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| **Title and code** of the subject: **Environmental technologies II - Water Quality Protection, Sewage Treatment, Waste Management in Agriculture and Food Industry, MTMKG7017A**  | **ECTS Credit Points: 3** |
| **Type** of the subject: compulsory  |
| **Ratio of theory and practice:** (credit%) 70/30 |
| **Type and number of classes per semester**: 28 hour(s) lecture and 14 hour(s) practice per **semester** Number of teaching hours / week : 2+1 (lecture and practice) |
| **Type of exam**: exam |
| **Subject in the curriculum:** semester 3 |
| Preliminary requirements:- |

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| **Summary of content - theory**:  |
| **Course objectives:**The purpose of the course is to acquaint students with the goals, concepts and tools of water quality protection, waste water treatment and waste management. They learn about methods of water qualification and water quality control, sources and forms of water pollution, methods of water treatment, quality and quantity protection and restoration of waters & watercourses. They acquire knowledge about the management, utilization and disposal of agricultural and food waste and by-products. **Curriculum (14 weeks)**1. The concept and purpose of water quality protection, the methods of water quality control and the legal background. Water quality parameters.
2. Human intervention in the river basin. Water pollution and hydromorphological regulations.
3. EU and international methods of water qualification (physical, chemical, biological & ecological water qualification)
4. Rehabilitation of surface water bodies in the river basin. Self-purification of water.
5. Pollution and protection of groundwater bodies. Water resources protection.
6. Purpose and degree of wastewater purification; the generation and characterization of waste water. Mechanical (primary) sewage purification
7. Ecological and microbiological basics of biological wastewater purification, aerobic and anaerobic sewage purification processes; activated sludge and trickling filters, biological nitrogen and phosphorus removal; digesters.
8. Natural sewage treatment technologies. Lagoon sewage purification systems; Natural aquatic plant systems, & Constructed Wetlands.
9. The communal waste management. The role of waste management in agriculture and the food industry; Types, grouping, quantity and agricultural utilization of communal, agricultural and food waste and by-products.
10. Composting technologies based on agricultural and food raw materials and sewage sludge.
11. Biogas production technologies based on agricultural and food raw materials and sewage sludge.
12. Hazardous waste from agriculture and food industry (pesticides, slaughterhouse waste, etc.);
13. The burning and pyrolysis of communal, agricultural and food waste and sewage sludge.
14. Waste disposal – landfill
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| **Summary of content - practice**: |
| Skills to be learnt: The general purpose of the practice is to provide students with knowledge on the operation of water quality, wastewater treatment and waste management technologies, the safe use of equipment, instruments used in environmental ratings, accident prevention role in field, plant and practical work.1. Accident prevention and work safety knowledge
2. Methods and means of field sampling 1.
3. Purchase, conservation and pre-treatment of biological and water samples, on-site measurements and tests (weather, etc.)
4. Analysis of field water samples. : Organoleptic Effects of Water Pollution
5. Biological water qualification. Classification of water pollutants
6. Basics of Hydrological and Water Quality Modelling, Hydrological, Morphological and Water Physics. River Water Quality
7. Basics of hydrological and water quality modelling biological and water chemistry. Introduction and application to the HEC-Ras model
8. The Debrecen Wastewater Treatment Plant, the Water Treatment Plant in Balmazújváros and the Eco centrum of Lake Tisza visit (8-10 hours)
9. Planning of Dorr settlers. Sewage treatment plant. Complex sewage treatment
10. Calculation of weighing scales in waste management and sewage treatment. Material flow chart.
11. Composting Quizzes
12. Analysis of the efficiency of wastewater treatment (Excel) Complex sewage treatment.
13. Examination of water quality and hydrological time series (Excel) Using regression, factor and cluster analysis through a practical example.
14. Establishment of a landfill. Isolation of a non-hazardous (municipal) landfill.
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| **Literature, handbooks in English**  |
| 1. The curriculum (ppt or pdf format) is available to the student.
2. Federal Interagency Stream Restoration Working Group (FISRWG) (10/1998). Stream Corridor Restoration: Principles, Processes, and Practices. GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN3/PT.653. ISBN-0-934213-59-3.
3. T. H. Christensen: Solid Waste Technology & Management, Volume 1 & 2. Blackwell Publishing Ltd 2011. Print ISBN: 9781405175173. Online ISBN: 9780470666883.
4. M. R. Templeton, D. Butler: An Introduction to Wastewater Treatment. Ventus Publishing 2011. ISBN 978-87-7681-843-2
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| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**
* The student possesses a general knowledge of the fields of science, environment, nature conservation, engineering and economics related to water quality and waste management (Acquisition, treatment and analysis of environmental samples.).
* The student is acquainted with the activity system, the design and implementation methods and rules of the scientific field.
1. **Skills** – **abilities:**
* The student is capable of a multidisciplinary, interdisciplinary approach to water quality, water purification and waste management.
* The student is able to carry out his / her professional activity as a contributor within the technical teamwork and legal framework.
* The student acquires ability to design, develop, implement and control natural, biological-based environmental technologies within a teamwork.
* The student is capable of defining, planning and organizing the activities of the subject field.
1. **Attitude:**
	* + The student is open and responsive to the knowledge and practical application of modern and innovative practices in the field of environmental management and technology
* The student is committed to solving problems on a professional basis.
* The student is compliant with regulations and demands from its subordinates.
1. **Autonomy and responsibility:**
* The student has considerable autonomy in the implementation of a specific activity.
* The student makes decisions with professional responsibility.
* The student is an equal partner in professional co-operation.
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| **Responsible lecturer: Dr Csaba Pregun,**  |
| **Terms of course completion:** |
| 1. Completing assignments / exercises
2. Giving presentation
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| **Form of examination:** |
| Written (Quizzes & Essays) |
| **Requirement(s) to get signature:** |
| Participating in the exercises.Successful written examination paper |

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| **Exam questions:** |
| **Water quality protection:**1. Pollutant sources of water, type of contamination, groups of water contaminants
2. Chemical properties of waters
3. Bacteriological classification of water
4. Biological rating of water
5. Physical characterization of water,
6. The organoleptic properties of water
7. Pollution and damage to surface waters, the self-cleaning of surface waters
8. Sources of pollution of groundwater, spread of pollutants in groundwater.
9. Groundwater pollution technologies
10. The means of water quality control and the technical methods of water quality protection,
11. Methods for regulating eutrophication
12. Oil pollution and its effects, the elimination of oil pollution
13. Ecological Water Quality Assessment (WFD)
14. Quality requirements for drinking water. Drinking water treatment.
15. Qualification and rehabilitation of watercourses. Qualification and rehabilitation of standing waters.

**Wastewater treatment:**1. Types of waste water, their generation and collection
2. Mechanical sewage treatment
3. Types of biological wastewater treatment
4. Drip irrigation and diving reel wastewater purification
5. An active sludge wastewater treatment and oxidation ditch
6. Third stage of sewage treatment. Removal of plant nutrients.
7. Degrees and description of sewage treatment
8. Sewage treatment in the lake (Lagoon)
9. Natural and semi-natural sewage treatment technologies
10. Artificial wetlands

**Waste Management:**1. Describe the definition and grouping of communal, food and agricultural wastes.
2. Characterize the collection and storage of communal, food and agricultural waste.
3. Describe the main usable components of communal, food and agricultural wastes!
4. Describe the main uses of communal, food and agricultural waste.
5. Describe the conditions for the utilization of communal, food and agricultural wastes for energy purposes.
6. Describe the technology and processes of incineration and pyrolysis of food and communal, agricultural wastes.
7. Describe the different biogas production technologies!
8. Characterize the composting processes and technologies of food and agricultural waste and by-products of different origins.
9. Describe the food and agricultural wastewaters and sewage sludge, and the rules and conditions of the agricultural placement!
10. Describe the conditions for disposal of waste by landfill.

**Test questions (quizzes):**All questions are discussed during the practices. |