



COURSE CARD

1. Basic information

Course name in English:	Alternative fuels	
Course name in Polish:	Paliwa alternatywne	
Number of hours:	30	
Type of course:	Elective course	
Form of course:	mixed forms (combination of lecture, seminar and laboratory)	
Code of course:		
Course leader:	<i>Katarzyna Pstrowska</i>	
Faculty of the course leader:	W3 Faculty of Chemistry	
Email address of the course leader:	katarzyna.pstrowska@pwr.edu.pl	
Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course):	Architecture and urban planning	<input type="checkbox"/>
	Automation, electronic, electrical engineering and space technologies	<input type="checkbox"/>
	Information and communication technology	<input type="checkbox"/>
	Biomedical engineering	<input type="checkbox"/>
	Chemical engineering	<input checked="" type="checkbox"/>
	Civil engineering, geodesy and transport	<input type="checkbox"/>
	Materials engineering	<input checked="" type="checkbox"/>
	Mechanical engineering	<input type="checkbox"/>
	Environmental engineering, mining, and energy	<input checked="" type="checkbox"/>
	Mathematics	<input type="checkbox"/>
	Chemical sciences	<input checked="" type="checkbox"/>
	Physical sciences	<input type="checkbox"/>
	Management and quality studies	<input type="checkbox"/>

2. Objectives

1. Understanding problems of manufacturing and using motor fuels including biofuels.
2. Knowing the physical and chemical properties of biofuels and their production methods in the industry.
3. Determination of biofuels properties using standardized analytical methods applied in the laboratory.
4. Understanding the relationships between operation of vehicles fuelled by alternative fuel and environmental issues.

3. Content

Detailed information about the course content, including topics and form of classes.

No.	Topic	Number of hours	Form of classes
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1	Gasoline& bioethanol	2	lecture
2	Diesel oil & biodiesel	2	lecture
3	Fuel additives for petroleum based fuels	2	lecture
4	Natural gas and LPG	2	lecture
5	Biogas – the fuel of future	2	lecture
6	Hydrogen energy	2	lecture
7	Renewable fuels – trends and forecasts	2	lecture
8	Oxford debate on alternative fuels	2	seminar
9	Transesterification of vegetable oils & preparation of transesterification catalysts	5	laboratory
10	Analysis of the properties of diesel fuel and its bio-components	5	laboratory
11	Analysis of the properties of gasoline and its bio-components	4	laboratory

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

1. Fundamentals of chemistry.
2. Ability to exercise independent laboratory tests, supported by elemental manual dexterity. Basic knowledge of preservation of health and safety in the laboratory.
3. Ability to do calculations, create graphs and prepare reports in any office software.

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

Symbol	Learning outcome	
	<i>KNOWLEDGE. Doctoral student knows and understands:</i>	
SzD_W3	the main trends in the development of the scientific or artistic disciplines covered in the curricula;	<input checked="" type="checkbox"/>
SzD_W4	research methodology;	<input checked="" type="checkbox"/>
SzD_W5	the rules for the dissemination of scientific results, including in open access mode;	<input type="checkbox"/>
SzD_W6	the fundamental dilemmas of modern civilization;	<input checked="" type="checkbox"/>
SzD_W7	the legal and ethical conditions of scientific activity;	<input type="checkbox"/>
SzD_W8	the economic and other relevant conditions of scientific activity;	<input type="checkbox"/>
SzD_W9	basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results.	<input type="checkbox"/>
	<i>SKILLS. Doctoral student is able to:</i>	
SzD_U2	use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular:	<input checked="" type="checkbox"/>



	- define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres;	
SzD_U3	communicate on specialised topics to the extent that they enable an active participation in the international scientific community;	<input checked="" type="checkbox"/>
SzD_U4	disseminate research results, including in popular forms;	<input type="checkbox"/>
SzD_U5	initiate debates and participate in a scientific discourse;	<input checked="" type="checkbox"/>
SzD_U6	be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment;	<input checked="" type="checkbox"/>
SzD_U7	plan and implement an individual or collective research or creative activity, including in an international environment;	<input type="checkbox"/>
SzD_U8	independently plan and act for one's own development and inspire and organize the development of others;	<input type="checkbox"/>
SzD_U9	plan classes or groups of classes and implement them using modern methods and tools.	<input type="checkbox"/>
<i>SOCIAL COMPETENCES. Doctoral student is ready to:</i>		
SzD_K3	fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way;	<input type="checkbox"/>
SzD_K4	maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection.	<input type="checkbox"/>

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Lecture – oxford debate on the proposed topic; Laboratory – report. final grade - average of the debate grade and the report grade.

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

Multimedia presentation (lectures), presentation & own work (seminar), Laboratory experiment & own work (laboratory)

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

PRIMARY LITERATURE:



- [1] Kułażyński Marek: Green fuels, Automotive Engineering, Wrocław University of Technology; 2011, pp.103.
- [2] Kułażyński Marek, Sroka Zbigniew J: Green fuels laboratory, Automotive Engineering, Wrocław University of Technology, 2011. pp. 76.
- [3] Kirk R. Smith: Biofuels, Air Pollution, and Health: A Global Review Springer Science & Business Media, 11 mar 2013 – pp 476
- [4] 2nd Edition Handbook of Alternative Fuel Technologies Edited By Sunggyu Lee, James G. Speight, Sudarshan K. Loyalka, CRC Press, 2015
- [5] Alternative Fuels Book The Future of Hydrogen, Third Edition By Michael Frank Horddeski, 3rd Edition First Published 2013, DOI <https://doi.org/10.1201/9781003151753>

SECONDARY LITERATURE:

- [1] Beata Narowska, Marek Kułażyński, Marcin Łukaszewicz. Sunflower oil as a substrate for biofuel production. w: Sunflower Oil: Interactions, Applications and Research. (red.) MD Monwar Hossain. NOVA Science Publishers, New York, 2017, s. 83-119
- [2] S. P. Srivastava, J. Hancsó, Fuels and Fuel Additives, John Wiley & Sons, 2014
- [3] R. Folkson, S. Sapsford (ed.); Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance. Towards Zero Carbon Transportation, 2nd Ed.; Elsevier; 2022.

9. Other remarks

Additional remarks, comments, (e.g., language of the course)

Course will be conducted in English.