COURSE DESCRIPTION CARD - SYLLABUS

Course name

Environmental Chemistry

Course

Field of study

Environmental Engineering

Year/Semester

1 / 2

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

30

Other (e.g. online)

Tutorials

30

Projects/seminars

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

dr inż. Dobrochna Ginter-Kramarczyk

email: dobrochna.ginter-kramarczyk@put.poznan.pl

tel. 616653496

Faculty of Environmental Engineering and Energy

Berdychowo 4, 61-131 Poznań

Responsible for the course/lecturer:

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tel. 616653496

Faculty of Environmental Engineering and Energy

Berdychowo 4, 61-131 Poznań

Prerequisites

1. Knowledge:

Knowledge of chemistry at the level of secondary school-leaving examination and general chemistry lecture cycle.

2. Skills:

The 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:

The 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. The 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 (obtained during the lecture) - [KIS_W02]

2. The student has ordered, theoretically founded general knowledge covering key issues in environmental chemistry (obtained during the lecture - [KIS_W03]

3. The student has detailed knowledge related to: assessment of water pollution, water protection, sanitary chemistry. (obtained during the lecture) - [KIS_W04]

Skills

1. The student is able to obtain information on chemical topics from literature, databases and other properly selected sources. (obtained during laboratory exercises) - [KIS_U03]

2. The student 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; (obtained during laboratory exercises) - [KIS_U05]

Social competences

1. The student is aware of the responsibility for making decisions (obtained during laboratory exercises) - [KIS_K03]

2. The student is aware of the non-technical aspects and effects of engineering activities, including its impact on the environment; (obtained during lecture and laboratory exercises) - [KIS_K01]

3. - [-]

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 in each class (rewarding activities);

Auditorium exercises:

- 3 mini tests

- final test (1.5 hours)

Laboratory exercises:

- written entrance tests before each exercise;

- preparation and individual defense of reports;

- continuous assessment in every class (rewarding activities); (

Getting extra points for activity during classes, especially for:

- signaling mistakes and ambiguities leading lecturers and exercises;

- suggesting alternative ways of solving tasks;

- help in improving teaching materials;

- indicating possibilities of improving the didactic process.

Scale for written work:

50% - 60% sufficient

61% - 70% satisfactory plus

71% - 80% good

81 - 90% a good plus

91 - 100% very good

Programme content

Lecture:

Electrolytic dissociation. Redox. pH. 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. Electrical phenomena at the solid-solution phase boundaries. Colloids. Types of colloids. Construction of the electric double layer, surface potential, electrokinetic potential. Coagulation. Coagulation mechanism. Types of coagulants. Stability of lyophilic and lyophobic colloids. Flocculation. Suspensions, sedimentation analysis. Foams and emulsions. Corrosion phenomenon. Types of corrosion. Corrosion mechanism. Ways to prevent corrosion.

Laboratories:

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., 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), soil and waste quality (compost) - this is still to be worked out but it is the chemistry of the environment and not only water and sewage, assessment of salinity and acidification, content of humus

Auditorium exercises:

Oxidation and oxygen dissolved, solving tasks that take into account issues arising from water, sewage and air chemistry: dissociation, ion product, ion product of water, pH, pH of natural waters, redox reactions, water alkalinity, water acidity, carbon dioxide, water corrosivity, water hardness, dissolved oxygen, law Henry-Dalton, percentage of water saturation with oxygen, BZT5, COD, TOC, water salinity (calculating the impact of the use of reagents on the increase in salinity), the need for biogens for biodegradation of pollutants, precipitation reactions, chemical treatment of exhaust gases, loads, concentrations, degree of purification, allowable load receiver

Teaching methods

Informative lecture, lecture with multimedia presentation, problem lecture; laboratories: exercise method, problem method, case study, measurement, observation, experiment.

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., Zwięzła 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	6,0
Classes requiring direct contact with the teacher	90	3,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam) [1]	60	2,5

[1] delete or add other activities as appropriate