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| **Title and code** of the subject: **Water management I. - Agrohydrology MTMKG7002A** | **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 1 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| Students acquire knowledge on hydrological cycle, watercourses, rules of water cycle. Accomplishing the course, students will be able to evaluate the soil-plant water relationship and assess the hydrological processes and water balance of cropping sites. The goal of the course is to make students understand and use the practical application of drought management, including the following: forms, rise, quantitative characteristics, measurement, spatial and periodical dispersions, and density- and dispersion functions of drought. Applying the mechanisms, forms, measurement and calculation of the evapotranspiration.  1. Water management of watersheds. Basics of agrohydrology, water cycle, water balance  2. Role of agrohydrology, water supply of Earth, the elements of water cycle, the element of water balance (precipitation, evapotranspiration, infiltration, runoff, water ponding. The basic relations of the elements of water cycle  3. Classification of water flow, categorization of natural water flows, Parameters of catchments, and characterization of catchment types. Characterization of ross section of river flows,  4. Pond formation and their morphology, types of ponds and reservoirs.  5. Origin, occurrence of underground water types. Classification and characterization of underground water. Anomalies in underground water. Dynamics of underground water.  6. Soil-plant water relationship  7. Crop damages caused by extreme weather - prevention  8. Measurement methods of meteorological and microclimatic factors effect on water balance  9. Measurement methods of soil water balance  10. Measurement methods of water supply  11. Define the concept of water scarcity and drought, drought types  12. Agricultural Drought Analysis Methods - traditional drought indices  13. Agricultural Drought Monitoring -Drought indices based on remote sensing data  14. The possibilities of drought damage prevention in agriculture. Options for adaptation to drought |
| **Summary of content - practice**: |
| The overall objective of the exercise is to provide practical knowledge of the terrain modeling required for river basin planning. In addition, during the semester students get acquainted with the practical application of applied drought indices and water supply measurement methodology. In addition, IT technology is also used to describe the use of river basin modeling for drainage and aggregation.  1-2. Basic land measurements, area survey in rectangular and polar coordinate systems. - demonstration field practice  3-4. Cross section and microrelief leveling. - demonstration field practice  5-6. Modeling of runoff, drainage and basin conditions based on data of practice 3-4 - GIS applications  7-8. Calculation and evaluation of traditional drought indices - calculation tasks  9-10. Measuring meteorological and microclimate factors affecting water resources - demonstration field practice  11-12. Measuring soil water resources - demonstration field practice  13-14. Measuring Abiotic Stress Effects on Foliage (Spectral, Thermography) - Demonstration Field Practice |
| **Literature, handbooks in English** |
| 1. Keith Wheatley (2015): Agricultural Water Management: Insights and Challenges. Callisto Reference ISBN: 9781632391278 2. Premjit Sharma (2013): Agricultural Water Management. Genetech, 302. ISBN: 9788189729233 3. OECD (2014): Climate Change , Water and Agriculture: Towards resilient systems, OECD Studies on Water, OECD Publishing ISBN:978-92-64-20913-8 4. Wilfried Brutsaert 2005: Hydrology: An Introduction. Cambridge University Press ISBN 9781107268791 5. World Meteorological Organization (WMO) and Global Water Partnership (GWP), 2016: Handbook of Drought Indicators and Indices (M. Svoboda and B.A. Fuchs). Integrated Drought Management Programme (IDMP), Integrated Drought Management Tools and Guidelines Series 2. Geneva. |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**  * Knows, understands and applies the professional vocabulary, expression and formulation of field of expertise in English. * Has general and specific knowledge of agricultural, food chain safety, natural sciences, environmental protection, nature conservation, technical and economic studies related to its field of specialization. * Understands the links between the fields of the related disciplines, and understands and systematizes the relationships. * Knows and understands the different legal policy environments of a given field of activity and the existing relationships. * Knows, understands, and applies the principles of protecting the natural environment.  1. **Skills:**  * capable of identifying special professional problems and exploring the detailed conceptual and practical background needed to solve them. * able to analyze in detail the different areas, to explore the comprehensive and specific contexts. * able to formulate a synthetic evaluation of the results of the analysis and produce a report. * able to use state-of-the-art IT tools to provide professional and effective oral and written communication. * Able to handle regional and cross-border agrarian and environmental conflicts after obtaining good practice and develop and implement solution proposals.  1. **Attitude:**  * Open and responsive to the knowledge and practical application of modern and innovative practices in the field of environmental management. * Recognizes values, responsive to the application of effective methods and tools. * Committed to solving problems on a professional basis. * Recognizes and accepts the limitations and risks of making decisions about the specialty of the profession.  1. **Autonomy and responsibility:**  * Has considerable autonomy in the implementation of a specific activity. * Capable of independent, environmentally-oriented management, and capable of applying and developing modern agricultural technologies. |

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| **Responsible lecturer: Dr. habil. Nagy Attila, associate professor, PhD** |
| **Other lecturer(s): -** |

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| **Terms of course completion:** |
| 1. Active participation in the practical lessons (at least 11) 2. Completing exercises 3. Submitting report at the end of the semester |
| **Form of examination:** |
| written exam |
| **Requirement(s) to get signature:** |
| A report, including the objective interpretation of roles, methods and the results of field scale and GIS laboratory exercises on the field of agrohydrology. |

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| **Exam questions:** |
| 1. Classify the watercourses! Categorize natural watercourses! 2. Describe the river valley types, stage features and estuary types. 3. Describe the geometric parameters of the catchment areas, describe the catchment areas. 4. Characterize the cross sections of the watercourses, perform a site survey. 5. Describe the generation and the morphology of the lakes. 6. Describe the types of lakes! 7. Group groundwater types on the basis of their origin and appearance. 8. Classify and characterize the stratified waters 9. Classify and characterize karst waters! 10. Describe the groundwater types based on depth and groundwater flow! 11. Describe the groundwater anomalies! 12. Define the concept of water scarcity and drought! 13. Describe the types of drought! 14. Describe the methods of analyzing drought in agriculture - traditional drought indices! 15. Characterize drought indices based on agricultural drought monitoring - remote sensed data! 16. Characterize the role of water in plants, water flow and water absorption factors. 17. Define and describe the concept of water potential. 18. Describe the evapotranspiration determination possibilities of vegetation! 19. Describe and characterize the relationship between soil and water (characteristics, permeability and water permeability)! 20. Describe the precipitation measurement methods (automatic, precipitation forecast)! 21. Describe evaporation measurement methods (basins, lysimeter)! 22. Describe air humidity measurement methods! 23. Describe soil infiltration measurement methods (4 types)! 24. Describe measuring soil water capacity! 25. Describe and characterize soil moisture measurement methods! 26. Describe and characterize soil sampling methods (undisturbed, undisturbed)! 27. Describe water potential measurement methods! 28. Describe hydraulic conductivity measurement methods (field and lab)! 29. Describe spectral measurement methods of abiotic stress on abiotic stress on foliage! 30. Describe the elements and operating principles of SAP FLOW. |