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| **Title and code** of the subject:  **Drought management, MTMKG7026A** | **ECTS Credit Points: 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 **semester**  Number of classes per week: 2 lectures + 2 semesters | |
| **Type of exam**: practical course mark | |
| **Subject in the curriculum:** semester 3 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| The aim of the course is to make students understand and apply the practical application of drought management, including the following: the 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. The ability of evaluation of technological practices, activities of drought monitoring concerning agriculture and environmental management. The course provides advanced knowledge on drought monitoring and mitigation techniques, theory and practice of designing, theory of setting and installation, handing over plant water supply for irrigation systems. As a result of completing the course students will be able to apply principles of advanced drought management as potential managers or professional experts. |
| **Summary of content - practice**: |
| The goal of the following exercises are to get the agricultural environmental management engineering MSc students acquainted with mainly drought management plans, drought stress monitoring and a method for measurement and calculation of the evapotranspiration. The exercises provide advanced knowledge on drought monitoring techniques, plant water supply for irrigation systems. As a result of completing the exercises, students will be able to apply principles of advanced drought monitoring.  1. Define the concept of water scarcity and drought, drought types  2. Water scarcity and droughts in the international policy and in the EU Water Framework Directive -drought, water quantity on points  3. National Drought Strategy elements, the main steps of drought management plans  4. Agricultural Drought Analysis Methods - traditional drought indices  5. Agricultural Drought Monitoring - Remote sensing data based vegetation indexes in Agricultural Drought Monitoring  6. The possibilities of drought damage prevention in agriculture  7. Options for adaptation to drought in agriculture  8. Soil-water-plant relations The measurement of soil water reservoir  9. Measurement micro-meteorological and climatic factors affecting water supply  10. Field data calibrated hyperspectral data in water stress detection  11. Measuring and analysing soil-water-plant relations abiotic stress on canopy based on spectral features  12. Irrigation scheduling and evapotranspiration calculation methods  13. The surface and subsurface water resources utilization periods of drought - Water retention opportunities in agriculture  14. Irrigation development opportunities in arid regions |
| **Literature, handbooks in English** |
| 1. Paul A. DeBarry (2004): Watersheds: Processes, Assessment and Management. John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN-13: 978-0471264231 2. Isobel W. Heathcote (2009): Integrated Watershed Management: Principles and Practice. John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN-13: 978-0470376256 3. World Meteorological Organization (WMO) and Global Water Partnership (GWP) (2014) National Drought Management Policy Guidelines: A Template for Action (D.A. Wilhite). Integrated Drought Management Programme (IDMP) Tools and Guidelines Series 1. WMO, Geneva, Switzerland and GWP, Stockholm, Sweden. 4. 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. 5. Global Water Partnership Central and Easter Europe (2015). Guidelines for the preparation of Drought Management Plans. Development and implementation in the context of the EU Water Framework Directive, Global Water Partnership Central and Eastern Europe, 48pp |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**  * Know, understand and apply the professional vocabulary, expressions and formulation of your field of expertise in English. * Familiar with sustainable farming, possesses the most up-to-date knowledge of remote sensing technology in agriculture, knows the principles of the technical-technological development of agriculture. * Have 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 field to related disciplines, and understands and systematises the relationships. * Know and understand the different legal policy environments of a given field of activity and the existing relationships. * Know, understand, and apply 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. * Recognize and accept 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, the application and development of 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 the lessons (at least 11) 2. Completing exercises 3. Submitting report at the end of the semester |
| **Form of examination:** |
| practical course mark in 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. |

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| **Exam questions:** |
| 1. What is the concept of water scarcity and drought? 2. What types of drought do you know? Describe! 3. How do you assess the international policy of water scarcity and drought? 4. What are the EU Water Framework Directives on Drought and Water Quantities? 5. What are the main steps in drought management plans? 6. What are the methods of analyzing drought in agriculture - traditional drought indices? 7. What are the drought indices based on agricultural drought monitoring - remote sensed data? 8. What are the possibilities to prevent agriculture from drought damage? 9. What are the options for adaptation to drought? 10. What are the role of water in plants, water flow, factors influencing water uptake? 11. What are the possibilities of evapotranspiration calculations of vegetation? 12. Characterize the relationship between soil and water (characteristics, drainage and water permeability)? 13. How do you describe the microclimatic conditions and changes of an agricultural site? 14. What are the possibilities of spectral measurement of abiotic stress on abiotic stress on foliage? Describe! 15. What are the possibilities of abiotic stress on abiotic stress measurements on foliage? Describe! 16. How is the relationship between water retention and good tillage analyzed? |