



## Subject card

Subject name and code	Renewable Energy Resources, PG_00039904						
Field of study	Mechanical Engineering, Mechanical Engineering						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2022/2023		
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	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Bartosz Dawidowicz				
	Teachers		dr inż. Bartosz Dawidowicz				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45		6.0		24.0	75
Subject objectives	Presentation of basic concepts, terms and information related to energy resources. Division and classification of renewable energy sources. Presentation of technology and physical phenomena occurring in various types of renewable energy sources. Theoretical foundations of the operation of energy conversion devices. Showing and discussing examples of renewable energy installations.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W09] possesses basic knowledge within the range of thermodynamics and fluid mechanics, construction and operation of heat generating devices, process equipment, including renewable energy sources, cooling and air conditioning		The student is able to make preliminary estimates and basic calculations for devices used in renewable energy sources		[SW1] Assessment of factual knowledge		
	[K6_U07] is able to design a typical construction of a mechanical device, component or a testing station using appropriate methods and tools, adhering to the set usage criteria		The student is able to design and select devices and elements of equipment for renewable energy installations.		[SU5] Assessment of ability to present the results of task		

Subject contents	<p>Lecture:</p> <p>Energy resources. Ocean and sea resources. Tidal energy. Wave energy. Osmotic energy. Ocean thermal energy conversion. Wind energy. Betz criterion. Aerogenerators. Hydro-power. Water turbines. Hydropower stations - types and characteristics. Geothermal energy. Dry rock and aquifer resources. Geothermal power stations and heat-generating plants. Solar energy. Solar collectors. Solar ponds. Solar "power tower". Solar "thermal tower". Photovoltaics.</p> <p>Laboratory:</p> <p>1. Investigation of a wind turbine. 2. Calculation and selection of wind turbines. 3. Testing of photovoltaic cells - determination of the current-voltage characteristics and efficiency of the module. 4. Calculation regarding the selection of photovoltaic modules for the installation. 5. Testing of photovoltaic cells - determination of the load characteristics. 6. Optimization of photovoltaic modules and installation equipment. 7. Investigation of a flat plate solar collector. 9. Calculation and selection of solar collectors. 5. Heat pump efficiency test. 10. Calculation of the heat pump's heat source. 11. Water turbines. 12. Determination of the power of hydroelectric power plants and selection of water turbines. 13. Hydroelectric power plants - types, operation, hydro-energetic devices. 14. Calculating the power of tidal and wave power plants. 15. Calculating the power of OTEC and osmotic power plants.</p>											
Prerequisites and co-requisites	Physics, thermodynamics, fluid mechanics, heat transfer											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="454 748 794 779">Subject passing criteria</th> <th data-bbox="794 748 1141 779">Passing threshold</th> <th data-bbox="1141 748 1482 779">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="454 779 794 810">Test</td> <td data-bbox="794 779 1141 810">56.0%</td> <td data-bbox="1141 779 1482 810">50.0%</td> </tr> <tr> <td data-bbox="454 810 794 842">Lab</td> <td data-bbox="794 810 1141 842">56.0%</td> <td data-bbox="1141 810 1482 842">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Test	56.0%	50.0%	Lab	56.0%	50.0%
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Recommended reading	Basic literature	<p>1. Mikielwicz J., Cieśliński J.T.: Niekonwencjonalne urządzenia i systemy konwersji energii. Maszyny Przepływowe pod red. E.S. Burki. Tom 24. IMP PAN, Ossolineum Wrocław 1999.</p> <p>2. Cieśliński J.T.: Niekonwencjonalne urządzenia i układy energetyczne. Przykłady obliczeń. Wyd. PG 1997.</p> <p>3. Lewandowski W.M.: Proekologiczne źródła energii odnawialnej. WNT W-wa, 2001. 4 Twidell J.W., A.D Weir: Renewable energy sources. London: Chapman and Hall 1990.</p> <p>4. Twidell J.W., A.D Weir: Renewable energy sources. London: Chapman and Hall 1990. 5. Boyle G.: Renewable Energy - Power for a Sustainable Future, Oxford University Press, The Open University, 1996.</p>										
	Supplementary literature	<p>Journals</p> <p>1. Czysta Energia, Energia i Recykling : gospodarka obiegu zamkniętego, ABRYŚ Sp. z o.o., miesięcznik, (<a href="http://energiairecykling.pl">http://energiairecykling.pl</a>),</p> <p>2. GLOBEnergia, GEOSYSTEM s.c., kwartalnik, (<a href="https://globenergia.pl">https://globenergia.pl</a>),</p> <p>3. Energetyka, SEP COSiW, miesięcznik, (<a href="https://elektroenergetyka.pl">https://elektroenergetyka.pl</a>).</p>										
	eResources addresses	<p>Adresy na platformie eNauzanie:</p> <p>Odnawialne źródła energii - Moodle ID: 29691  <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=29691">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=29691</a></p>										

Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"><li>1. Physical properties of renewable sources</li><li>2. OTEC system</li><li>3. Classification of hydro power plants and their advantages</li><li>4. Types of geothermal sources and scheme of the binary power plant</li><li>5. Features of wind/electricity generating systems</li><li>6. Solar constant</li></ol>
Work placement	Not applicable