Water Resources

Educational subject description sheet

Basic information

Field of study Joint Bachelor in Sustainability	**Education cycle** 2025/26
Speciality Environmental & Life Sciences	**Subject code** UJ.WPAJBSELSS.8100.16548.25
Organizational unit Faculty of Law and Administration	**Lecture languages** english
Study level first cycle (joint degree programme)	**Subject related to scientific research** Yes
Study form full-time degree programme	**Disciplines** Earth sciences and the environment
Education profile General academic	**ISCED classification** 0521 Environmental sciences
Mandatory obligatory	**USOS code**

Subject coordinator	Piotr Szwedo
Lecturer	Lucia De Stefano, Riansares Muñoz Olivas, Rubén Miranda Carreño, Esther Sánchez-Tirado, Mikel Calle Navarro, Ángela Potenciano de las Heras, Esperanza Montero González, Wojciech Fiałkowski

Period	**Examination**	**Number of ECTS points**
Semester 5	exam **Activities and hours** Lecture: 33 Classes: 12	5.0

Goals

C1	The main goal of this course is to familiarise students with water resources characteristics as well as a sustainable exploitation. Students must be aware of the current and future threats to freshwater resources being able to propose innovative solutions.

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the theory and methodology of different disciplines in order to analyse sustainability-related problems in relation to water resources.	JBS_K1_W03, JBS_K1_W04, JBS_K1_W06, JBS_K1_W07	written exam, findings
W2	essential international instruments and institutions related to sustainability of water resources uses, particularly the European Union Water Framework Directive and the other water-related Directives	JBS_K1_W04, JBS_K1_W07	written exam
W3	the main characteristics and dynamics of natural systems and understands the consequences of human water uses on those systems	JBS_K1_W03, JBS_K1_W07	written exam
Skills – Student can:			
U1	critically analyse academic literature, formulate questions and conduct laboratory work under supervision	JBS_K1_U01	report
U2	summarize and report knowledge, methodologies, data treatment and critical discussion about water resources characteristics and uses clearly and comprehensively	JBS_K1_U02, JBS_K1_U03	written exam, report
Social competences – Student is ready for:			
K1	to identify and analyse possible trade-offs between socioeconomic uses of water and conservation of natural systems	JBS_K1_K03	written exam
K2	to identify and quantify the main sources of uncertainty associated to the analysis of water resources and their management	JBS_K1_K05	written exam

Calculation of ECTS points

Activity form	Activity hours*	
Lecture	33	
Classes	12	
preparation for the exam	30	
preparation for classes	35	
report preparation	15	
Student workload	**Hours** 125	**ECTS** 5.0

* hour means 45 minutes

Study content

No.	Course content	Subject's learning outcomes
1.	Sources of freshwater: Rivers' key characteristics and dynamics; Alteration of river's dynamics; Degradation of riverine ecosystems	W3, U1, U2, K1
2.	Sources of freshwater: Aquifers' key characteristics and dynamics; Groundwater overexploitation and its consequences	W3, U1, U2, K1
3.	Sources of freshwater: Key characteristics and functioning of lentic systems; Anthropic influence on lentic systems. Relationships and interdependencies across different water body types. The River Continuum Concept.	W3, U1, U2, K1
4.	Sources of freshwater: Water resources development (grey and green infrastructure); Unconventional water resources (water reuse / reclaimed water/ water desalination)	W3, U1, U2
5.	Water resources assessment: Quantification of water resources, water balance and availability of water resources.	W3, U1, U2
6.	Water resources assessment: Methods to quantify the water cycle components. Uncertainties in quantifying water resources. Management of droughts and water scarcity	W3, U1, U2, K2
7.	Water resources management: EU Water Framework Directive and other selected water-related Directives	W1, W2, K1
8.	Water resources management: Water resources planning: river basin management, water allocation and water rights	W1, W2, K1
9.	Water body status: Definition of water status/potential. Definition and assessment of the ecological status of surface water bodies (biological, physico-chemical and hydromorphological elements), quantitative status of groundwater bodies	W1, W2
10.	Characterization of water quality: analysis of water physico-chemical parameters, compliance with water quality standards according to the Water Framework Directive and other water-related Directives	W1, W2, U1, U2, K1, K2
11.	Mitigation of anthropic impact on water ecosystems functioning environmental flows, dam removal, river restoration, nature-based solutions applied to water resources	W1, W2, W3, K1, K2
12.	PRACTICE. Visit to a Urban Water Supply Control Center Canal Isabel II Gestión (Fuencarral)	W1, W3, K2
13.	PRACTICE. Visit to a river flow gauging station in the Manzanares river; hands-on measurement of river flow; demonstration of the River Habitat Survey method; onsite observation of anthropic alteration of river dynamics and of measures for river restoration.	U1, U2, K2
14.	PRACTICE. Hands-on lessons on water quality analysis: Total suspended solids, nitrogen, phosphorous and/or (pH, conductivity, hardness)	U1, U2, K2
15.	PRACTICE. Hands-on lessons on water quality analysis: COD, BOD5 (dissolved oxygen), heavy metals, etc.	U1, U2, K2

Course advanced

Teaching methods :

conversation lecture, discussion, practicals

Activities	Examination methods	Credit conditions
Lecture	written exam, findings	The exam counts 70% towards the final grade. The students need to get at least 50% of points in order to pass the exam. Cases and/or exercises will be presented and discussed in class as applied assignments to be completed at home and handed in later for being graded. They will count 10% towards the final grade
Classes	report	The activity summary reports required after each practical session and/or visit count a 20% towards the final grade. The students need to get at least 50%

Entry requirements

None

Literature

Obligatory

1. Standard Methods for the examination of Water and Wastewater, 2017, Rodger B. Baird, Andrew D. Eaton and Eugene W. Rice. American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF). Washington DC (USA).
2. Water and Wastewater Engineering: Design Principles and Practice, 2010, Davis, M. L., McGraw Hill. Michigan (USA).
3. Wastewater engineering: treatment and reuse, 2004, Metcalf and Eddy, Inc., McGraw-Hill. New York (USA).
4. Managing Europe's water resources: twenty-first century challenges, 2016, Staddon, C. Routledge.
5. Hydrogeology: principles and practice, 2014, Hiscock, K. M., & Bense, V. F., John Wiley & Sons
6. Water: A critical introduction, 2023, Meehan, K. Mirumachi, N. Loftus, A. and Akhter, M., John Wiley & Sons
7. Fundamentals of groundwater, 2024, Schwartz, F. W., & Zhang, H., John Wiley & Sons
8. Applied hydrology, 1988, Chow, V. T., Maidment, D. R., & Mays, L. W.
9. Standard Methods for the examination of water and wastewater, 2023, W.C. Lipps, E. Burton, T.E. Baxter, American Public Health Association, American Water Works Association, Water Environment Federation

Effects

Code	Content
JBS_K1_K03	The graduate can consider different visions of the future and develop own evidence-based opinions in reference to the balance of values linked to economic development, social welfare, and environmental protection.
JBS_K1_K05	The graduate can defend the importance of scientific data and methods as a basis for decision-making.
JBS_K1_U01	The graduate can critically analyse academic literature, formulate research questions and conduct research under supervision.
JBS_K1_U02	The graduate can present and report knowledge, methodologies, ideas, problems and solutions, clearly and comprehensively, in different forms destined for different audiences – including discussions and debates which require defending a substantiated opinion, as well as conversations in a foreign language at the CEFR B2 level.
JBS_K1_U03	The graduate can apply adequate methods and tools, including selected IT tools, to solve problems related to data collection, analysis, and management in the context of sustainability.
JBS_K1_W03	The graduate can give examples of sustainability-related dilemmas and hypothesize on the optimal course of action.
JBS_K1_W04	The graduate can identify sustainability-related problems specific to selected cultural, geographical, and political contexts.
JBS_K1_W06	The graduate can describe interconnections between various aspects of sustainability and identify their significance in the context of natural and social sciences, with a special focus on disciplines included in the selected specialisation track (law and politics; chemistry and physics; chemistry and biology; economics and geography; economics, management and engineering; humanities).
JBS_K1_W07	The graduate can apply the theory and methodology of disciplines included in the selected specialisation track to sustainability-related problems, taking into consideration practical limitations such as protection of intellectual property.