COURSE DESCRIPTION CARD - SYLLABUS

Course name

Modelling of pollutants spread [S1TOZ1>MPRsZ]

Course

Field of study
Circular System Technologies

Year/Semester
4/7

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
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge in the field of: - basic physicochemical phenomena and processes occurring in the natural environment, - issues of generating environmental pollution in industrial processes, - fluid mechanics. Ability to use software for data analysis. Readiness to make decisions and cooperate within a specified team. Awareness of the need of lifelong learning.

Course objective

Acquiring the knowledge about the spread of pollutants in the environment, with particular emphasis on surface and ground waters. Acquiring the skills of analytical description of these processes and learning about selected computer and engineering (expert) models of pollutant transport prediction.

Course-related learning outcomes

Knowledge:

1. the student knows the analytical description of the processes of pollutants spread in the environment (air, water) [k_w01, k_w02, k_w09].
2. the student knows the limitations of mathematical models concerning the prediction of pollutant transport in the environment [k_w01, k_w09].

3. the student knows the rules for assessing the correctness of the model and prediction errors [k_w01, k_w09].
4. the student knows the criteria for assessing the share of individual pollution emission sources and their impact on the environment [k_w02, k_w08].

Skills:
1. the student is able to use the software for modeling the processes of pollution spread [k_u02, k_u19, k_u22].
2. the student is able to choose a mathematical model based on the available data from the environment [k_u01, k_u12].
3. the student is able to assess the correctness of the model and errors in predicting the transport of pollutants based on its application [k_u01, k_u12].
4. the student is able to interpret the results of the modeling procedure in relation to specific environmental and technological conditions [k_u21, k_u22].
5. the student is able to plan and organize work individually and in a group [k_u08].
6. based on the acquired knowledge, the student is able to prepare an independent or team project/report on the performed tasks and prepare multimedia presentation [k_u15].

Social competences:
1. the student demonstrates independence and inventiveness in individual work, as well as effectively interacts in a team, playing various roles in it; objectively assesses the effects of his own work and that of team members [k_k02].
2. the student supports the idea of harmonious, global civilization and economic development, promoting the principles of circular economy, sustainable development and rational management of natural environment resources on a local and global scale [k_k09].
3. the student is aware of the negative impact of human activity on the state of the environment and actively counteracts its degradation [k_k10].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture - written test; evaluation criterion: 3 - 50.1%-70.0%; 4 - 70.1%-90.0%; 5 - od 90.1%.
Project - performing an individual project task and passing an oral assessment of the submitted project, consisting of open questions related to the subject of the project. Passing threshold: 51% of points from the oral answer and correctness of the prepared project.

Programme content

1. Lecture
Explaining the mechanisms of the spread of pollutants in the atmosphere, stagnant and flowing waters. Introduction to engineering issues of methods of solving pollution transport prediction problems. The concept of the mixing zone in terms of water and air quality criteria. Mixing processes in the atmosphere and the water environment. Hydrodynamic phenomena occurring in the near-field and far-field mixing zones. Stable/unstable emission conditions. Types of emitters. Overview and selection rules of appropriate mathematical models.
2. Project
Getting acquainted with the concept of software for modeling pollutant transport processes (CORMIX, Visual Plumes, OpenFOAM). Solving practical issues regarding the spread of pollutants in the environment with the use of selected software that will be the basic tool for the preparation of the project task.

Teaching methods

Lecture - multimedia presentation.
Project - multimedia presentation illustrated with examples demonstrated with the use of computer software and practical exercises with the application of modelling software.

Bibliography

Basic

1. K. Rup, Procesy przenoszenia zanieczyszczeń w środowisku naturalnym, Wydawnictwo Naukowo-Techniczne, Warszawa 2015.
2. J. Sawicki, Migracja zanieczyszczeń, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2007.
3. G.H. Jirka, R.L. Doneker, S.W. Hinton, User"s manual for CORMIX: A Hydrodynamic model and decision support system for pollutant discharges into surface waters, US EPA 1996.
4. W.E. Frick, P.J.W. Roberts, L.R. Davis, J. Keyes, D.J. Baumgartner, K.P. George, Dilution models for effluent discharges (Visual Plumes), US EPA 2003.
5. A. Mohammadian, H.K. Gildeh, I. Nistor, CFD modelling of effluent discharges: A review of past numerical studies, Water, 2020, 12, 856, doi:10.3390/w12030856.
Additional
1. Z. Orzechowski, J. Prywer, R. Zarzycki, Mechanika płynów w inżynierii środowiska, WNT, Warszawa 1997.
2. M.T. Markiewicz, Podstawy modelowania rozprzestrzeniania sięzanieczyszczeń w powietrzu atmosferycznym, Oficyna Wydawnicza Politechniki Warszawskiej 2004.
3. P. Holnicki-Szulc, Modele propagacji zanieczyszczeń atmosferycznych w zastosowaniu do kontroli i sterowania jakościąśrodowiska, Akademicka Oficyna Wydawnicza EXIT, Warszawa 2006.
4. R.A. Falconer, Review of modelling flow and pollutant transport processes in hydraulic basins, w: Water pollution: modelling, measuring and prediction, Springer, 1991, 3-23.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	38	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	37	1,50