Subject programme

1. Subject name / subject module: **Electronics**
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	...				exam																	

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	**32/0**
Independent study of the subject	**41/0**
Participation in an exam / graded assignment / final grading	**2/0**
Total student workload (TSW)	**75/0**
ECTS credits	**3**
* Student's workload related to practical forms	**75/0**
Student's workload in classes requiring direct participation of academic teachers	**32/0**

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

   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 possesses sufficient knowledge of electronics, and electrical engineering, necessary to understand the fundamental laws of electricity and the principle of operation of passive and active electronic components.**	**Laboratory classes**	**inquiry methods**	**Assesment of laboratory tasks.**
K_W08	**A student possesses adequate theoretical and practical knowledge on parameters of passive and active electronic components, and about the role of those components in control systems.**			
Skills				

K_U08	A student is able to measure basic parameters of active and passive electronic components, has sufficient skills to prepare computer simulation of basic electronics circuits, interpret the obtained results, and draw conclusions.	Laboratory classes	inquiry methods	Assesment of laboratory tasks.

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

0% - 60%	ndst	**81% - 90%**	db
61% - 70%	dst	**91% - 93%**	db+
71% - 80%	dst+	**94% - 100%**	bdb

Activity	Grades	Calculation	To Final
Laboratory tasks	**db; bdb; bdb; db (4; 5; 5; 4)**	**4 * 1.25% + 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. Basic concepts of electronics;
2. Basics of circuit theory - Ohm's law, Kirchhoff's law, Thevenin and Norton principles;
3. Resistors and calculations of circuits containing resistors, voltage sources and current sources. Different types of resistors, power resistors, potentiometers;
4. Capacitors and calculations of circuits containing capacitors. Different types of capacitors, variable capacitors;
5. Coils and calculations of circuits containing coils. Different types of coils, variable coils;
6. Low-pass, high-pass and band-pass filters, low-stop, high-stop and band-stop filters;
7. Introduction to the PSpice simulation environment;
8. Simulations of DC and AC circuits in the PSpice environment;
9. Basics of semiconductors;
10. Semiconductor diodes: rectifying diodes, a half-wave rectifier, a full-wave rectifier, a bridge full-wave rectifier. Rectifiers with a capacitor filter;
11. Zener diodes. Rectifiers with a Zener diode;
12. LED diodes, LED-RGB;
13. Bipolar transistors (NPN, PNP): structure and operation, examples of applications;
14. Transistor amplifiers using bipolar transistors;
15. Integrated operational amplifiers (OpAmps) and their applications;
16. MOSFET transistors: NMOS and PMOS: structure and operation, examples of applications;
17. CMOS technology: inverter, NAND, NOR, AND, OR and XOR gates;
18. Selected measurements of physical quantities using electronic devices.

11. Required teaching aids

Laboratory classes - specialist laboratory

12. Literature:
    a. Basic literature:
        - Scherz Paul, Monk Simon; Practical electronics for inventors; ISBN 978-1-25-958754-2; McGraw - Hill Education 2016
        - Horowitz Paul, Hill Winfield; The art of electronics; ISBN 978-0-521-80926-9; Cambridge University Press 2016

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

    c. Internet sources:
        - SparkFun Tutorials - learn.sparkfun.com
        - Electronics Notes - www.electronics-notes.com
        - Electronic Design - www.electronicdesign.com
        - EE Times - www.eetimes.com
        - EDN - www.edn.com
        - Basic Analog Circuits - www.ni.com/en-us/innovations/white-papers/06/basic-analog-circuits.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. Laboratory classes	Grad Piotr, dr inż.