Subject programme

1. Subject name / subject module: **Programmable Logic Devices**
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: **Ocetkiewicz Tomasz, mgr 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				33	42	3																3
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	33
Preparation to laboratory classes	16
Preparation of final project	16
Independent study of the subject	8
Participation in an exam / graded assignment	2
Total student workload (TSW)	75
ECTS credits	3
* Student's workload related to trainings	75
Student's workload in classes requiring direct participation of academic teachers	33

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 sufficient knowledge of automation, electronics, and electrical engineering, necessary to understand dependencies in mechatronic systems and is able to apply this knowledge in practice through the use of appropriate methods, tools, and**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_W08	**A student possesses sufficient knowledge of selected issues in the field of automation, electronics, and electrical engineering related to the design of control systems (including robotics) based on programmable logic devices and practical applicatio**			
Skills				
K_U14	**remove from the syllanus**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_U15	**A student has adequate skills to choose the appropriate algorithms, programming language, programming tools, and programmable logic devices to solve a simple engineering task in the field of mechatronics.**			

K_U16	**A student possesses sufficient skills to use appropriate methods, techniques, and tools - by the given specification - to design and implement a simple device, object, system, or process, typical that require the use of a programmable logic device (P**			

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

0% - 50%	ndst	**80% - 86%**	db
51% - 70%	dst	**87% - 93%**	db+
71% - 79%	dst+	**94% - 100%**	bdb

Activity	Grades	Calculation	To Final
Lab reports	dst, db, bdb, db (3,4,5,4)	arithmetic mean (3,4,5,4) * 50%	2,0
Final project	bdb (5)	5.0 * 50%	2,5
Final result			4,5
Grade		4,5/5 = 90%	**db+ (4,5)**

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

(Laboratory work)

1. Architecture and principle of programmable controllers;
2. Rules for connecting programmable controllers with objects;
3. Ladder language (LD) for Omron controllers; Bit control instructions. Logical instructions; Timers and counters; Data transfer and copying operations. Arithmetic shifts and circular shift registers. Data comparison; Subroutines. Program execution control; Calculations on binary numbers and in BCD. Data conversion;
4. Construction and operation of programmable relays;
5. User interface design and programming.

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. Vaibbhav Taraate; PLD Based Design with VHDL; ISBN 978-981-10-3296-7; Springer 2017

2. Brock J. LaMeres; Introduction to Logic Circuits & Logic Design with VHDL; ISBN 978-3-319-34195-8; Springer 2017

3. Peter Athanas, Dionisios Pnevmatikatos, Nicolas Sklavos; Embedded Systems Design with FPGAs; ISBN 978-1-4614-1362-2; Springer 2013

b. Supplementary literature:

1. Sanjay Churiwala; Designing with Xilinx FPGAs; ISBN 978-3-319-42438-5; Springer 2017
2. Esteban Tlelo-Cuautle, Jose Rangel-Magdaleno, Luis Gerardo de la Fraga; Engineering Applications of FPGAs; ISBN 978-3-319-34115-6; Springer 2016
3. Philip Andrew Si

c. Internet sources:

1. DigiKey Article Library (FPGA) - https://www.digikey.pl/en/articles/techzone?t=FPGA
2. Xilinx Spartan-3 FPGA Family - https://www.xilinx.com/products/silicon-devices/fpga/spartan-3.html
3. Xilinx University Program - https://www.xilinx.com/support/university.html

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	Ocetkiewicz Tomasz, mgr inż.
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	