Subject programme

1. Subject name / subject module: **Modern Power Supply Systems**
1. Lecture language: **English**
2. 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**
   - Ftield or fields (implementation of effects standard): **Mechatronics**
3. 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:
4. 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				16	22	1,5																1,5
Part-time studies																						
Credit rigor				Graded assignment																		

5. 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	16
Preparation to laboratory classes	12
Independent study of the subject	20
Participation in an exam / graded assignment	-
Total student workload (TSW)	38
ECTS credits	1,5
* Student's workload related to trainings	30
Student's workload in classes requiring direct participation of academic teachers	16

6. 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.
7. 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 power supply devices and systems and to apply this knowledge in practice through the use of app**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_W08	**A student possesses adequate theoretical and practical knowledge on analog and digital circuits to design, prototype, and build high-efficiency power supply systems for control systems and robots**			
Skills				
K_U16	**A student has adequate skills to use appropriate methods, techniques, and tools - in accordance with the given specification - to design and build a prototype of a high-efficiency power supply system.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_U17	**A student has sufficient language skills to prepare documentation, using specialized vocabulary, and to give an oral presentation of an engineering project in the field of mechatronics.**			

K_U18	A student is able to take part in a debate to present and discuss the social, economic, and political impact of technology.			

8. 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
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)**

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

(Laboratory work)

1. The essentials of electric shock protection, earthing systems and RCDs (Residual-Current Devices);
2. Electric power generation and transmission;
3. Power network systems;
4. Three-phase electric power;
5. Voltage regulators, regulated power supplies;
6. Types of rectifiers. Types of rectifier filters;
7. Linear voltage regulators versus switching regulators;
8. Cooling methods for voltage regulators. Cooling systems for voltage regulators calculations and designing. How temperature affects mean time to failure (MTTF)?;
9. Introduction to modern power supply systems;
10. DC-DC step-up, step-down, step-up-and-down converters characteristics, testing and designing;
11. ATX power supply units characteristics and testing;
12. Buffer power supply units. Buffer power supply system designing;
13. Modern power supply units testing: short circuit protection testing, overload limits testing, efficiency testing;
14. Modern power supply designing.

10. Required teaching aids:

a. Lecture - multimedia projector

b. Laboratory classes - specialist laboratory

11. Literature:

a. Basic literature:

a. Scherz P., Monk S.; Practical electronics for inventors; ISBN 978-1-25-958754-2; McGraw - Hill Education 2016

b. Branko L. Dokić, Branko Blanuša; Power Electronics Converters and Regulators; Springer 2015

b. Supplementary literature:

a. Van Breussegem T., Steyaert M.; CMOS Integrated Capacitive DC-DC Converters; ISBN 978-1-4614-4280-6; Springer 2013

b. Wen-Wei Chen, Jiann-Fuh Chen; Control Techniques for Power Converters with Integrated Circuit; ISBN 978-981-10-7004-4; Springer 2018

c. Internet sources:

a. Texas Instruments; DC/DC switching regulators – Technical documents; https://www.ti.com/power-management/non-isolated-dc-dc-switching-regulators/technical-documents.html

b. Philips Semiconductors; Switched Mode Power Supplies; https://eclass.duth.gr/modules/document/file.php/TMA495/PHILIPS%20APPLICATIONS/PHILIPS%20SemiCond%20HB.pdf

c. Switch Mode Power Supply (SMPS) Topologies; http://ww1.microchip.com/downloads/en/appnotes/01114a.pdf

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

13. Teachers implementing particular forms of education:

Form of education	Name and surname
1. Lecture	
2. Laboratory classes	Grad Piotr, dr inż.
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	