GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Renewable energy sources, PG_00037308		
Field of study	Technical Physics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish Classes are conducted in Polish and English; in the case of foreign students, classes are conducted exclusively in English.
Semester of study	4	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Molecular Photophysics -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Piotr Grygiel	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	0.0	15

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	15	2.0	8.0	25

Subject objectives

Understanding the operation principles and use of basic renewable energy sources.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U09] uses technical literature in English	He uses specialist literature in English on issues related to renewable energy sources.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task
[K6_W02] has systematized knowledge of the basics of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and particle physics, solid-state physics, nuclear and elementary particle physics	Has structured knowledge of the fundamentals of physics (including mechanics, thermodynamics, electricity and magnetism, optics, atomic and molecular physics, solid state physics, nuclear physics and elementary particle physics) to the extent necessary for learning and understanding. the principles of operation and use of basic renewable energy sources.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – lecture

1. Fuel cells: principle of operation, types of fuel cells, fuel cell systems, including cogeneration systems.
2. Solar energy. The usage of solar energy for electricity generation (photovoltaic cells, solar thermal power stations). The usage of solar energy for heat generation (solar collectors, water and air heating systems).
3. Energy of wind. Conversion of wind energy in a wind turbine. Wind power plant, wind farms.
4. Geothermal energy. Methods of obtaining geothermal energy and its use. Heat pumps.
5. Biomass and biogas. Use of biomass for heat production.
6. Energy of water. Conversion of energy in a hydroelectric turbine. Types of hydroelectric power plants.

Prerequisites and co-requisites

Knowledge of a basic course in physics and electrochemistry.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Preparation and oral completion of a written essay on a selected topic.</td><td>50.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. E. Boeker, R. van Grondelle, Environmental Physics, second edition, John Viley & Sons, 1997

2. J. Larminie, A. Dicks, Fuel Cell Systems Explained, John Viley & Sons, 2003</td></tr>
<tr><td>Supplementary literature</td><td>1. S.A. Kalogirou, Solar Energy Engineering Processes and Systems, Elsevier Inc., 2014</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">1. Calculation of the Gibbs free energy of the fuel cell reaction.
2. The Butler-Volmer equation.
3. AFC type fuel cell.
4. DMFC type fuel cell.
5. PAFC type fuel cell.
6. MCFC type fuel cell.
7. SOFC type fuel cell.
8. Fuel cell power generation systems.
9. Solar radiation and its concentration.
10. The maximum power point of a photovoltaic cell and its tracking.
11. Tracking systems for photovoltaic installations.
12. Types of photovoltaic systems.
13. Parameters of flat plate solar collectors and their determination.
14. Determination of the optimum tilt angle of a solar collector.
15. Principle of operation, properties, construction and operational problems of vacuum tube collectors.
16. Wave energy.
17. Wave power plants.
18. Tidal energy.
19. Tidal power plants.
20. Biomass energy conversion.
21. Biomass power plants.
22. Geothermal energy.
23. Geothermal power plants.

It is possible to prepare a presentation on a topic of your choice, after consulting with the course instructor.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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