Water quality monitoring - BMEEOVKMV-2

I. Subject Specification

1. Basic Data

1.1 Title

WATER QUALITY MONITORING

1.2 Code

BMEEOVKMV-2

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	2

1.5 Evaluation

Midterm grade

1.6 Credits

2

1.7 Coordinator

name	Dr.Clement Adrienne
academic rank	Associate professor
email	clement.adrienne@emk.bme.hu

1.8 Department

Department of Sanitary and Environmental Engineering

1.9 Website

https://epito.bme.hu/BMEEOVKMV-2
https://edu.epito.bme.hu/course/view.php?id=4910

1.10 Language of instruction

english

1.11 Curriculum requirements

Compulsory in the Water and Hydro-Environmental Engineering (MSc) programme

1.12 Prerequisites

1.13 Effective date

1 September 2021

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2. Objectives and learning outcomes

2.1 Objectives

The course aims to provide application-level awareness of environmental monitoring systems, with a special focus on water quantity and quality.
The curriculum includes the theoretical background for the design and operation of monitoring systems, from sampling and network design to laboratory analytics and methods to data processing. During the lectures and the related practical tasks, the students get acquainted with the data collection in the field of aquatic environmental protection. Technical and legal aspects – including the requirements of the EU Water Framework Directive - will be introduced. Main topics: sampling techniques, design of a measurement program, bias stemming from unfrequent sampling, data processing and evaluation, water quality standards and application of classification systems.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. Will get an overview of the conceptual framework for environmental monitoring and the rules for designing and operating the systems.
2. Will understand the legal issues of environmental monitoring.
3. Will be able to interpret in its context, the physical, chemical and biological indicators of monitoring, which are applied for describing the aquatic environment.
4. Will know the quantitative and qualitative elements of the surface water and groundwater monitoring systems, and gets acquainted with the data collection systems.
5. Will understand the statistical principles of sampling technics and how to determine the statistical error resulting from incomplete sampling.
6. Will learn about methods and tools of surface and groundwater sampling.
7. Will be aware of the chemical and biological methods and conditions of their application to measure the water quality parameters.
8. Get an overview of the status of Hungary's and European surface and groundwater.

B. Skills

1. Will be able to evaluate analytical test results, including identification of measurement errors.
2. Will be able to design sampling and measurement programs to explore a specific problem, or to determine the water quality status.
3. Will be able to evaluate water quality data series, apply classification methods, will be able to conclude human impacts.
4. Will be able to use aquatic environmental data collection systems at the user level.
5. Will be able to apply an engineering approach and mindset in the field of planning and operation of aquatic monitoring systems.

C. Attitudes

1. Will collaborate with the instructor and fellow students in expanding the knowledge.
2. Will broaden knowledge also by gathering information from various sources, including extracurricular sources (i.e. the Internet) as well.
3. Open to the use of information technology tools,
4. Strives for accurate and flawless problem-solving.

D. Autonomy and Responsibility

1. Will independently evaluate data, analyze and think through problems and solves them based on specific resources.
2. Openly welcomes substantiated critical remarks.
3. Will take a systematic approach to his thinking.

2.3 Methods

Lectures (oral presentations)

2.4 Course outline

Week	Topics of lectures and/or exercise classes
1.	Introduction. Objectives and elements of environmental monitoring. Task, structure, and elements of monitoring systems (from sampling to data processing). Immission and emission monitoring by environmental elements (examples of operating networks). Principles of design of monitoring systems.
2.	Basics of water quality. Determination of general water quality (physical, chemical, and biological characteristics).
3.	Water Framework Directive (WFD). Requirements for monitoring of European waters, classification according to the WFD. Introduction to data nationwide and European data collection systems (WISE, PETR, etc.).
4.	Inventory of sampling uncertainties. The effect of sampling frequency on the accuracy of the information obtained from the measurements (number of samples needed to determine the annual mean, extreme values, trend detection, continuous time series). Determination of precision and accuracy, reliability.
5.	Evaluation of data series, application of water quality classification. Computational practice.
6.	Calculation of river loads. Error stemming from infrequent sampling and refinement of load estimation.
7.	Test 1.
8.	Sampling methods, conditions for their application, equipment for sampling, and sample preparation for water quality tests.
9.	Analytical methods in water chemistry (theoretical foundations, applicability - measured substances, LOQ, LOD, practical aspects.
10.	Ecological monitoring of aquatic systems. Aims and methods. Indicator organisms, ecological indices, advantages - disadvantages compared to traditional hydrochemical monitoring. WFD monitoring issues (included organisms, information, reliability, experiences).
11.	Design of monitoring networks. Global requirements and local issues for designating sampling sites. Determination of mixing zones in rivers.
12.	Use of remote sensing methods in environmental monitoring and assessment.
13.	Other issues of aquatic monitoring (e.g. passive samplers, online sensors)
14.	Test 2.

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

2.6 Other information

2.7 Consultation

The instructors are available for consultation during their office hours, as advertised on the department website. Special appointments can be requested via e-mail from the lecturers: clement.adrienne@emk.bme.u

This Subject Datasheet is valid for:

2025/2026 semester I

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

The assessment of the learning outcomes set out in point 2.2 is based on two indoor tests and homework consisting of data series evaluation, as well as active participation in the lessons (partial performance assessment).

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
Test 1	T1	A.1-A.4; B.1, B.3; C.4
Test 2	T2	A.5-A.8; B.2; C.4
Homework	HW	B.1-B.5; C.1-C.4; D.1-D.3

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

3.3 Evaluation system

Jele	Részarány
T1	40
T2	30
HW	30
Összesen	**100%**

3.4 Requirements and validity of signature

Signature can't be obtained.
The criterion for completion of the subject is to collect at least 50% of the total points of the written tests (T1 and T2) and submit homework that can be evaluated with at least a sufficient grade.

3.5 Grading system

Grade	Score (% of points)
Excellent (5)	>= 80
Good (4)	70-79
Satisfactory (3)	60-69
Passed (2)	50-59
Failed (1)	<50

3.6 Retake and repeat

It is possible to replace the mid-term study performance evaluations (T1 and T2) one by one. If the student is not able to obtain a grade other than insufficient with the replacement according to point 1), he/she - in addition to paying the fee specified in the regulations - a second attempt in a consolidated form to correct the unsuccessful first replacement. The homework - in addition to paying the fee specified in the regulations - can be submitted late until 16:00 on the last day of the replacement period or sent electronically until 23:59. The submitted and accepted homework can be corrected free of charge by the deadline and in the manner specified in point 2).

3.7 Estimated workload

Activity	Hours/semester
Contact houres	28
Preparation for the tets	8
Preparation of the homework	24
Sum	**60**

3.8 Effective date

1 September 2021

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2025/2026 semester I