Subject programme

1. Subject name / subject module: **Components and Devices of Control Systems**
2. Lecture language: **English**
3. The location of the subject in study plans:
   - Area or areas of the studies: **Computer Engineering and Mechatronics**
   - Degree of the studies: **1st degree studies**
   - Field or fields (implementation of effects standard): **Mechatronics**
4. Supervision of subject implementation:
   - The Institute / Another unit: **Institute of Informatics and Mechatronics**
   - The person responsible for the subject: **Szychta Leszek, prof. dr hab. inż.**
   - People cooperating in the development of the programme of the subject:
5. The number of hours and forms of teaching for individual study system and the evaluation method:

Teaching activities with the tutor																						
Mode of study	Form of classes																					Total
	...	SOW	ECTS	Laboratory work	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	...	SOW	ECTS	ECTS
Full-time studies				22	28	2																**2**
Part-time studies																						
Credit rigor				Graded assignment																		

6. Student workload – ECTS credits balance:

   1 ECTS credit corresponds to 25-30 hours of student work needed to achieve the expected learning outcomes including the student's own work

Activity (please specify relevant work for the subject)	**Hourly student workload (full-time studies/part-time studies)**
Participation in lectures	-
Participation in laboratory classes	22
Preparation to laboratory classes	18
Independent study of the subject	10
Participation in an exam / graded assignment	2
Total student workload (TSW)	50
ECTS credits	2
* Student's workload related to trainings	50
Student's workload in classes requiring direct participation of academic teachers	22

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:
   - Recommended admission requirements – none.
   - Recommended duration of the subject is taken from the course plan.
8. Specific learning outcomes – knowledge, skills and social competence:

Specific learning outcomes for the subject		**Form**	**Teaching method**	**Methods for testing of (checking, assessing) learning outcomes**
Outcome symbol	**Outcome description**			
Knowledge				
K_W05	**A student has basic knowledge of Components and Devices of Control Systems that can be easy applied in automation, electronics and electrical engineering,as the level of the complex dependencies of mechatronic systems**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_W08	**A student knows and understands selected specific issues in the field of Components and Devices of Control Systems related to: designing automation systems, control systems, robotics and kwons how to apply it in practise.**			
Skills				
K_U08	**A student is able to plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions - to project a control system by real devices.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_U14	**A student is able to see problems, imperfections in functioning or newly designed control systems as a part of mechatronic systems, identify the problem and formulate a specification of choosen elements odevices of control systems**			

9. Assessment rules / criteria for each form of education and individual grades

0% - 50%	ndst	**80% - 86%**	db
51% - 70%	dst	**97% - 93%**	db+
71% - 79%	dst+	**94% - 100%**	bdb

Activity	Grades	Calculation	To Final
Tasks done during laboratory classes	dst, db, bdb, db (3,4,5,4)	arithmetic mean (3,4,5,4) * 90%	3,6
Attendance	on 70% of all classes	70% * 5 -> 3,5 * 10%	0,35
Final result			3,95
Grade		3,95/5 = 79%	**db (4.0)**

10. The learning contents with the form of the class activities on which they are carried out:

(Laboratory work)

Classification of control systems. Controls, theory, feedback, selection of optimum PID control settings. Hardware and functional architecture of computer control systems, classification and characteristics of basic structures, hardware requirements of computer control systems in memory, computing power, interrupts, input/output circuits. Software for computer control systems, process variable collection and processing algorithms, input/output device support, human communication - system. Computer integrated control systems: Industrial PLC drivers, industrial computers, PC-based PLC industrial computers. Programmable logic controllers (PLC). Design of controllers, programming languages for drivers, logical diagram of the controller and its workflow. Layout and operation of modular industrial controllers using the SIMIC systems: Main unit, digital modules, analog inputs / outputs, special modules, counter systems. Communication systems. Memory map, special driver logs. Power supply to the controllers. Rules for use of controls, assembly, external connections.Distributed control, network control systems, industrial networks (CAN, Profibus, Profine). Communications protocols used in embedded systems: Wired (CAN, Ethernet) and Wireless (ZigBee). Monitoring and visualization systems and control of the superior SCADA.

11. Required teaching aids:

a. Lecture - multimedia projector.

b. Laboratory classes - specialist laboratory.

c. Exercises - a room adapted for conducting classes in the form of exercises / workshops, multimedia projector.

12. Literature:

a. Basic literature:

1. Nise Norman, Control Systems engeeniring, John Willey&Sons, 2008,

2. Ogata Katsuhiko, Discrete-time control systems, Prentice Hall, 1995

b. Supplementary literature:

Dort Richard, Bishop Robert, Modern Control Systems, Pearson Prentice Hall, 2008

c. Internet sources:

13. Available educational materials divided into forms of class activities (Author's compilation of didactic materials, e-learning materials, etc.)

14. Teachers implementing particular forms of education:

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Szychta Leszek, prof. dr hab. inż. Ocetkiewicz Tomasz, mgr inż.
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	