Aquatic pollution and wastewater management

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Lecturers/Instructors: Athanasios Stasinakis, Olga-Ioanna Kalantzi, Asimina Koukoura

GENERAL

SCHOOL	School of Environment			
ACADEMIC UNIT	Department of Environment			
LEVEL OF STUDIES	Postgraduate			
COURSE CODE	ENV513	SEMESTER	Spring	
COURSE TITLE	Aquatic pollution and wastewater management			
INDEPENDENT TEACHING ACTIVITIES			WEEKLY TEACHING HOURS	CREDITS
	Lectures		6	
	Field Trip		1	
	Laboratory exercises			
	Course Total		50	2
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).				
COURSE TYPE	Skill development			
PREREQUISITE COURSES:	None			
COURSE WEBSITE (URL)				

LEARNING OUTCOMES

Learning outcomes
Knowledge • Develop critical thinking and critical knowledge on aquatic pollution and wastewater management • Recognize key environmental problems that are directly and indirectly related to aquatic pollution Understanding (Comprehension) • Understand the concepts: aquatic pollution, pollution monitoring, ecosystem based management, wastewater management • Understand the fundamentals of wastewater treatment, including the common physical, chemical and biological unit operations encountered in treatment process Application • Apply procedures for the estimation of pollution in selected areas • Apply procedures and techniques for designing of pollution monitoring programmes • Apply procedures and techniques for designing of remediation strategies Analysis • Analyse the quality characteristics of a water body in view of assessing its pollution state • Analyse wastewater quality parameters in view of assessing the suitability of wastewater treatment processes Synthesis

- Use monitoring data to identify existing pollution problems in a water body
- Use wastewater data to plan of an appropriate wastewater management plan

Evaluation

- Evaluate aquatic pollution state
- Evaluate the performance of wastewater management plants

General Competences

The aim of the course is to provide students with an understanding about the key concepts of aquatic pollution from municipal and industrial wastewater, and the organization of relevant pollution monitoring programs to assess the quality of the receiving waters.

The student who will successfully complete the course is expected to be able to:

- Search for, analyse and combine bibliographical and monitoring data in view of assessing aquatic pollution status from municipal wastewater effluents
- Contribute to the organisation of monitoring programmes in view of assessing the quality of municipal wastewater and the ecological status of aquatic environment
- Contribute to a decision-making process for the evaluation of the quality of the aquatic environment
- Work in an interdisciplinary environment on wastewater management, and aquatic pollution assessment
- Work on project planning and management of environmental issues
- Respect natural environment and contribute to the sustainable development of in line with UN Sustainable Development Goals
- Communicate information, ideas, problems and solutions in relation to aquatic pollution and its mitigation, to pollution experts, decision makers and the general public

SYLLABUS

Courses outline:

1. Introduction to water pollution: major groups of contaminants in municipal wastewater; fate of contaminants in the aquatic environment and impact on the aquatic ecosystem. Special focus to PFAS (Forever Chemicals)
2. Developing an ecosystem based approach; steps, criteria and indicators as they relate to EU legislation
3. Integrated monitoring and assessment programme: strategy for sampling, parameter selection, analysis of contaminants, data quality assurance and reporting
4. Municipal Wastewater Treatment and Reuse: current status in EU and legislation, basic treatment processes, monitoring strategy, future challenges
5. Sewage Sludge Treatment and Reuse: sludge management in EU, methods of treatment and disposal, legislation and future challenges
6. Field trip to ZeroPM and Hydrousa pilot plants including the application of a sampling protocol for soil and plants to assess the risks associated with wastewater reuse in agricultural irrigation
7. Oral presentations of the PFAS case study group reports

TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to Face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td><td>Use of ICT, communication with students</td></tr>
<tr><td>TEACHING METHODS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>12 h</td></tr>
<tr><td>Field trip</td><td>7 h</td></tr>
<tr><td>Essay writing</td><td>10 h</td></tr>
<tr><td>Study and analysis of bibliography</td><td>21 h</td></tr>
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<tr><td>Course total</td><td>50 h</td></tr>
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<tr><td>STUDENT PERFORMANCE EVALUATION</td><td>Students will be individually graded based on:

• One individual assignment on PFAS in the environment (30%)
• One group written report on a case study aiming to the development of a monitoring strategy of a PFAS contaminated area (50%) and its oral presentation (20%)</td></tr>
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ATTACHED BIBLIOGRAPHY

- Arkema, K.K., Abramson, SC, Dewsbury, BM (2006). Marine ecosystem-based management: from characterization to implementation. Frontiers in Ecology and the Environment, Volume: 4, Issue: 10, Pages: 525-532.
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- Directive 2000/60/EC establishing a framework for Community action in the field of water policy
- Directive 2008/56/EC for a European Marine Strategy Framework
- Directive 2024/3019 of the European Parliament and of the Council of 27 November 2024 concerning urban wastewater treatment
- Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption
- https://environment.ec.europa.eu/topics/water/surface-water_en
- UNEP (2011). Taking steps toward marine and coastal Ecosystem-Based Management: An introductory guide.
- Arvaniti O.S., Fountoulakis M.S., Gatidou G., Kalantzi O.I., Vakalis S., Stasinakis A.S. (2024) Perfluoroalkyl and polyfluoroalkyl substances in sewage sludge: challenges of biological and thermal treatment processes and potential threats to the environment from land disposal. Environmental Sciences Europe 36, 207.
- Thomaidi V.S., Stasinakis A.S., Borova V.L., Thomaidis N.S. (2015) Is there a risk for the aquatic environment due to the existence of emerging organic contaminants in treated domestic wastewater? Greece as a case-study. Journal of Hazardous Materials 283, 740-747.

- Kelessidis A., Stasinakis A.S. (2012) Comparative study of the methods used for treatment and final disposal of sewage sludge in European countries. Waste Management 32, 1186-1195.
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