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| **Title and code** of the subject: **Drainage engineering, MTMKG7028A** | **ECTS Credit Points: 3** |
| **Type** of the subject: optional | |
| **Ratio of theory and practice:** (credit%) 0/100 | |
| **Type and number of classes per semester**: 0 hour(s) lecture and 42 hour(s) practice per semester  Number of teaching hours / week : 0+3 (lecture and practice) | |
| **Type of exam**: practical course mark | |
| **Subject in the curriculum:** semester 1 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
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| **Summary of content - practice**: |
| Course objectives:  The students attending the course can get acquainted with the importance, methods, tools and effects of surface- and subsurface drainage in hilly and flat areas aiming water management conditions suitable for different land use purposes.  Skills to be gained:  Students will practice the implementation of principles, and application of procedures as well as interpretation methods in the fields of basic hydrology, water resources, watershed management, surface and subsurface drainage, agrometeorology, lysimetry, basics of irrigation, soil-water-plant relations.  Contents:   * + - 1. Basics, goals and methods of surface drainage       2. Water damages, formation of surplus waters, resistance of crops to water surplus       3. Surface drainage on hilly areas       4. Surface drainage on flat areas, protection against water loggings       5. Determination of flow carrying capacity of channels       6. Channel design calculations       7. Goals, necessity, importance and history of subsurface drainage       8. Basics and scientific establishment of subsurface drainage (lysimetry)       9. Soil- and groundwater sampling and analyses for subsurface drainage       10. Methods and elements of subsurface drainage       11. Materials and objects of subsurface drainage       12. Design of subsurface drainage networks       13. Subsurface drainage design calculations       14. Construction, operation and maintenance of subsurface drainage networks |
| **Literature, handbooks in English** |
| Larry W. Mays (2011): Water resources engineering. ISBN-13: 978-0470460641, ISBN-10: 0470460644  Nakagami, Ken’ichi, Kubota, Jumpei, Setiawan, Budi Indra (Eds.) (2016): Sustainable water Management. Springer. ISBN: 9789811012044 9811012040 9811012024 9789811012020  Lambert K. Smedema, Willem F. Vlotman, David Rycroft (2004): Modern Land Drainage: Planning, Design and Management of Agricultural Drainage Systems. CRC Press. ISBN 9789058095541  Waller, Peter, Yitayew, Muluneh (2016): Irrigation and Drainage Engineering. Springer. ISBN 978-3-319-05699-9 |
| **Competencies gained** |
| 1. **Knowledge:**  * Understand principles in environment and water management and apply legal requirements. * Understand and able to synthetize agricultural and environmental subjects in relation to agro-environmental issues in an interdisciplinary way. * Know the latest technology alternatives and is open to keep his knowledge up-to-date. * Familiar with the procedure of management in the field of agro-environmental issues**.**  1. **Skills:**  * Able to identify the relations in a soil-water-plant system, able to measure and interpret proper data and information, as well as to carry out scenario analyses. * Able to identify agro-environmental issues, problems and to recommend potential solutions in an innovative way.  1. **Attitude:**  * Become committed to the application of the best techniques to protect environment in the field of water management related to agriculture.  1. **Autonomy and responsibility:**  * Able to complete as well as to manage a research project in a group. |

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| **Responsible lecturer: József Zsembeli, PhD, scientific advisor** |

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| **Terms of course completion:** |
| 1. Completing assignments / exercises listed in Exercise book: Practical exercises for the course of Drainage engineering. 2. Being active in group works. 3. Completing lab works and calculations. 4. Taking part in field visits. |
| **Form of examination:** |
| Oral exam is taken in the examination period of the semester focusing on the knowledge gained. |
| **Requirement(s) to get signature:** |
| Completing the exercises in due time, taking part actively in the practices and field trips and completing homework individually are compulsory. Student may skip class maximum 3 times during the semester. |

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| **Exam questions:** |
| 1. Define the basic principles, goals, and methods of drainage. 2. How damages caused by excess water can be formed, how long can crops tolerate saturated conditions in the soil? 3. What factors must be taken into account in case of drainage in hilly regions? 4. What factors must be taken into account in case of drainage in flat regions? 5. How can water discharge be measured or determined? 6. Describe the methods and conditions of scaling channels? 7. Describe the necessity, importance and history of drainage. 8. Define the types, function and operation of lysimeters. 9. What soil and groundwater analyses are required before the implementation of drainage? 10. Describe the elements of a drain system. 11. Describe the materials and equipment of a drain system. 12. What kind of parameters must be taken into consideration for designing a drainage system? 13. Describe the scaling methods of drainage systems. 14. Describe the implementation, operation and maintenance requirements of drainage systems. |