Subject programme

1. Subject name / subject module: **Digital Circuits**
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: **Grad Piotr, dr 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				32	43	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 laboratory classes	**32**
Preparing for laboratories	**25**
Independent study of the subject	**16**
Participation in an exam / graded assignment / final grading	**2**
Total student workload (TSW)	**75**
ECTS credits	**3**
* Student's workload related to practical forms	**75**
Student's workload in classes requiring direct participation of academic teachers	**32**

7. Implementation notes: recommended duration (semesters), recommended admission requirements, relations between the forms of classes:

   Electronics

   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 possesses sufficient knowledge of electronics, and electrical engineering, necessary to understand, at an advanced level, the complex dependencies in digital electronics and to apply this knowledge in practice through the use of appropriate meth**	**Laboratory work**	**inquiry methods, expository methods**	**Class tasks**
K_W08	**A student possesses adequate theoretical and practical knowledge on topics related to the design of digitalc circuits.**			
Skills				
K_U15	**A student possesses sufficient skills to select and use appropriate methods, components, and tools - in accordance with the given specification - to design and implement a**	**Laboratory work**	**inquiry methods, expository methods**	**Class tasks**

	simple device or system that requires the use of digital signals and compontents.			

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

0% - 50%	ndst	**81% - 90%**	db
51% - 70%	dst	**91% - 93%**	db+
71% - 80%	dst+	**94% - 100%**	bdb

Activity	Grades	Calculation	To Final
Laboratory tasks	**Example: db; bdb; bdb; db (4; 5; 5; 4)**	**4 * 12.5% + 5 * 12.5% + 5 * 12.5% + 4 * 12.5% = 2.25**	**2.25**

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

(Laboratory work)

1. Electric Circuit Theory Review;
2. Digital and Analog.;
3. Number Systems;
4. Common Logic Gates : AND, OR, NOT gates, ICs.;
5. Common Logic Gates (II): NAND, NOR. ICs, Troubleshooting;
6. Combinational Logic. Theorems of Boolean Algebra. DeMorgan's Theorem. The Uniting Theorem;
7. NAND/NOR Universality. ;
8. XOR, XNOR, Parity Circuits;
9. Boolean Cubes. Mapping Truth Tables onto Boolean Cubes;
10. Karnaugh Maps;
11. Binary Addition and Subtraction, Two's Complement System and Arithmetic, BCD Arithmetic, Half and Full Adders, Adder ICs, Adder/Subtractor, ALU;
12. Comparators, Decoding/Encoding, Code Converters, MUXs, DeMUXs;
13. Hazards;
14. A Sequential System;
15. Sequential Logic; Registers; SR Latch; D, JK, T Flip Flops; MS and Edge Triggering; IC Flip Flops; Octal FF chip; FF Function Tables;
16. Sequential Circuit Analysis, Ripple Counters, Modulus, Divide-by-n Counters,;
17. Synchronous Counters;
18. TTL Family, Totem Pole and Open Collector Outputs, CMOS Family, Interfacing Logic Families, Auto Delay Gate, Auto Reset Circuit, Schmitt Trigger, Debouncing, Pull-up Resistors;
19. Introduction to PLD;
20. Introduction to VHDL.

11. Required teaching aids

Laboratory classes - specialist laboratory

12. Literature:

a. Basic literature:

1. Ulrich Tietze, Christoph Schenk, Eberhard Gamm; Electronic Circuits; ISBN 978-3-540-78655-9; Springer, Berlin, Heidelberg 2008

2. Jean-Pierre Deschamps, Elena Valderrama, Lluís Terés; Digital Systems; ISBN 978-3-319-41198-9; Springer, Cham 2017

a. Supplementary literature:

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

2. Hassan Salmani; Trusted Digital Circuits; ISBN 978-3-319-79081-7; Springer, Cham 2018

3. Vaibbhav Taraate; Digital Logic Design Us

b. Internet sources:

1. SparkFun Tutorials - learn.sparkfun.com
2. Electronics Notes - www.electronics-notes.com
3. Electronic Design - www.electronicdesign.com
4. EE Times - www.eetimes.com
5. EDN - www.edn.com
6. Nuts and Volts - www.nutsvolts.com/magazine/article/April2016_Beginner-Guide-to-Digital-Electronics

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. Laboratory classes	Grad Piotr, dr inż.