COURSE DESCRIPTION CARD - SYLLABUS

Course name
Modeling and simulations in Environmental Engineering II [N2IŚrod2-ZwCKiOP>MII]

Course

Field of study
Environmental Engineering

Year/Semester
2/3

Area of study (specialization)
Heating, Air Conditioning and Air Protection

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
8

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

dr inż. Andrzej Górka
andrzej.gorka@put.poznan.pl

dr inż. Karol Bandurski
karol.bandurski@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge about Windows operating system. Basics of building physics and heating systems (hygrothermal properties of buildings, operation principles of heating systems). Basics of thermodynamics and fluid mechanics (heat and mass transfer, laminar and turbulent fluid flow). Spatial imagination, ability to edit and create technical drawings using CAD / CAM software. Ability to work in a team. Awareness of the constant need to update and supplement one's knowledge and skills.

Course objective

Learning the methods and computer programs used for computer modeling and simulation in the field of environmental engineering

Course-related learning outcomes

Knowledge:
Methodology of static and dynamic energy modeling of buildings and thermal systems.

Numerical modeling methodology for typical heat- and fluid flow problems considered in the field of Environmental Engineering.
Fundamentals of Integrated Design Process.
The latest computer programs used for modeling and simulation in Environmental Engineering.

Skills:
Student can indicate correct modeling method for solving clearly defined technical problem.
Student can state basic assumptions and define boundary conditions necessary to build valid model for specific numerical simulation.
Student can use specific modeling/simulation software.

Social competences:
Awareness of the need to constantly acquire and expand one's knowledge in order to competently pursue the career in engineering.
Awareness of responsibility associated with participation in complex engineering projects.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratories: evaluation of the tasks performed in class. Perform the basic scope of each task presented.

Programme content

Learning selected tools for advanced simulation analysis of environmental engineering problems.

Course topics

Laboratories:
Numerical simulation of air flow through ventilation damper (CFD).
Multi-zone energy analysis of a building (TRNSYS).
Energy system analysis (TRNSYS).

Teaching methods

Laboratories: multimedia presentation and practical simulation tasks performed by students.

Bibliography

Basic:
Training materials provided by software developers.
Hensen, J. L. M. & Djunaedy, E., Building simulation for making the invisible visible - air flow in particular, https://www.researchgate.net/publication/254892279_Building_simulation_for_making_the_invisible_visible_-_air_flow_in_particular
Lain, M., Bartak, M., Drkal, F., & Hensen, J. L. M., Use of computer simulation for the evaluation of low energy cooling in the Czech Republic, https://www.researchgate.net/publication/252129995_Use_of_computer_simulation_for_the_evaluation_of_low_energy_cooling_in_the_Czech_Republic
IBPSA Education Webinars Series 1:
https://www.youtube.com/playlist?list=PLX95PEAoM5YPEdIenaZAarVNcvUBmEBC5
IBPSA Education Webinars Series 3:
https://ibpsa.org/collection/ibpsa-education-webinars-series-3-2021-22/
Górka A., Bandurski K., Szczechowiak E., Budynki efektywne energetycznie - zintegrowane metody symulacji i projektowania, (63 Konferencja Naukowa Komitetu Inżynierii Lądowej i Wodnej PAN oraz Komitetu Nauki PZITB, Krynica 2017), Warszawa 2017, ISBN 978-83-249-8485-5

Additional:
Beausoleil-Morrison I., Fundamentals of Building Performance Simulation, Routledge, 2020
Building Performance Simulation for Design and Operation, red. J. L. M. Hensen, R. Lamberts, Son Press, 2011, 2019
Ratajczak K., Bandurski K., Płóciennik A., Incorporating an atrium as a HAVC element for energy consumption reduction and thermal comfort improvement in a Polish climate, Energy and Buildings

(2022)
Bandurski et al., The Green Structure for Outdoor Places in Dry, Hot Regions and Seasons-Providing Human Thermal Comfort in Sustainable Cities, Energies (2020)
Bandurski K., Mielczyński T., Koczyk H., Thermal comfort and energy consumption of the ecological house - simulation analysis of DOMTRZON, Technical Transactions - 2014, nr 3-B (8)

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	8	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	17	0,50