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| **Title** of the subject: **Water management II – excess water management, irrigation techniques** | **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 2 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| Course objectives:  The students attending the course can get acquainted with the importance, methods, tools and effects of excess water management and irrigation.  Contents:   1. Causes and conditions of forming of excess water. 2. Excess water systems and water shed areas in plain lands. 3. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration. 4. Tools of implementation, technical, agrotechnical and agronomical measures aiming excess water management. 5. Designing and setting of outlet systems. Setting and maintaining excess water outlet canals. 6. Objects of excess water outlet canals, objects serving outlet water control. 7. Preparation of watershed management plans. 8. Reutilisation of waters, the quality of retained, stored water. 9. Management focussing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts. 10. Review of technological practices, activities of irrigation management concerning agriculture and environmental management. 11. Review of theoretical knowledge of irrigation and exercises in practice. 12. Basic knowledge of irrigation techniques, process of setting of an irrigation system, general information on automatic irrigation systems, main elements of irrigation systems. 13. Features and application of surface, sprinkle and micro irrigation. 14. Theory of designing, theory of setting and installation, handing over of irrigation systems. |
| **Summary of content - practice**: |
| 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 and agrometeorology, lysimetry, irrigation management and operation, water resources, watershed management, surface and subsurface drainage, soil-water-plant relations.  Contents:   1. Basic definitions of excess water management. 2. Causes and conditions of forming of excess water. 3. Technical, agrotechnical and agronomical measures of excess water management. 4. Setting, maintaining and objects of excess water outlet canals. 5. Preparation of water shed management plans. 6. Utilisation of excess waters for the decrease of water demand of irrigation. 7. Fundamentals and basic definitions of irrigation technology. 8. Elements and techniques of surface irrigation. 9. Elements and techniques of sprinkler irrigation. 10. Elements and techniques of micro-irrigation. 11. Pumps applied in irrigation. 12. Theory and practice of irrigation design. 13. Irrigation systems in the XXI century. |
| **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  [Larry Keesen; Cindy Code](http://www.amazon.com/s/ref=ntt_athr_dp_sr_1?_encoding=UTF8&sort=relevancerank&search-alias=books&field-author=Larry%20Keesen%3B%20Cindy%20Code) (1995): The Complete Irrigation Workbook: Design, Installation, Maintenance & Water Management. GIE Media, Inc., Richfield OH.  [Stephen W. Smith](http://www.amazon.com/s/ref=ntt_athr_dp_sr_1?_encoding=UTF8&sort=relevancerank&search-alias=books&field-author=Stephen%20W.%20Smith) (1997): Landscape Irrigation: Design and Management. John Wiley & Sons, Inc., Hoboken, New Jersey. |
| **Competencies gained** |
| 1. **Knowledge:**  * Understand principles in water management and irrigation 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 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 home work 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 excess water management. 2. Describe the causes and conditions of the formation of excess water. 3. Describe the characteristics of inland water systems and flat land water sheds. 4. Describe the technical, agrotechnical and agronomical measures of excess water management. 5. What factors must be taken into account for the design and construction of a discharge system? 6. Describe the implementation, operation and maintenance requirements of a discharge system. 7. What soil and groundwater analyses are required before the implementation of drainage? 8. What are the elements of the design of a watershed management plan? 9. How can excess water be utilized for irrigation? What are the conditions? 10. Describe the basic definitions of irrigation techniques. 11. Describe the elements and technical methods of surface irrigation. 12. Describe the elements and technical methods of sprinkle irrigation. 13. Describe the elements and technical methods of micro irrigation. 14. What factors must be taken into consideration for designing irrigation? 15. Describe the irrigation systems applied in the 21st century. |