



## COURSE CARD

### 1. Basic information

Course name in English:	New generation of feed and fertilizer technologies	
Course name in Polish:	Paszowe i nawozowe technologie nowej generacji	
Number of hours:	15	
Type of course:	Elective course	
Form of course:	seminar	
Code of course:	W03INC-SD0105S /CIQ100400S	
Course leader:	Mateusz Samoraj	
Faculty of the course leader:	W3 Faculty of Chemistry	
Email address of the course leader:	mateusz.samoraj@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, and electrical engineering	<input type="checkbox"/>
	Information and communication technology	<input type="checkbox"/>
	Biomedical engineering	<input checked="" type="checkbox"/>
	Chemical engineering	<input checked="" type="checkbox"/>
	Civil engineering and transport	<input 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 checked="" type="checkbox"/>
	Management and quality studies	<input type="checkbox"/>

### 2. Objectives

**C1** To acquaint PhD students with the mission of chemical and biological sciences in the development of modern sustainable agriculture

**C2** To acquaint the PhD students with the organization of the research and development cycle and its role in implementing process and product innovations in the production of agrochemicals

**C3** To acquaint the PhD students with new civilization challenges related to sustainable development, raw materials and energy problems in the chemical industry

**C4** To acquaint the PhD students with the principles and problems of the development of the innovative fertilizer industry in the EU and Poland

**C5** To acquaint PhD students with the possibilities of financing research and innovation programs

### 3. Content

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



No.	Topic	Number of hours	Form of classes
1	Introduction - chemical innovations in the development of sustainable agriculture: development of modern plant and breeding economy supported by safe for health and the environment chemical products	2	lecture
2	Macro and micronutrients in animal nutrition and field crops, vegetable and fruit growing, problem of phosphorus and nitrogen in the environment, effective use of fertilizer nitrogen / nitrogen use efficiency NUE /	3	seminar
3	Mineral and biological raw material resources for the production of fertilizers and feed, new raw material base (renewable raw materials)	2	seminar
4	Trends in the production and use of innovative fertilizers in sustainable agriculture (new generation fertilizers, foliar and seed fertilizers, controlled release fertilizers, stimulators and activators, fertilizing chelates)	3	seminar
5	Trends in the production and use of innovative feed and feed additives (innovations in feed production, functional food for animals, feed chelates, feed additives, specialized preparations for animals, premixtures, microbiological preparations)	3	seminar
6	Supercritical extraction, biosorption and bioaccumulation processes as an effective way of obtaining valuable ingredients for feed and mineral fertilizers	2	seminar

#### 4. Prerequisites

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

1. Basic knowledge of chemical technology and chemical sciences

#### 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 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 checked="" 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 checked="" 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: - 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;	<input type="checkbox"/>
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 checked="" 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 checked="" 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.

Presentation, seminar discussion

## 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, discussion, literature studies*

## **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] IFA International Fertilizer Association , World fertilizer use manual, Rome 2012
- [2] Ch.Hodge, R. Popovici “ Fertilizer production pollution control” M.Dekker , New York
- [3] International Fertilizer Association, Glossary of fertilizers terms, IFA,Paris,2013
- [4] European Fertilizer Manufactures Association, Forecast 2012-2022 of food, farming and fertilizer use I European Union, EFMA Brussels,2013
- [5] European Fertilizer Manufactures Assotiation, Fertilizer Production and Technology, EFMA,Brussel,2012
- [6] H.Górecki,Z.Dobrzański, K.Chojacka “Chemia dla rolnictwa” w: Misja nauk chemicznych pr.zb.pod red.B.Marcińca, Poznań, 2012
- [7] K.Chojancka,“Biosorption and bioacumulation” wed. Nova, New York 2010
- [8] REGULATION (EU) 2019/1009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019

### SECONDARY LITERATURE:

- [1] Scientific and technical journals
- [2] Patent Office Bulletin
- [3] Fertilizer Europe.com

## **9. Other remarks**

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