Water Quality Management - BMEEOVKAI44

I. Subject Specification

1. Basic Data

1.1 Title

Water Quality Management

1.2 Code

BMEEOVKAI44

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	2
Seminar	1

1.5 Evaluation

Midterm grade

1.6 Credits

3

1.7 Coordinator

name	Adrienne Clement, PhD
academic rank	Associate professor
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1.8 Department

Department of Sanitary and Environmental Engineering

1.9 Website

https://edu.epito.bme.hu/course/view.php?id=3581
https://edu.epito.bme.hu/course/view.php?id=3581

1.10 Language of instruction

english

1.11 Curriculum requirements

Compulsory in the Specialization in Infrastructure Engineering (BSc) programme

1.12 Prerequisites

Weak prerequisites:

- Water Chemistry and Hydrobiology (BMEEOVKAI43)

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

In the framework of the subject, students learn methods for determining pollutant loads in the aquatic environment and analyzing their consequences. The course material contributes to students' ability to manage water quality protection projects and solve watershed-scale problems. Topics are as follows: water quality evaluation and status assessment according to the requirements of the WFD, status quo of European surface waters, and introduction of the main water quality deterioration problems through case studies. Pollutant sources and pollutant transport. Organic matter pollution, eutrophication, bacteriological problems, hazardous substances and toxic pollution. Measures for water quality control. Monitoring, status assessment, emission estimation. Application of water quality models in the seminars.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. Aware of the goal of water quality management and knows its basic tools.
2. Knows the basics of legal regulations related to water quality protection.
3. Knows and understands the context of the parameters used to evaluate water quality.
4. Knows the principles of methods suitable for describing the transport of pollution in the water systems and analyzing the effects of water pollution.
5. He/she is aware of the methods, processes and operation of municipal wastewater treatment plants.
6. Has knowledge about the lake ecosystems in their contexts of eutrophication, and knows methods for improving the quality of lakes.
7. Knows the terms of diffuse pollution and its assessment methods.

B. Skills

1. Routinely applies methods for calculating the mixing of pollutants in rivers.
2. Capable of applying simple water quality models on examples.
3. Able to develop water quality management strategies for pollutant load reduction.

C. Attitudes

1. In his/her written expressions, strives to produce demanding, orderly documentation of the standard expected by the engineering profession.

D. Autonomy and Responsibility

1. Able to form an independent opinion in recognizing the problems in the context of the aquatic environmental problems and solving them.
2. He/she applies the systematic approach in his/her thinking.

2.3 Methods

Lectures to give theoretical knowledge; seminar exercises to practice the calculation on numerical examples, developing written and oral communication. Use of IT tools and techniques.

2.4 Course outline

Week	Topics of lectures and/or exercise classes
1.	Introduction to water quality and problems related to the aquatic environment.
2.	Point and diffuse emissions. A basic example of water quality management (optimization).
3.	Definition of water quality, quality of natural waters: physical, chemical and biological characteristics. Occurrence of hazardous substances: toxic metals, organic micropollutants in water and their physiological effects.
4.	Water quality monitoring, water uses, classification.
5.	Mixing and spreading of pollutants in water. The transport equation: advection, diffusion and dispersion processes.
6.	Analytical solutions and numerical examples. Permanent pollution in rivers, accidental pollution. Spread of pollutant plume in watercourses, Pollutant wave. 1D - 2D approach. Mixing calculations.
7.	Heat pollution (thermal water and cooling water). Mixing of heat plume in the river. Thermal pollution and its effects on the aquatic ecosystem.
8.	Oxygen household of watercourses. Effect of organic pollution, processes affecting oxygen economy. Atmospheric diffusion, organic matter decomposition, nitrification. The basics of the Streeter - Phelps oxygen sag model. Example of calculating the critical oxygen level.
9.	Measures of regulating the oxygen household problems. Reduction of organic load (artificial and natural wastewater treatment processes). Improving oxygen intake, interventions in the riverbed and watershed.
10.	Water quality of lakes, characterization, and classification of lakes (shallow and deep lakes), Problems related to nutrients (eutrophication, cycle of nutrients, limitation, internal and external load). The Vollenweider P model describing the relationship between load and trophic status.
11.	Processes related to the internal load of lakes. Adsorption isotherm. The role of sediment in the phosphorus balance of lakes. Measures to improve lake water quality (dredging, sediment treatment, aeration,

	biomanipulation techniques)
12.	Determining nutrient loads from the watershed (emission models and their limitations). Sources of non-point pollution: erosion, surface runoff, atmospheric deposition, etc.
13.	Water quality management on catchment scale. Application of technical measures and legal regulations applied at different locations of the catchment. Legal and institutional requirements. Cost-effectiveness.
14.	Summary and replacement.

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5 Study materials

Materials uploaded to the Moodle website (presentations, numeric examples, etc.)

2.6 Other information

2.7 Consultation

Yes, the time of consultation had to be agreed with the lecturer (by e-mail).

This Subject Datasheet is valid for:

2022/2023 semester I

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
Short test 1	ED1	A.1-A.3; D.1-D.2
Short test 2	ED2	A.3-A.4; D.1-D.2
Short test 3	ED3	A.4-A.5; D.1-D.2
Short test 4	ED4	A.6-A.7; D.1-D.2
Midterm test	ZH	B.1-B.3; C.1; D.1

The dates of deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

3.3 Evaluation system

Abbreviation	Score
Midterm test	50
Short tests (4)	50
Sum	**100%**

3.4 Requirements and validity of signature

3.5 Grading system

Grade	Points (P)
excellent (5)	80-100
good (4)	70-79
satisfactory (3)	60-69
passed (2)	50-59
failed (1)	<50

3.6 Retake and repeat

ZH can be replaced free of charge once, and it can be replaced a second time during the replacement period against a special procedure fee. 2 arbitrarily chosen EDs can be replaced during the replacement period.

3.7 Estimated workload

Activity	Hours/semester
Participating in the classes	42
Self-preparation	48
Sum	**90**

3.8 Effective date

1 September 2022

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2022/2023 semester I