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| **Title and code** of the subject: **Remote sensing and GIS in hydrology, MTMVG7014A** | **ECTS Credit: 4** |
| **Type** of the subject: compulsory / optional | |
| **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+2 | |
| **Type of exam**: **exam** | |
| **Subject in the curriculum:** semester 2 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| Course objectives:  The goal of this subject is to make it possibile for the students to do image analyses and to learn the basics of remote sensing and hydrological data collection. Within this subject the students get acquainted with the modern spatial resolution support methods as well. They can build up and manage several geo-database systems and learn the theoretical and practical essentials of water management models.   1. Spatial objects 2. GIS models 3. GNSS methods 4. Input data collection methods 5. Structure of geo-database for surface waters 6. Structure of geo-database for groundwater 7. Spatial decision support in water management 8. Spatial uncertainty and risk analysis in water management 9. Physically background of remote sensing 10. Space borne and airborne remote sensing 11. Image analysis and land use 12. Image analysis and water quality management 13. Hydrological modelling 14. Hungarian and international hydrology databases and data mining |
| **Summary of content - practice**: |
| Skills to be learnt:   1. Sample collection and preparation 2. EM spectra VI 3. EM spectra NIR 4. Avantes spectrometer 5. Alta spectrometer 6. Uncalibrated measuring 7. Calibration measuring 8. Spectral curves 9. Soil spectrum 10. Vegetation spectrum 11. Satellite spectrum 12. Unsupervised classification 13. Supervised classification 14. Technical reporting and presentation |
| **Literature, handbooks in English** |
| 1. Li, Z., Zhu, Q., Gold, C. (2005): Digital terrain modeling: Principles and Methodology. CRC Press. 318 p. (ISBN: 0-415-32462-9) 2. Khorram, S., van der Wiele, C. F., Koch, F. H., Nelson, S. A. C., Potts, M. D. (2016): Principles of Applied Remote Sensing. Springer. 307 p. (ISBN: 978-331-922-593) 3. Maquire, D. J. (2005): GIS, Spatial Analysis and Modeling. ESRI Press. 479 p. (ISBN: 978-158-948-130-5) |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**   - Has a high level of natural sciences and technical knowledge necessary for the operation of agricultural water management.  - Know the applicability and the legal regulation of the latest agricultural water management technologies and procedures.  - Acknowledges in detail the characteristics of agricultural water management and processes, recognizes the existing relationships among them.   1. **Skills:**   - They are able to apply and further develop the latest agricultural water management technologies and processes  - They are able to independently interpret and apply legislation related to their professional activity.  - Capacity to analyse and evaluate agri-business and related sectors  - Have the knowledge in a written and oral communication in Hungarian and foreign languages.   1. **Attitude:**   **-**  The student is committed to environmental protection and a sustainable agricultural economy.  - Recognize professional values, responsive to the application of effective methods and tools  - Open and responsive to the knowledge and practical application of modern and innovative processes   1. **Autonomy and responsibility:**   - Equal partner in professional and specialist co-operation.  - Represents special science and engaged to keep the ethical rules of engineering and environment of its field. |

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| **Responsible lecturer: Prof. János Tamás** |
| **Other lecturer(s): Dr. Attila Nagy** |

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| **Terms of course completion:** |
| 1. Completing assignments / exercises 2. Submitting essay 3. Giving presentation |
| **Form of examination:** |
| written exam |
| **Requirement(s) to get signature:** |
| Active participation in lectures and exercises, plus a successful fulfilment of the tasks defined by the lecturer. |

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| **Exam questions:** |
| 1. Spatial objects 2. EM spectrum Visible 3. EM spectrum Near infrared 4. EM spectrum Radar 5. Physically background of remote sensing 6. Space borne and airborne remote sensing 7. Landsat satellite systems 8. Sentinel satellite system 9. Supervised classification 10. Unsupervised classification 11. Image analysis and land use 12. Image analysis and vegetation indexes 13. Image analysis and water quality management 14. Hyperspectral image analysis 15. Airborne laser scanning 16. Point clouds segmentation 17. Hydrological modelling DEM 18. Hungarian and international hydrology databases and data mining |