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| **Title and code** of the subject: **Excess water management, MTMVG7020A** | **ECTS Credit: 4** |
| **Type** of the subject: compulsory |
| **Ratio of theory and practice:** (credit%) 50/50 |
| **Type and number of classes per semester**: 28 hour(s) lecture and 28 hour(s) practice per semesterNumber of classes per week: 2+2 |
| **Type of exam**: exam |
| **Subject in the curriculum:** semester 4 |
| Preliminary requirements:- |

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| **Summary of content - theory**:  |
| Course objectives:Causes and conditions of forming of excess water. Excess water systems and water shed areas in plain lands. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration. Tools of implementation, technical, agrotechnical and agronomical measures aiming at excess water management. Designing and setting of outlet systems. Setting and maintaining excess water outlet canals. Objects of excess water outlet canals – sluices, water controlling objects – objects serving outlet water control. Preparation of water shed management plans. Retaining and fast outlet of excess waters in a particular area. Utilisation of excess waters for the decrease of water demand of irrigation. Reutilisation of waters, the quality of retained, stored water. Management focusing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.Contents:1. Basic definitions of excess water management.
2. Causes and conditions of forming of excess water.
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. Excess water systems and watershed areas.
6. Technical, agrotechnical and agronomical measures of excess water management.
7. Objects of excess water outlet canals, objects serving outlet water control.
8. Designing and setting of outlet systems.
9. Setting, maintaining and objects of excess water outlet canals.
10. Preparation of water shed management plans.
11. Utilisation of excess waters for the decrease of water demand of irrigation.
12. Management focussing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.
13. Reutilisation of waters, the quality of retained, stored water.
14. Basic principles of law governing water use management.
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| **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, water resources, watershed management, surface and subsurface drainage, agrometeorology, lysimetry, basics of GIS, soil-water-plant relations.Contents:1. Principles of designing a discharge system in an area regularly endangered by excess water.
2. Hydrological analysis that provides the input parameters essential for the design of a discharge system.
3. Watershed and river basin planning.
4. The components of the hydrologic cycle, including precipitation, evapotranspiration, infiltration, subsurface flow, runoff.
5. Simulation of the hydrologic cycle by means of lysimeters.
6. Basic concept of meteorological phenomena especially which related to agriculture and climate analysis.
7. Introduction of water resources.
8. Principles, methods of water regulation and distribution of flow through different hydraulic structures
9. Social, political and economic dimensions of water-supply development.
10. Improved operation of sustainable watershed management.
11. Basic hydraulics and hydrology.
12. The effects of physical soil properties on crop growth and soil water movement.
13. Designing a subsurface drainage system
14. Practical and methodological fundamentals and techniques on hydrobiology and water ecology.
15. Finding the latest scientific articles in relation to drainage.
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| **Literature, handbooks in English**  |
| Larry W. Mays (2011): Water resources engineering. ISBN-13: 978-0470460641, ISBN-10: 0470460644Nakagami, Ken’ichi, Kubota, Jumpei, Setiawan, Budi Indra (Eds.) (2016): Sustainable water Management. Springer. ISBN: 9789811012044 9811012040 9811012024 9789811012020Cech, Thomas. 2005. Principles of Water Resources: History, Development, Management, and Policy. 2nd Edition. Wiley.Todd, D.K., Groundwater Hydrology, 2nd ed., Wiley, New York, 1980. |
| **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 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 Excess water management.
2. Being active in group works.
3. Completing lab works and calculations.
4. Taking part in field visits.
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| **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. Define the types, function and operation of lysimeters.
8. What soil and groundwater analyses are required before the implementation of drainage?
9. What are the conditions of utilizing excess water for irrigation?
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