



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Environmental Chemistry [N1IŚrod2>CHŚ]

### Course

Field of study

Environmental Engineering

Year/Semester

1/2

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

part-time

Requirements

compulsory

### Number of hours

Lecture

20

Laboratory classes

20

Other

0

Tutorials

20

Projects/seminars

0

### Number of credit points

6,00

### Coordinators

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### Lecturers

### Prerequisites

1. Knowledge: Knowledge of chemistry at the level of secondary school-leaving examination and general chemistry lecture cycle. 2. Skills: Solving equations and systems of algebraic equations, formulating chemical, physicochemical and environmental problems in the language of mathematics, solving simple differential and logarithmic equations. 3. Social competencies: Awareness of the need to constantly update and supplement knowledge and skills.

### Course objective

The aim of education within this subject is to consolidate and expand students' knowledge of environmental chemistry necessary to further study environmental engineering. The student will become familiar with the factors affecting environmental reactions. Understand the importance of chemical balance and kinetics for the processes taking place in the world around us. As part of the subject, he will acquire the ability to design and conduct laboratory experiments, and work out the results. Ability to write an independent problem in environmental chemistry and physical chemistry based on literature sources.

### Course-related learning outcomes

Knowledge:

1. Student has basic knowledge in the field of ecology and environmental chemistry useful for formulating and solving simple tasks in the field of environmental engineering.
2. Has ordered, theoretically founded general knowledge covering key issues in environmental chemistry.
3. Has detailed knowledge related to: assessment of water pollution, water protection, sanitary chemistry.

#### Skills:

1. Student is able to obtain information on chemical topics from literature, databases and other properly selected sources.
2. Is able to formulate and solve engineering tasks in the field of environmental engineering to see their systemic and non-technical aspects and the need to apply the principles of sustainable development.

#### Social competences:

1. Student is aware of the responsibility for making decisions.
2. Is aware of the non-technical aspects and effects of engineering activities, including its impact on the environment.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

#### Lecture:

1-part written final exam, duration: 45 minutes, exam includes checking skills (2 tasks), checking knowledge (3 questions).

In addition, continuous assessment for all classes (rewarding activity).

The possibility of obtaining additional points for the activity in the classroom, especially for:

- reporting any confusion conducting
- propose other ways of solving problems;
- assistance in the improving teaching materials;
- identifying opportunities to improve the teaching process.

#### Auditorium exercises:

3 mini tests.

#### Laboratory exercises:

Written entrance tests before each exercise.

Preparation and individual defense of reports.

Continuous assessment in every class (rewarding activities).

Grading Scale. Scale of written evaluations:

50% - 60% sufficient

61% - 70% positive plus

71% - 80% good

81 - 90% good plus

91 - 100% very good

### Programme content

#### Lecture:

1. Electrolytic dissociation.
2. Redox. pH.
3. Phase boundary. Liquid surface. Sorption processes. Chemical, physical and ion exchange adsorption. Adsorption on the liquid-gas, liquid-liquid, liquid-solid boundary. Surface of solids, adsorption on the surface of solids. Adsorption isotherms, influence of various factors on the adsorption process
4. Electrical phenomena at the solid-solution phase boundaries. Colloids. Types of colloids. Construction of the electric double layer, surface potential, electrokinetic potential.
5. Coagulation. Coagulation mechanism. Types of coagulants. Stability of lyophilic and lyophobic colloids. Flocculation. Suspensions, sedimentation analysis. Foams and emulsions.
6. Corrosion phenomenon. Types of corrosion. Corrosion mechanism. Ways to prevent corrosion.

#### Auditorium exercises:

1. Dissociation.
2. Ion product.
3. pH, pH of natural waters.

4. Redox reactions.
5. Water alkalinity, water acidity, carbon dioxide, water corrosivity, water hardness.
6. Dissolved oxygen, BZT5, COD.
7. Salt hydrolysis, solubility product.

Laboratory exercises:

1. Introduction, general health and safety rules in chemical laboratories, discussion of basic glass and laboratory equipment, utilization of reagents, safety data sheets, standards, development of results, error analysis, etc.
2. pH and acidometry (titration), physical properties, e.g. conductivity, color, turbidity, taste, smell, temperature, phosphates, alkalinity, hardness, calcium, magnesium (types, calculations), manganese, acidity, carbon dioxide (forms, balance graph), suspensions, dissolved bodies, dry residue, loss after roasting, ammonium nitrates, nitrites, nitrates, iron with phenanthroline (general and II), oxidation, oxygen (Winkler method + sensor).
4. Soil and waste quality (compost) - assessment of salinity and acidification, content of humus.

## Course topics

none

## Teaching methods

Informative lecture, lecture with multimedia presentation, problem lecture.

Auditorium exercises: problem method, solving tasks.

Laboratory exercises: experiment method, practical exercises.

## Bibliography

Basic:

1. Whittaker A.G., Mount A.R., Heal M.R., Krótkie wykłady, Chemia fizyczna, PWN S.A., W-wa 2003.
2. Sienko M.J., Plane R.A., Chemia podstawy i zastosowania, WNT, W-wa, 1999.
3. Szperliński Z., Chemia w ochronie i inżynierii środowiska, tomy 1-3, Oficyna Wydawnicza PW, W-wa 2002
4. B.i E. Gomółkowie, Ćwiczenia laboratoryjne z chemii wody, Oficyna Wydawnicza Politechniki Wrocławskiej, 1998
5. L. Gajkowska - Stefańska i inni, Laboratoryjne badania wody, ścieków i osadów ściekowych, część I i II, Oficyna Wydawnicza Politechniki Warszawskiej, 2007

Additional:

1. Cox P.A., Krótkie wykłady. Chemia nieorganiczna, PWN S.A., W-wa 2003.
2. Cox P.A. Krótkie wykłady. Chemia organiczna, PWN S.A., W-wa 2003
3. Pauling L., Pauling P., Chemia, PWN, W-wa, 1997
4. Lee J.D., Związła chemia nieorganiczna, PWN, W-wa, 1994.
5. Dojlido J.R.: Chemia wód powierzchniowych, Wydawnictwo Ekonomia i Środowisko, Białystok, 1995

## Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	90	3,50