GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Water resources management, PG_00058830						
Field of study	Environmental Engineering						
Date of commencement of studies	October 2023		Academic year of realisation of subject	2025/2026			
Education level	first-cycle studies		Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	Polish			
Semester of study	6		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Geotechnical and Hydraulic Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Tomasz Kolerski				
	Teachers						

Lesson types							
	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	E-learning hours included: 0.0						

Learning activity and number of study hours					
	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	45	4.0	33.0	82

Subject objectives	
	The aim of the course "Water Resources Management" is to provide students with a comprehensive understanding of water management in the context of contemporary challenges related to extreme hydrological events such as floods and droughts. The course focuses on developing knowledge and skills necessary for planning and implementing water retention measures, including both traditional reservoir-based retention methods and nature-based solutions (e.g., blue-green infrastructure, small-scale retention). Particular emphasis is placed on sustainable water management, enhancing the resilience of ecosystems and communities to climate change, and integrating technical and environmental approaches into spatial planning.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W05] knows the theoretical basis of hydromechanics and its practical models, necessary to solve technical problems in the field of environmental engineering (sanitary engineering, water melioration, water management and flood protection, pollution spread)	Understands the theoretical foundations of hydromechanics and their practical applications in solving engineering problems related to water resources management, including flow modeling in rivers and channels, flood risk assessment, surface runoff formation, and the design of retention and drainage systems.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_U03] can prepare documentation regarding the implementation of an engineering task/project and prepare a text or presentation including a discussion of the results of the implementation	Is able to prepare documentation for an engineering task in the form of a conceptual project based on a real-world problem. Independently collects relevant data and information, selects an appropriate technical solution based on the analysis, describes it in a report, and presents and discusses the results with the group.	[SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task
[K6_W04] possesses elementary knowledge in the field of land mechanics, ground science, land reclamation and geotechnics; has basic knowledge about the composition of air, water and soil, environmental pollution and processes responsible for their formation and ways to reduce them, knows the principles and organization of sustainable water management	Has basic knowledge of the water cycle and the factors influencing the water balance, including phenomena leading to floods and droughts. Understands the processes responsible for surface runoff, infiltration, and evapotranspiration, and their relevance in water resource planning and management.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_U08] can use properly selected methods and devices of hydraulics and hydrology, enabling determination of basic quantities characterizing the flow of water in open channels and rivers, pipelines and flow objects of environmental engineering	Is able to use appropriately selected methods and tools in the fields of hydraulics and hydrology, including open-access tools and software provided to students of Gdańsk University of Technology. Can determine fundamental parameters characterizing water flow in rivers, open channels, pipelines, and water infrastructure facilities. Is capable of calculating catchment area and characteristics, effective rainfall, surface runoff, thermal conditions of rivers and water reservoirs, as well as flow rates in natural watercourses and engineered channels.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
[K6_U16] can, when formulating and solving engineering tasks in environmental engineering, evaluate, select and apply appropriate methods and tools, recognize their non-technical aspects, including environmental, economic and legal aspects	Is able to assess, select, and apply appropriate engineering methods and tools when formulating and solving environmental engineering problems, including specialized hydrological and hydraulic software. Takes into account non-technical aspects such as environmental, economic, and legal considerations that are essential in the design and evaluation of water management solutions.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information

Subject contents

Course content – lecture

1. **Water Management in Poland and Worldwide:**
   1. Overview of water management systems in different countries.
   2. Analysis of water policies in Poland, the European Union, and globally.
   3. Challenges in managing water resources in regions with diverse climatic and geographic conditions.
2. **Water Resources:**
   1. Definition and classification of water resources.
   2. Types of water resources: surface water, groundwater, water retention.
   3. Water balance and its role in water resource management.
   4. Analysis of water resource availability in Poland and worldwide.
3. **Water Resource Management during Droughts and Floods:**
   1. Practical approaches to water management during water excess (floods) and shortages (droughts).
   2. Use of early warning systems and meteorological forecasts.
   3. Planning of flood protection infrastructure and drought mitigation strategies.
   4. Tools and technologies supporting water resource management under extreme conditions.
4. **Water Resources in the Era of Climate Change:**
   1. Impact of climate change on the availability of water resources.
   2. Analysis of changes in the hydrological cycle and their implications for water management.
   3. Adaptation of water management systems to new climatic conditions.
   4. Examples of adaptation strategies at national and international levels.
5. **Water Retention:**
   1. Types of water retention: natural, artificial, surface and subsurface retention.
   2. Role of retention in managing stormwater, floods, and droughts.
   3. Retention technologies and methods: reservoirs, ponds, drainage ditches, green infrastructure systems.
   4. Influence of retention on water quality, water balance, and biodiversity.
   5. Examples of good retention practices in Poland and abroad.
6. **Environmental and Minimum Flows:**
   1. Definition and ecological importance of environmental flows.
   2. Principles of calculating environmental flow requirements.
   3. Legal regulations on minimum river flows and their relevance for environmental protection.
   4. Use of hydrological data to assess flows in the context of biodiversity conservation.
7. **River Basin Management Plans:**
   1. Overview of the process of creating river basin management plans.
   2. Legal and organizational foundations for water planning.
   3. Integrated approach to water resource management.
   4. Monitoring and evaluation of the implementation of water management plans.
8. **Drought Impact Mitigation Analysis:**
   1. Definition of drought and its effects on water resources and the economy.
   2. Tools and methods for drought impact prevention and mitigation.
   3. Examples of drought mitigation measures: water retention, rainwater harvesting, water demand reduction.
   4. The role of agriculture, forestry, and industry in drought prevention.
9. **Water Management in Winter Conditions:**
   1. Challenges and opportunities related to winter water retention.
   2. River and lake management principles under winter conditions, including prevention of ice jams.
   3. Protection of water infrastructure against frost damage.
10. **Lake Connectivity Issues:**

- Theory and practice of lake connections in water management.
- Benefits and risks of lake interconnections: hydrological, ecological, and social aspects.
- Use of lake connectivity to enhance water retention and improve water quality.

Prerequisites and co-requisites

To participate in the course, students should have basic knowledge of hydrology, meteorology, hydraulics, and fluid mechanics. Understanding atmospheric processes, the hydrological cycle, principles of water flow in channels and rivers, as well as basic fluid mechanics, is essential for effectively acquiring material related to water resources management.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test	60.0%	70.0%
project	60.0%	30.0%

Recommended reading

Basic literature	*Hydrologia inżynierska* Julian Lambor Water Resources Engineering Larry W. Mays Open Chanel Flow F.M. Henderson
Supplementary literature	brak
eResources addresses	

Example issues/ example questions/ tasks being completed

Discuss methods of water resource management during extreme hydrological events, such as droughts and floods, taking into account the role of water retention.

Explain the differences between natural and controlled (managed) retention, and discuss their significance in the context of sustainable water resource management

Practical activites within the subject	Not applicable

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