COURSE DESCRIPTION CARD - SYLLABUS

Course name
SUSTAINABLE MANUFACTURING IN CHEMICAL INDUSTRY

Course

Proposed by Discipline
Chemical Science
Type of studies
Doctoral School
Form of study
full-time

Year/Semester
II/4
Course offered in
English
Requirements
elective

Number of hours

Lecture
8

Tutorials
-

Projects/seminars
-

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Knowledge: A PhD student knows basic chemical processes performed on industrial scale and the principles of chemical production.

Skills: A PhD student can obtain information from literature, databases and other sources of chemical and environmental sciences, he/she can interpret them, draw conclusions, and formulate opinions.

Social competencies: A PhD student understands the need for further education and improvement of his/her professional and personal competences.

Course objective

Gaining knowledge of principles of sustainable manufacturing and implementation of these principles in chemical industry. Getting acquainted with the biorefinery concept and advances in biorefining.

Course-related learning outcomes

Knowledge

A PhD student who graduated from doctoral school knows and understands:

1) to the extent that enables revision of existing paradigms - global achievements, covering theoretical basis as well as general and selected specific issues, that are specific to scientific disciplines studied at the doctoral school, [P8S_WG/SzD_W01]
2) key developmental trends of science disciplines in which education takes place at the doctoral school, [P8S_WG/SzD_W02]
3) fundamental dilemmas of the contemporary civilization, including sustainable development, [P8S_WK/SzD_W05]
4) economic, legal, ethical and other vital conditions related to scientific activity. [P8S_WK/SzD_W06]

Skills

A PhD student who graduated from doctoral school can:

1) critically analyze and asses scientific research results, work of experts and other creative activities together with their contribution into knowledge development, [P8S_UW/SzD_U02]
2) take part in scientific discourse. [P8S_UW/SzD_U07]

Social competencies

A PhD student who graduated from doctoral school is ready to:

1) critically assess the achievements within a given scientific discipline. [P8S_KK/SzD_K01]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

PQF code	Methods for verification of learning outcomes	Assessment criteria
W01, W02, W05, W06	Test on e-learning platform	Percentage points - Grade 100-91 - 5.0 (very good) 90-81 - 4.5 (good plus) 80-71 - 4.0 (good) 70-61 - 3.5 (sufficient plus) 60-51 - 3.0 (sufficient) less than 51 - 2.0 (insufficient)
U02, U07	Academic discussion	No grades
K01	Academic discussion	No grades

Programme content

The objective of this course is to familiarize PhD students with the principles and assumptions underlying sustainable development. The course will also explore the range of knowledge, values and attitudes that facilitate environmentally sustainable decision-making supported by examples of technological case studies.

Course topics

The course topics cover:

- effective use of green technologies and processes in professional settings to minimize negative environmental impacts while conserving energy and natural resources
- five scopes of sustainable manufacturing
- methodology of carbon footprint calculation
- sustainable manufacturing of safe chemical products
- transformation of biomass into fuels and chemicals
- current and future scenarios for fuels and chemicals
- potential raw materials for chemical processes
- the main processing technologies and their commercial potential
- concept of biorefinery and the opportunities offered by this approach

Teaching methods

Lecture, discussion.

Bibliography

Basic

1. E.A. Cudney, S.L. Furterer, C.M. Laux, G.S. Hundal, Lean Sustainability. A Pathway to a Circular Economy, 1st Edition, CRC Press, Boca Raton, 2023. https://doi.org/10.1201/9780429506192
2. M. Berners-Lee, How Bad Are Bananas? The carbon footprint of everything, Profile Books, London 2020.
3. K.R. Hakeem, S.A. Bandh, F.A. Malla, M.A. Mehmood, Environmental Sustainability of Biofuels. Prospects and Challenges, Elsevier, The Netherlands 2022. https://doi.org/10.1016/C2020-0-04172-1
4. A. Pandey, R. Höfer, C. Larroche, M. Taherzadeh, K.M. Nampoothiri, Industrial Biorefineries and White Biotechnology, Elsevier, 2015 (e-book).

Additional

1. B. Gates, How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need, Penguin Books Ltd., London 2022.
2. Kuila, M. Mukhopadhyay, Biorefinery Production Technologies for Chemicals and Energy, John Wiley & Sons, 2020 (e-book).
3. A. Pandey, R.D. Tyag, S. Varjani, Biomass, Biofuels, Biochemicals - Circular Bioeconomy - Current Developments and Future Outlook, Elsevier, 2021 (e-book).

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	8	0
Doctoral student's own work (literature studies, preparation for the final test) [1]	42	2,0

[1] delete or add other activities as appropriate