Subject programme

1. Subject name / subject module: **Renewable Energy 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**
   - Ftield 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 Elżbieta, 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				27	36	2,5																2
Part-time studies																						
Credit rigor				Grader 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	27
Preparation to laboratory classes	23
Independent study of the subject	-
Preparation of final project	10
Participation in an exam / graded assignment	2
Total student workload (TSW)	63
ECTS credits	2,5
* Student's workload related to trainings	63
Student's workload in classes requiring direct participation of academic teachers	27

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 in the field of automation, electronics and electrical engineering, necessary to understand at an advanced level the complex dependencies of electricity generation using renewable sources and to apply this knowledge**	**Laboratory work**	**Inquiry methods**	**Student learning activities**
K_W08	**A student knows and understands selected specific issues in the field of automation, electronics and electrical engineering related to designing energy generation systems with the use of renewable sources and practical applications of this knowle**			
Skills				
K_U02	**A student is able to use his knowledge - to formulate and solve problems and perform tasks typical for professional activities in the industry of electricity generation systems using renewable resources.**	**Laboratory work**	**Inquiry methods**	**Student learning activities**

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 (3,5,4)	arithmetic mean (5,3,4) * 50%	2
Attendance	on 80% of all classes	80% * 5 -> 4 * 10%	0,4
Final project	bdb (5)	5 * 30%	1,5
Homeworks	dst, db, bdb (3,5,4)	arithmetic mean (5,3,4) * 10%	0,4
Final result			4,3
Grade		4,3/5 = 86%	**Db (4.0)**

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

(Laboratory work)

1. General principles of energy conversion. Renewable energy sources. Renewable energy potential;

2. Wind energy. Its conversion in wind turbine. Wind power station;

3. Biomass energy conversion systems;

4. Solar energy. Solar radiation conversion processes: photovoltaic conversion, solar thermal conversion, photoelectro-chemical conversion. Solar thermal electricity generators, solar power stations, solar collectors;

5. Geothermal energy;

6. Energy of water, hydro, tidal and wave energy conversion;

7. Electrochemical energy, fuel cells;

8. Integration of renewable energy sources to electrical power networks;

9. Economic problems. Choices, problems and opportunities.

11. Required teaching aids:

Lectere - multimedia projector

Laboratory classes - specialist laboratory

12. Literature:

a. Basic literature:

1. 758 /CDE European research spending for renewable energy sources Energy Market Authority

2. Beren Argetsinger, Keyes & Fox LLP, Benjamin Inskeep, EQ Research LLC: „Standards and Requirements for Solar Equipment, Installation, and Licensing and Certification A Guide for States and Municipalities" February 2017, U.S. Department of Energy

3. 765 /CDE "Biomas : green energy for Europe"

b. Supplementary literature:

1. Sorensen B.: Renewable energy conversion, transmission and storage. Elsevier, USA, 2007.
2. Spera D.: Wind turbine technology. ASME Press 2009.
3. Burton T.: Wind energy. John Wiley and Sons 2001 (Knowel Library Base).

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 Elżbieta, prof. dr hab. inż.
3. Training	
4. Project classes	
5. Workshop classes	
6. Simulation game	
7. Language classes	