# Environmental Technology

Educational subject description sheet

## Basic information

| | |
|---|---|
| **Field of study**<br>Joint Bachelor in Sustainability<br>**Speciality**<br>Environmental & Life Sciences<br>**Organizational unit**<br>Faculty of Law and Administration<br>**Study level**<br>first cycle (joint degree programme)<br>**Study form**<br>full-time degree programme<br>**Education profile**<br>General academic<br>**Mandatory**<br>obligatory | **Education cycle**<br>2025/26<br>**Subject code**<br>UJ.WPAJBSELSS.8100.16549.25<br>**Lecture languages**<br>english<br>**Subject related to scientific research**<br>Yes<br>**Disciplines**<br>Earth sciences and the environment, Environmental engineering, mining and energy<br>**ISCED classification**<br>0712 Environmental protection technology<br>**USOS code** |

| | |
|---|---|
| **Subject coordinator** | Piotr Szwedo |
| **Lecturer** | Yolanda Madrid Albarrán, Rubén Miranda Carreño, Ana Pintado Valverde, Margaret Graham, Krzysztof Wiąckowski |

| | | |
|---|---|---|
| **Period**<br>Semester 5 | **Examination**<br>exam<br><br>**Activities and hours**<br>Discussion class: 33<br>Fieldwork classes: 12 | **Number of ECTS points**<br>5.0 |

## Goals

| | |
|---|---|
| C1 | The main goal of the course is to introduce the students to the current environmental problems through the characterization of different sources of pollution and the study of the existing technologies for the treatment and control of pollution and waste management with the goal of improvement the environment and contribution to sustainability. |

## Subject's learning outcomes

| Code | Outcomes in terms of | Effects | Examination methods |
|---|---|---|---|
| **Knowledge – Student knows and understands:** | | | |
| W1 | the main atmospheric, water and soil pollutants and emerging pollutants and their sources | JBS_K1_W04 | written exam, credit |
| W2 | sampling and methodologies for water, soil and air analysis | JBS_K1_W04 | written exam, report |
| W3 | the existing technologies for air, water, and soil pollution | JBS_K1_W01, JBS_K1_W07 | written exam, credit |
| W4 | the importance of waste management, residues revalorization and reuse | JBS_K1_W01, JBS_K1_W07 | written exam, credit |
| W5 | the legislation ruling environmental policy and its potential role in the resolution of the problems | JBS_K1_W05 | written exam |
| **Skills – Student can:** | | | |
| U1 | apply adequate methods and tools to evaluate environmental pollution | JBS_K1_U01, JBS_K1_U03 | written exam, report |
| U2 | plan and develop the technology more suitable for any environmental pollution case of study | JBS_K1_U01, JBS_K1_U04 | written exam, report, credit |
| U3 | present and report knowledge, methodologies, ideas, problems, and solutions, clearly and comprehensively, in different forms destined for different audiences – including discussions and debates related to aspects of environmental technology | JBS_K1_U02 | written exam, report, credit |
| U4 | critically evaluate scientific literature and data | JBS_K1_U01 | written exam, report, credit |
| **Social competences – Student is ready for:** | | | |
| K1 | to demonstrate initiative autonomy and organise activities beneficial for protecting the environment | JBS_K1_K01, JBS_K1_K02 | report, credit |
| K2 | to build networks and collaborative relationship with others and with different opinions and approaches | JBS_K1_K03 | report, credit |
| K3 | to critically assess and verbalized practices and take position related to sustainability and environment protection | JBS_K1_K04 | report, credit |

## Calculation of ECTS points

| Activity form | Activity hours* |
|---|---|
| Discussion class | 33 |
| report preparation | 12 |
| tasks solving | 12 |
| preparation for the exam | 56 |

| | |
|---|---|
| Fieldwork classes | 12 |

| **Student workload** | **Hours** | **ECTS** |
|---|---|---|
| | 125 | 5.0 |

* hour means 45 minutes

## Study content

| No. | Course content | Subject's learning outcomes |
|---|---|---|
| 1. | INTRODUCTION (Type of pollutants, impact on health, emerging pollutants) | W1, U3, U4 |
| 2. | AIR POLLUTION: Sources, transport, and dispersion of pollutants (climate change, acid rain, ozone depletion and photochemical smog). Biomonitoring. Sampling and analysis of air pollutants: gases and atmospheric and biological particles | W1, W2, U1, U3, U4 |
| 3. | TREATMENT TECHNOLOGIES FOR ATMOSPHERIC POLLUTION: Removal of particulates, S (SO2 Y H2S), NOx and VOCs. Approaches for minimising vehicles emissions: towards decarbonising road transport | W3, U2, U3, U4 |
| 4. | WATER POLLUTION: Sources and impact on health. Sampling and analysis of water pollutants. Emerging contaminants, including microplastics and nanoplastics. Main problems of water pollution: eutrophication, nitrification... | W1, W2, U1, U3, U4 |
| 5. | TREATMENT TECHNOLOGIES FOR WATER POLLUTION PART 1: treatment of urban, industrial and agricultural wastewater. Wastewater sludge treatment, | W3, U2, U3, U4 |
| 6. | TREATMENT TECHNOLOGIES FOR WATER POLLUTION PART 2 Advanced water treatment technologies for emerging pollutants. Biological treatment of wastewater. Reuse of water | W3, U2, U3, U4 |
| 7. | SOIL POLLUTION. Characteristics of soils and composition. Nitrogen cycle. Sources and transport of pollutants in soils. Sampling and analysis of pollutants in soils. Main problems of soil pollution. Desertification | W1, W2, U1, U2, U3 |
| 8. | TREATMENT TECHNOLOGIES FOR SOIL POLLUTION: Remediation and biorremediation (incl. phytoremediation) of contaminated soils. Restoration of contaminated soils. Restoration of eroded and degraded soils | W3, U2, U3, U4 |
| 9. | WASTE MANAGEMENT PART 1. Waste classification (industrial, urban, etc.). Waste management hierarchy (Waste Framework Directive): Reuse, Recycling (including composting), | W4, U3, U4 |
| 10. | WASTE MANAGEMENT PART 2. Energy valorisation, Landfilling. Wastewater sludge reuse. | W4, U3, U4 |
| 11. | ENVIRONMENTAL POLICY AND LEGISLATION: Directive of industrial emissions/BAT reference documents. European Pollutant release and Transfer register (E_PRTR). Environmental Liability Directive (ELD). | W5, U3, U4, K1, K2, K3 |
| 12. | PRACTICE. VISIT TO A WASTEWATER TREATMENT PLANT AND COMPOSTING PLANT | W3, W4, U2, U3, U4, K2, K3 |
| 13. | PRACTICE. AIR BIOMONITORING. SAMPLING AND LICHENS ANALYSYS | W1, W2, U1, U3, U4, K2, K3 |
| 14. | PRACTICE. ACTIVATE SLUDGE CHARACTERIZATION/SEDIMENTATION AND COAGULATION | W4, U3, U4, K2, K3 |
| 15. | PRACTICE . SOIL CHARACTERIZATION. pH, conductivity, volatile solids, metals (Na, K, Fe, Zn, etc.) | W3, U2, U3, U4, K2, K3 |

## Course advanced

### Teaching methods :

text analysis, lecture with multimedia presentation, discussion, laboratories

| Activities | Examination methods | Credit conditions |
|---|---|---|
| Discussion class | written exam, credit | Written exam, (graded), exercises or oral presentation (graded) – minimum passing grade 5/10 |
| Fieldwork classes | report | The submission of laboratory reports (graded) – minimum passing grade 5/10 |

## Entry requirements

None

## Literature

**Obligatory**


1. M.L. Davies, S.J. Masten. Principles of Environmental Engineering & Science. 2019. 4th Edition. McGraw Hill.
2. L. Theodore, R. R. Dupont and K. Ganesan. “Unit operations in Environmental Engineering”. Wiley-Scrivener. 2017.
3. Metcalf and Eddy, Inc. Wastewater engineering: treatment and reuse. 4th Edition (2004). McGraw-Hill. New York (United States).
4. Davis, M. L. Water and Wastewater Engineering: Design Principles and Practice. McGraw Hill. Michigan (Estados Unidos), 2010.
5. Van Loosdrecht, M.C.M. et al. 2016 Experimental methods in wastewater treatment. IWA Publishing,(2016)
6. Rodger B. Baird, Andrew D. Eaton and Eugene W. Rice (editors). Standard Methods for the examination of Water and Wastewater. American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF). 23rd Edition (2017). Washington DC (United States).
7. Z. Tan. “Air pollution and greenhouse gases. From basic concepts to engineering applications for air emission control”. Springer. 2014.
8. European Environmental Agency. Air Pollution. “Air pollution”. Available at: https://www.eea.europa.eu/en/topics/in-depth/air-pollution
9. European Environmental Agency (EEA). “Europe’s air quality status 2023”. Available at: https://www.eea.europa.eu/publications/europes-air-quality-status-2023
10. Kranner, I., Beckett, R. P., & Varma, A. (Eds.). Protocols in lichenology: culturing, biochemistry, ecophysiology and use in biomonitoring. Berlin/Heidelberg, Germany: Springer 2002
11. G. Tchobanoglous, F. Kreith. “Handbook of Solid Management”. 2nd Edition. 2002. The McGraw-Hill Companies, Inc.
12. Gary M. Pierzynski G.F. Vance, J.T. Sims. “Soils and Environmental Quality”. 3rd Edition. 2005. CRC Press, Boca Raton (United States).
13. N. Radojevic; V. N. Bahkin “Practical Environmental Analysis”. RSC. 2006.
14. R. N. Reeve. “Introduction to Environmental Analysis”. John Wiley & Sons, LTD. Chichester. 2002
15. S. Manahan, Environmental Chemistry 11 th Ed. CRC Press (2022)
16. T.G.Spiro, K. Purvis- Roberts and W.M. Stigliani. Chemistry of the Environment 3th Ed. University Science Book ( 2011)

## Effects

| Code | Content |
|---|---|
| JBS_K1_K01 | The graduate can encourage sustainability-driven practices in the workplace and appraise sustainability of own values, perceptions, roles, and actions, with a special focus on environmental wellbeing. |
| JBS_K1_K02 | The graduate can demonstrate considerable entrepreneurial initiative, autonomy, and readiness to act in complex and changing environments, especially in the context of supporting, undertaking, and co-organising activities beneficial for a sustainable society. |
| 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_K04 | The graduate can critically assess and verbalize own competencies and skills related to different aspects of sustainability as well as their need for development. |
| 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_U04 | The graduate can plan and effectuate simple sustainability-related projects under supervision and in the context of personal lifelong learning, both individually and in a team, using appropriate transversal skills and taking shared responsibility for the outcome. |
| JBS_K1_W01 | The graduate can describe the concept of sustainability and recognize the differences in relevant definitions, models and approaches. |
| JBS_K1_W04 | The graduate can identify sustainability-related problems specific to selected cultural, geographical, and political contexts. |
| JBS_K1_W05 | The graduate can identify essential international instruments and institutions related to sustainability and explain their potential role in resolution of a given problem. |
| 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. |