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| **Title and code** of the subject: **Wastewater and slurry management, MTMVG7011A** | **ECTS Credit: 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 classes per week: 2+1 | |
| **Type of exam**: **exam** | |
| **Subject in the curriculum:** semester 2 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| Course objectives:  The wastewater and slurry management course introduces students to modern wastewater treatment objectives, concepts and its importance. Furthermore, water pollution forms caused due to human action and the methods of water purification and treatments are also introduced. Students learn the objectives and procedures of modern slurry treatments and recovery. It promotes the formation of new agro-environmental approach. Students will be able to determine the likely impact of water pollution, and its degree and danger, they can make a decision about the need for intervention. Important information will be scored in the topic of sewage, sludge, sewage sludge compost and manure storage and agricultural utilization, and their legal background. The students become proficient for the selection of the necessary wastewater cleaning, treatment and particularly the utilization technology based on the relevant legal requirements. The students will have theoretical and practical background knowledge about the necessary wastewater qualification methods.   1. The objectives of wastewater treatment technology; The production and characterisation of wastewater; General wastewater quality requirements. 2. The degree of wastewater treatment (mechanical, physical-chemical, biological wastewater treatment operations). Theoretical basis, their conditions and implementation; 3. Chemical treatment degree of wastewater treatment. Theoretical basis, their conditions and implementation 4. The conditions and microbiological background of aerobic wastewater treatment processes, and their practical implementation; Trickling water treatment, biological nitrogen and phosphorus removal; 5. The conditions and microbiological background of anaerobic wastewater treatment processes, and their practical implementation; Digesters; 6. Natural Technologies of Wastewater Treatment; Aquatic plants systems and Bioeliminators. 7. Visiting of Wastewater Treatment Plant of Debrecen, Hungary 8. Calculations and sizing of the wastewater treatment technologies; Examination of models of activated sludge and fixed film systems. Options of intensification for sludge anaerobic digestion. 9. Presentation of specific wastewater treatment processes used in industrial plants: Ion exchange, reverse osmosis, membrane filtration. 10. Presentation and comparing methods of sewage sludge treatment and recovery processes (agricultural utilization, composting, biogas production, incineration); Sludge dewatering and sizing of its equipment. 11. International and national position, proportions and practical implementation of sewage sludge utilization; Legal background and framework of sludge storage, utilization and transport; 12. Concept of slurry, conditions of slurry production, the quality and composition of slurry. Presentation and comparing of the slurry-treatment processes; 13. Slurry-utilization methods (agricultural utilization, biogas production, etc.). Legal background of slurry storage and utilization; Presentation of Nitrate Directive rules. 14. Visiting of Regional Biogas Plant of Nyíbátor, and Cattle Farm of Bátortrade Ltd., Hungary |
| **Summary of content - practice**: |
| Skills to be learnt: |
| **Literature, handbooks in English** |
| Crites, R. W., Middlebrooks, J. Reed, S. R. (2006): Natural Wastewater Treatment Systems. CRC Press. 549 p. (ISBN: 978-146-658-326-9)ű  Gerardi, M. H. (2006): Wastewater bacteria. John Wiley & Sons, Inc., Hoboken, New Jersey. 272 p. (ISBN: 978-047-197-991-3)  Hettiarachchi, H., Ardakanian, R. (2016): Safe Use of Wastewater in Agriculture: Good Practice Examples. UNU-Flores. United National University. Institute for Intergrated Management of Material Fluxes and of Resources. (ISBN: 978-394-486-330-6).  Sastry, C. A., Hashim, M. A., Agamuthu, P. (1995): Waste Treatment Plants 1st Edition. Wiley. 435 p. (ISBN: 978-047-114-301-7)  Tamás J., Kovács E. (2008): Environmental technology. University of Debrecen, Institute of Water- and Environmental Management. TÁMOP 4.1.2.   1. <http://www.tankonyvtar.hu/en/tartalom/tamop425/0032_kornyezettechnologia_en/ch03.html> |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**   - - Has a high level of natural sciences and technical knowledge necessary for the operation of agricultural water management.  - Know the applicability and the legal regulation of the latest agricultural water management technologies and procedures.  - Acknowledges in detail the characteristics of agricultural water management and processes, recognizes the existing relationships among them.   1. **Skills:**   - They are able to apply and further develop the latest agricultural water management technologies and processes  - They are able to independently interpret and apply legislation related to its professional activity.  - Capacity to analyse and evaluate agri-business and related sectors  - Have the knowledge in a written and oral communication in Hungarian and foreign languages.   1. **Attitude:**   **-** It is committed to environmental protection and a sustainable agricultural economy.  - Recognize professional values, responsive to the application of effective methods and tools  - Open and responsive to the knowledge and practical application of modern and innovative processes   1. **Autonomy and responsibility:**   - Equal partner in professional and specialist co-operation.  - Represents special science and engaged to keep the ethical rules of engineering and environment of its field. |

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| **Responsible lecturer: Prof. Dr. János Tamás** |
| **Other lecturer(s): Dr. Elza Kovács** |

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| **Terms of course completion:** |
| 1. Completing assignments / exercises 2. Submitting essay 3. Giving presentation |
| **Form of examination:** |
| written exam |
| **Requirement(s) to get signature:** |
| Active participation in lectures and exercises, is a successful fulfilment of the tasks defined by the lecturer. |
| **Exam questions:** |
| 1. Sewer network 2. Mechanical treatments of WWTP 3. Screening of WWTP 4. Sedimentation of WWTP 5. Aerobic lagoons 6. Artificial wetlands 7. Anaerobic ponds 8. Facultative ponds 9. Aerobic ponds 10. Biological treatments 11. Denitrifications 12. Phosphorous removal 13. Pre and post sedimentations 14. Biological kinetics of microbiological process 15. Chemical treatments 16. Dewatering of sludge 17. Bio digestion of sludge 18. Microbiological process of digestion 19. Biogas utilization 20. Sludge composting 21. Sludge disposal 22. Sludge incineration |