# COURSE DESCRIPTION CARD - SYLLABUS

Course name
ENVIRONMENTAL IMPACT OF XENOBIOTICS [S5NC>OKS]

## Course

Proposed by Discipline
–

Year/Semester
3/6

Level of study
Doctoral School

Course offered in
English

Form of study
full-time

Requirements
elective

## Number of hours

Lecture
4

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

## Number of credit points

1,00

## Coordinators

dr hab. inż. Anna Parus
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## Lecturers

## Prerequisites

The course is designed for doctoral students with a background in environmental sciences, chemistry, biology, or related disciplines. Participants are expected to have: - Basic knowledge of general and organic chemistry, - Familiarity with fundamental concepts of toxicology and microbiology.

## Course objective

The aim of the course is to provide doctoral students with an advanced understanding of xenobiotics as environmental contaminants. The course focuses on the processes that govern their fate in aquatic and soil systems, their biological and toxicological effects, and contemporary approaches to mitigation and remediation. Special emphasis is placed on developing interdisciplinary perspectives that integrate chemical, environmental, and biomedical sciences in addressing complex environmental challenges

## Course-related learning outcomes

Knowledge:
- Knows classification, sources, and pathways of xenobiotics (P8S_WG / SzD_W01).
- Understands environmental fate processes (sorption, degradation, bioaccumulation) (P8S_WG / SzD_W02).
- Has knowledge of toxicological mechanisms of xenobiotics, including endocrine disruption (P8S_WG / SzD_W03).

- Understands technological solutions for removal and prevention (P8S_WG / SzD_W04).

Skills:
- Can critically analyze environmental case studies of xenobiotic contamination (P8S_UW / SzD_U01).
- Can evaluate potential impacts of xenobiotics on ecosystems and health (P8S_UW / SzD_U02).
- Can propose remediation or preventive strategies in interdisciplinary contexts (P8S_UW / SzD_U03).

Social competences:
- Demonstrates awareness of global environmental challenges (P8S_KK / SzD_K01).
- Recognizes ethical responsibility of scientists and engineers in relation to anthropogenic contaminants (P8S_KK / SzD_K02).

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Assessment methods and criteria:
- Final exam (written, open questions + problem analysis).

2. Grading scale in accordance with that used at Poznań University of Technology.

3. To obtain a positive grade, 50% of the points must be achieved.

## Programme content

The course provides doctoral students with an in-depth understanding of xenobiotics in the environment, combining chemical, biological, and engineering perspectives.

The program covers:

1. Introduction to xenobiotics – definitions, classification schemes, main sources, and pathways of entry into aquatic and terrestrial environments.

2. Environmental fate of xenobiotics – physicochemical properties, partitioning, sorption, transformation, degradation, and interactions with biotic and abiotic factors.

3. Biological and toxicological impacts – mechanisms of toxicity, ecotoxicological assessments, biomarkers of exposure and effect, and implications for human and ecosystem health.

4. Technological challenges and perspectives – advanced remediation strategies, applications of green chemistry, biotechnological and engineering approaches, and an overview of regulatory and legal frameworks.

## Course topics

- Lecture 1: Introduction to xenobiotics – definition, classification, sources, environmental entry.
- Lecture 2: Environmental fate – physicochemical and biological processes, interactions.
- Lecture 3: Biological and toxicological impacts – ecotoxicology, biomarkers, human health.
- Lecture 4: Technological challenges and perspectives – remediation, green chemistry, legal frameworks.

## Teaching methods

Teaching methods:

- Lectures with multimedia presentations.
- Case studies analysis.
- Group discussions.

## Bibliography

Core / Recommended Reading:
1. Walker, C.H., Sibly, R.M., Hopkin, S.P., & Peakall, D.B. (2012). Principles of Ecotoxicology. 4th ed. CRC

Press.

2. Hutzinger, O. (Ed.). (2011). The Handbook of Environmental Chemistry. Springer.

3. Schwarzenbach, R.P., Gschwend, P.M., & Imboden, D.M. (2017). Environmental Organic Chemistry. 3rd ed. Wiley.

4. Newman, M.C. (2019). Fundamentals of Ecotoxicology: The Science of Pollution. 5th ed. CRC Press.

Supplementary Reading:
Recent peer-reviewed articles from journals such as Environmental Science & Technology, Chemosphere, Science of the Total Environment, Environmental Pollution, Journal of Hazardous Materials.

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 25 | 1,00 |
| Classes requiring direct contact with the teacher | 4 | 0,00 |
| Doctoral student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) | 21 | 1,00 |