# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of electrochemical technology - Advanced electrochemical oxidation processes [S1TOZ1>PTEzpeu]

## Course

Field of study
Circular System Technologies

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

## Number of hours

Lecture
0

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

## Number of credit points

1,00

## Coordinators

dr inż. Tomasz Rozmanowski
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## Lecturers

## Prerequisites

Has basic knowledge of mathematics and physical chemistry as well asuses basic techniques on a laboratory scale. The student understands the need for continuous training and improvement of their professional and personal competences.

## Course objective

To acquaint students with advanced processes of electrochemical oxidation with particular emphasis on the mechanisms of the course of reactions,design of reactors and practical use of the above mentioned processes.

## Course-related learning outcomes

Knowledge:
1. has knowledge of physics and chemistry to understand the phenomena and changes occurring in technological and environmental processes - [k_w02],
2. has systematized, theoretically founded knowledge of inorganic, organic, physical and analytical chemistry - [k_w04 ],

3. has basic knowledge of the neutralization and recovery processes of industrial and municipal waste - [k_w07 ],
4. has knowledge of the physical and chemical basis of unit operations of circular systems technologies- [k_w22 ].

Skills:
1.is able to obtain information from literature, databases and other sources related to circular systems technologies, also in a foreign language, integrate them, interpret them, draw conclusions and formulate opinions - [ k_u01],
2. plans, selects equipment and scientific apparatus, carries out research, analyzes the results and formulates conclusions - [ k_u03],
3. can plan and carry out simple experiments related to circular systems technologies, using both experimental and simulation methods, and can interpret their results and formulate conclusions- [ k_u21].

Social competences:
1. in every situation behaves professionally, takes responsibility for decisions made in connection with professional duties, acts in accordance with moral principles and the principles of professional ethics - [k_k01],
2. demonstrates independence and inventiveness in individual work, effectively cooperates in a team, playing various roles in it; objectively assesses the effects of his own work and that of team members- [k_k02],
3. objectively assesses the level of his knowledge and skills, understands the importance of improving professional and personal competences adequately to the changing social conditions and the progress of science - [k_k05],
4. demonstrates care and full responsibility for the specialist equipment entrusted to him for testing - [k_k07].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
The skills acquired during the laboratory classes are verified on the basis of written tests. In the case of introducing the remote teaching mode, the credit will take the form of a tests posted on the e-Kursy platform or on the basis of an oral test using e-meting platform.

## Programme content

1.Electrode materials used in advanced electrochemical oxidation processes.
2. Kinetics of electrochemical oxidation processes.
3. Indirect and direct methods of electrochemical oxidation.
4. Practical use of advanced electro-oxidation processes.
5. Electrochemical oxidation supported by chemical and photochemical processes.
6. Designs solutions of electrochemical reactors and their influence on the course of electrochemical oxidation processes.

## Teaching methods

Laboratory exercises, didactic discussion.

## Bibliography

Basic
1. A. Kisza – Elektrochemia cz. I i II (Jonika i Elektrodyka) WNT, W-wa, 2001.
2. R. Dylewski, W. Gniot, M. Gonet, Elektrochemia przemysłowa, Wyd. Politechniki Śląskiej, 1999.
3. A. Ciszewski, Technologia chemiczna. Procesy elektrochemiczne, Wyd. Politechniki Poznańskiej, 2008.
4. F. C. Moreira, R. A.R. Boaventura, E. Brillas, V. J.P. Vilar, Electrochemical advanced oxidation processes: A review on their application to synthetic and real wastewaters,Applied Catalysis B: Environmental 202 (2017) 217–261.
5. S.A. Karolewski, Zaawansowane utlenianie odcieków składowiskowych – przegląd metod, Politechnika Gdańska 2, (2015).

6. L. Dąbek, Zastosowanie sorpcji i zaawansowanego utleniania do usuwania fenoli i ich pochodnych z roztworów wodnych, Annual Set The Environment Protection, Rocznik Ochrona Środowiska, Volume/Tom 17. Year/Rok 2015, 616–645.
Additional
1. R. Dylewski, W. Gnot, M. Gnot - Elektrochemia Przemysłowa - Wybrane Procesy i Zagadnienia, 1999;
2. V. Katheresan, J. Kansedo, S. Lau, Efficiency of various recent wastewater dye removal methods: A review, Journal of Environmental Chemical Engineering, Wolumin 6 (2018), Strony 4676–4697
3.L. Szpyrkowicz, C. Juzzolino, S. Kaul, A Comparative study on oxidation of disperse dyes by electrochemical process, ozone, hypochlorite and fenton reagent, Water Research, Wolumin 35 (2001), Strony 2129-2136 .
4. Y. Kong, Z. Wang, Y. Wang, J. Yuan, Z. Chen, Degradation of methyl orange in artificial wastewater through electrochemical oxidation using exfoliated graphite electrode, New Carbon Materials, Wolumin 26 (2011), Strony 459-464.
5. R. Dylewski, Metody elektrochemiczne w inżynierii środowiska, Wydawnictwo Politechniki Śląskiej Gliwice 2000.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 25 | 1,00 |
| Classes requiring direct contact with the teacher | 16 | 0,50 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 9 | 0,50 |