



SZKOŁA GŁÓWNA  
GOSPODARSTWA  
WIEJSKIEGO

## Groundwater and Soil Protection

### Educational subject description sheet

#### Basic information

<b>Field of study</b> Course Offer for exchange students - second cycle studies, including uniform master studies (MA programmes)		<b>Didactic cycle</b> 2024/25	
<b>Speciality</b> -		<b>Subject code</b> PWMPWM2S_D.B100000.03757.24	
<b>Organizational unit</b> Course Offer for exchange students		<b>Lecture languages</b> english	
<b>Study level</b> second cycle studies, including uniform master studies (MA programmes)		<b>Mandatory</b> Elective subjects	
<b>Study form</b> full-time studies		<b>Block</b> Major subjects	
<b>Education profile</b> General academic		<b>Disciplines</b> Environmental engineering, mining and energy	
<b>Coordinator</b>	Mateusz Grygoruk		
<b>Teacher</b>	Mateusz Grygoruk		
<b>Period</b> Winter semester	<b>Examination</b> Pass with grade	<b>Number of ECTS points</b> 2	
	<b>Activities and hours</b> Lecture: 10 Project exercises: 20		

## 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
<b>Knowledge - Student knows and understands:</b>			
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
<b>Skills - Student can:</b>			
U1	groundwater model development, execution, calibration and application in solving real-life problems.		Report
U2	develop a simple groundwater flow model.		Project
<b>Social competences - Student is ready to:</b>			
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/Environment-Agency-approach-to-groundwater-protection.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/692989/Environment-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](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
<b>Student workload</b>	<b>Hours</b> 50

<b>Number of ECTS points</b>	<b>ECTS</b> 2
------------------------------	------------------

\* hour means 45 minutes