** Classes: **-** Laboratory: **10** Project/seminars: **-**				**3**

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 3%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of mathematics, physics and electrical engineering
2	**Skills**	Skill of effective utilization knowledge from mathematical analysis and physics
3	**Social competencies**	Necessity of continously actualization and verification knowledge

Assumptions and objectives of the course:

-The transfer knowledge to students about control theory as a system discipline. Development skills concerning with dynamic objects and systems characteristics. The quality analysis of control system. Description of main control elements: sensors and controllers. Underline of new directions in control systems.

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

Knowledge:

1. Student knows basic terms utilized in control theory and control engineering - [K_W02]

2. Student knows description principles and desining od simply swiching systems - [K_W02,K_W07]

3. Student know the fundamentals mathemathical description of dynamic objects and processes in environemtal engineering - [K_W02,K_W07]

4. Student knows the rules of automatic control and evaluation quality criteria of control   - [K_W02,K_W07]

5. Student understands the working of controllers and typical sensors - [K_W07]

6. Student knows basic of computer control systems - [K_W07]

Skills:

1. Student skills to design simply control system utilizing logical elements, - [K_U15]

2. Student describes objects and processes using dynamic and frequency characteristics , - [K_U09]

3. Student skills to evaluate the stability of linear control system - [K_U10]

4. Student explanates action of typical sensors: temperature, level, preasure and flow   - [K_U09]

Social competencies:

1. Student understands necessity team working for solution of theoretical and practical problems - [K_K03, K_K04]

2. Student docenia the importance of cooperation with technologists, computer and control engineers for effective application of new technology kresie automatyzacji   - [K_K07]

3. Student understands neccessity systematic knowledege and skills expansion - [K_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
Basic terms of control and control engineering systems. Basic of swiching systems. Desciption of logical systems using Boole algebra. Minimization of swiching functions. Desining of ligical systems using NAND and NOR elements. Examples pf simply logical system desing.
Linear control systems. Description of objects? dynamic with examples. Transfer function. Linearization of nonlinear characteristics. Identification of dynamic characteristics. Frequency response methods. Basic characteristics of objects: transfer function, jump function, amplitude-phase characteristic, examples and notation on the schema. Stability and quality of control systems. Blocks schema and its transformations. Classic governors: P, PI, PD, PID. Rules of controllers and parameters choice. Sensors and measurements converters of nonelectric magnitudes ? chosen examples, intelligent sensors. Nonlinear control systems. Introduction to computer control systems ? hardware and functional structure. Example of solutions.

Basic bibliography:

1. Urbaniak A., Podstawy automatyki, Wyd. PP, Poznań 2007 (wyd. III)

2. Dorf R.C., Bishop R.H., Modern control systems, Addison Wesley, 1995

Additional bibliography:

1. Findiesen W., Technika regulacji automatycznej, WNT, Warszawa 2006 r.

2. Klimasara W.J., Piłat Z., Podstawy automatyki i robotyki, WSiP, Warszawa 2006r.

Result of average student's workload	
Activity	**Time (working hours)**
1. Participation in lectures	10
2. Participation in the laboratory exercises	10
3. Preparation to laboratory exercises and its reporting	25
4. Preparation to exam	20

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	80	3
Contact hours	25	2
Practical activities	15	1