SZKOŁA GŁÓWNA GOSPODARSTWA WIEJSKIEGO

Groundwater and Soil Protection

Educational subject description sheet

Basic information

Field of study Course Offer for exchange students - second cycle studies, including uniform master studies (MA programmes) **Speciality** - **Organizational unit** Course Offer for exchange students **Study level** second cycle studies, including uniform master studies (MA programmes) **Study form** full-time studies **Education profile** General academic	**Didactic cycle** 2024/25 **Subject code** PWMPWM2S_D.B100000K.03757.24 **Lecture languages** english **Mandatory** Elective subjects **Block** Major subjects **Disciplines** Environmental engineering, mining and energy

Coordinator	Mateusz Grygoruk
Teacher	Mateusz Grygoruk

Period Winter semester	**Examination** Pass with grade **Activities and hours** Lecture: 10 Project exercises: 20	**Number of ECTS points** 2

Goals

Code	Goal
C1	The aim of the course is to acquaint students with the principles of groundwater flow and the role of infiltration through different soil types in shaping groundwater resources as well as to familiarize students with theoretical and practical aspects of the groundwater flow modelling. The course consists of mathematical basis of the modelling theory and the model setup, execution, calibration and the result analysis. In the practical part of the course, the MODFLOW 2005 algorithm. The model will be used to test possibilities of land management as a source of problems in groundwater and soil protection.

Entry requirements

Advanced knowledge on GIS (preferably ESRI ArcGIS 10 or QGIS), Hydrogeology and Hydrological processes, knowledge on groundwater recharge, base flow and evapotranspiration as well as soil types and their role in shaping infiltration processes.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	construction, principle of operation and design of selected types of surface and groundwater intakes.		Project, Report
W2	principles of groundwater flow.		Project, Report
W3	role of soils in groundwater recharge and infiltration processes		Project
Skills – Student can:			
U1	groundwater model development, execution, calibration and application in solving real-life problems.		Report
U2	develop a simple groundwater flow model.		Project
Social competences – Student is ready to:			
K1	work independently as well as in the team.		Presentation

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	The course consists of mathematical basis of the modelling theory and the model setup, execution, calibration and the result analysis. In the practical part of the course, the MODFLOW 2005 algorithm. The model will be used to test possibilities of land management as a source of problems in groundwater and soil protection.	W1, W2, W3, U1, U2, K1	Lecture, Project exercises

Course advanced

Activities	Methods of conducting classes
Lecture	Lecture, Presentation, Problem solving
Project exercises	Case study

Activities	Examination method	Percentage
Lecture	Presentation	40%
Lecture	Project	30%
Project exercises	Report	30%

Activities	Credit conditions
Lecture	1. A complete groundwater flow model project along with preliminary calibration and sensitivity analysis results and scenario analyses, documented by a final report (60%); 2. Presentation of the research outcome (40%)
Project exercises	1. A complete groundwater flow model project along with preliminary calibration and sensitivity analysis results and scenario analyses, documented by a final report.

Literature

Obligatory

1. Anderson M., Woessner M., Hunt, R.J., 2016. Applied Groundwater Modeling, Second Edition, Blackwell, New York.
2. Pinder, G. 2010. Groundwater modelling. Wiley India Ltd.
3. Hill, M.C., Tiedemann, C., 2007. Effective groundwater flow model calibration. With analysis of data, sensitivities, predictions, and uncertainty. USGS publications DOI: 10.1002/9780470041086.index

Optional

1. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Envirnment-Agency-approach-to-groundwater-protection.pdf
2. European Commission, Directorate-General for Environment, Groundwater protection in Europe : the new Groundwater Directive : consolidating the EU regulatory framework, Publications Office, 2009, https://data.europa.eu/doi/10.2779/84304
3. https://www.bgs.ac.uk/geology-projects/groundwater-research/groundwater-protection/
4. https://www.epa.gov/sites/default/files/2017-02/documents/gwhb041404.pdf
5. https://joint-research-centre.ec.europa.eu/scientific-activities-z/soil-protection_en

Calculation of ECTS points

Activity form	Activity hours*
Lecture	10
Project exercises	20
Preparation of the report	5
Preparing the project	15
Student workload	**Hours** 50

Number of ECTS points	**ECTS** 2

* hour means 45 minutes