

I. Tantárgyleírás

1. Alapadatok

1.1 Tantárgy neve

WATER QUALITY MONITORING AND MODELLING

1.2 Azonosító (tantárgykód)

BMEEOVKMSFIN04-00

1.3 Tantárgy jellege

Kontaktórás tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Előadás (elmélet)	1
Gyakorlat	1

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Félévközi érdemjegy

1.6 Kreditszám

4

1.7 Tárgyfelelős

név	Dr. Clement Adrienne
beosztás	Egyetemi docens
email	clement.adrienne@emk.bme.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Vízi Közmű és Környezetmérnöki Tanszék

1.9 A tantárgy weblapja

epito.bme.hu

<https://edu.epito.bme.hu/course/view.php?id=5207>

1.10 Az oktatás nyelve

magyar

1.11 Tantárgy típusa

Kötelező az Infrastruktúra-építőmérnök (MSc) szak Víz- és vízi környezetmérnöki specializációján

1.12 Előkövetelmények

1.13 Tantárgyleírás érvényessége

2025. szeptember 1.

2. Célkitűzések és tanulási eredmények

2.1 Célkitűzések

The course aims to provide application-level awareness of environmental monitoring systems, with a special focus on water quantity and quality. A further goal is to provide an overview of water quality modelling, with particular attention to the availability of different tools and their principles for application. 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 principles of water quality and watershed modelling are presented in the course.

2.2 Tanulási eredmények

A tantárgy sikeres teljesítése után a hallgató

A. Tudás

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, with special focus on water related EU legislation. 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. Get an overview of the status of surface and groundwater. 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, and the analytical methods to measure the water quality parameters. 7. Has knowledge about the analysis of pollution sources and impacts on river systems. 8. Has knowledge about pollution pathways at the watershed scale and tools for their quantification.

B. Képesség

1. Understand and be able to apply engineering tools in the field of environmental monitoring that ensure the assessment of the waters. 2. Able to plan the laboratory measurements, and evaluate the results, aware of the uncertainties of the measurements. 3. Able to plan a sampling program aimed at revealing a given problem. 4. Able to analyze water quality time series. 5. Able to apply classification methods and draw conclusions regarding human impacts. 6. Can use water and environmental data bases. 7. Recognize and understand the input data needs of different models used in the field of water quality protection. 8. Can apply simple calculation methods of water quality impact analysis, able to choose an appropriate model for performing the designed task.

C. Attitűd

1. Engages in collaboration with instructors and peers to expand their knowledge base. 2. Actively seeks to deepen their understanding by continuously acquiring new information, including open resources beyond mandatory course materials. 3. Open to using IT tools. 4. Open to cooperating with representatives of other disciplines. 5. Strives for clarity and precision in verbal communication, while maintaining a structured, high-quality approach to written documentation that aligns with engineering industry standards.

D. Önállóság és felelősség

1. Collaborates with peers as part of a team to solve tasks. 2. Applies a system-oriented approach in their thinking. 3. Takes responsibility for their own learning and actively seeks solutions to challenges independently. 4. Demonstrates initiative in problem-solving while considering both technical and regulatory constraints. 5. Open to cooperating with representatives of other fields in the course of solving his/her tasks.

2.3 Oktatási módszertan

Lectures with theoretical knowledge; communication in writing and speaking. Practical classes. Individual work.

2.4 Részletes tárgyprogram

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. Requirements for monitoring of European waters, classification according to the WFD. Introduction to data

nationwide and European data collection systems (WISE, PETR, etc.). 4. Sampling methods, conditions for their application, equipment for sampling, and sample preparation for water quality tests. 5. Analytical methods in water chemistry (theoretical foundations, applicability - measured substances, LOQ, LOD, practical aspects. 6. 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). 7. Design of monitoring networks. Global requirements and local issues for designating sampling sites. Determination of mixing zones in rivers. 8. 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. 9. On-line monitoring, Evaluation of data series, application of water quality classification. 10. Calculation of river loads. Error stemming from infrequent sampling and refinement of load estimation. 11. Introduction to watershed modelling. Model input data needs. 12. River and lake models and their data needs. 13-14. Tests and presentations.

A félév közbeni munkaszüneti napok miatt a program csak tájékoztató jellegű, a pontos időpontokat a tárgy honlapján elérhető "Részletes féléves ütemterv" tartalmazza.

2.5 Tanulástámogató anyagok

Lecture slides Hands-on work materials

2.6 Egyéb tudnivalók

Attendance at classes is mandatory. A student who misses more than 30% of the sessions will not be eligible to earn course credits.

2.7 Konzultációs lehetőségek

Contact the lecturers via e-mail: clement.adrienne@emk.bme.hu

Jelen TAD az alábbi félévre érvényes:

II. Tárgykövetelmények

3. A tanulmányi teljesítmény ellenőrzése és értékelése

3.1 Általános szabályok

The assessment of the learning outcomes specified in section 2.2. is conducted through a midterm test and two homeworks. Homework (data analysis) must be submitted by the end of the semester. A presentation on a chosen topic must be prepared and presented during the academic year.

3.2 Teljesítményértékelési módszerek

Assessment Name (Type)	Code	Assessed Learning Outcomes
Midterm test	MT	A.1-A.8, D1-5, C1-5
Homework	HW	B1-3, D1-5, C1-5
Individual work and presentation	IW	B4-8, D1-5, C1-5

A szorgalmi időszakban tartott értékelések pontos idejét, a házi feladatok ki- és beadási határidejét a "Részletes féléves ütemterv" tartalmazza, mely elérhető a tárgy honlapján.

3.3 Teljesítményértékelések részaránya a minősítésben

Code	Weight
MT	30%
HW	40%
IW	30%
Total	100%

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

In case of the course there is no signature.

3.5 Érdemjegy megállapítása

Grade	Points (P)
excellent (5)	
good (4)	
satisfactory (3)	
passed (2)	
failed (1)	

3.6 Javítás és pótlás

In the case of a failed midterm test, a retake is possible in accordance with the Academic and Examination Regulations (TVSZ). A second retake is also available upon payment of a special procedure fee. Submission of tasks and the Individual work can be replaced in week 15 upon payment of a special procedure fee.

3.7 A tantárgy elvégzéséhez szükséges tanulmányi munka

Activity	Hours/Semester
Participation in contact classes	14*2=28
Individual work and preparation for the presentation	24
Homework	24
Preparation for the midterm test	44

3.8 A tárgykövetelmények érvényessége

2025. szeptember 1.

Jelen TAD az alábbi félévre érvényes: