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| **Title and code** of the subject: **Remote sensing, MTMKG7025A** | **ECTS Credit Points: 3** |
| **Type** of the subject: optional |
| **Ratio of theory and practice:** (credit%) **0/100** |
| **Type and number of classes per semester**: 0 hour(s) lecture and 42 hour(s) practice per **semester** Number of teaching hours / week : 0+3 (lecture and practice) |
| **Type of exam**: practical course mark |
| **Subject in the curriculum:** semester 3 |
| Preliminary requirements:- |

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| **Summary of content - theory**:  |
| Though there are no theory lectures, the aim of the course is to present the basics and practical application of remote sensing. Throughout the course, students will learn about the physical background of remote sensing, the tools of remote sensing and methods of data processing and their practical applications. The course practice is orientated to the aspects of remote sensing with agricultural, environmental management applications. The subject covers the topics of multispectral, hyperspectral remote sensing, thermography and laser scanning. |
| **Summary of content - practice**: |
| Skills to be learnt: During the exercises, the students will be able to process the data from the remote sensations using GIS software. The students learn several RS based land-use change and monitoring, vegetation analysis, abiotic stress effects on orchards, arable crops, drought management, forestry applications, drainage conditions, ground conditions and inland water risk analysis. The analytical methods are acquired through sample tasks in a GIS software environment. 1. Physical basics of remote sensing. Interpretation of the physical characteristics of the electromagnetic wave through the measurement and analysis of the reflection properties of soil and vegetation.
2. Grouping remote sensing devices and data. Description of more commonly used satellites, evaluation of aerial remote sensing methods for analyzing multispectral and hyperspectral remote sensing methods
3. Georeferencing remote sensing data
4. Analysis of relevant vegetation indices. Quantitative evaluation methods
5. Interpretation and Application of supervised and unsupervised classifications, Post Processing, Error Matrix, and Kappa Index Calculation Methods.
6. Assessing effects of abiotic stress, regional drought and biomass monitoring based on multispectral data
7. Project task: Multispectral and airborne hyperspectral data analysis of agricultural land, by supervised classification, post-processing
8. Project task: Hyperspectral examination of spatial distribution of vegetation by supervised class classification, post-processing
9. Run-off modeling based on radar and laser scanning data
10. Forest monitoring and species variety composition analysis based on hyperspectral data
11. Spectral assessment of the physical density and moisture of the soils
12. Spectral evaluation of canopy water supply
13. Thermography in the assessment of water supply in agriculture
14. Analysing on orchards by non-destructive instruments
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| **Literature, handbooks in English**  |
| 1. x
2. x
3. x
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| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**
* Know, understand and apply the professional vocabulary, expression and formulation of your field of expertise in English languages.
* 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.
* Familiar with the specificRS based research methods and techniques of the field of expertise, the ways of developing the practical aspects of theoretical questions.
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.
* Ability to measure and sustain sustainable agro-ecological potential on regional, municipal and land-level planning processes.
* Capable of designing, developing, implementing and controlling natural, biological-based environmental technologies
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** |

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

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| **Exam questions:** |
| 1. What are the physical basics of remote sensing?
2. How can the reflection characteristics of vegetation be characterized (draw the relevant reflectance spectrum)? What are the most relevant wavelength intervals?
3. How can the reflection characteristics of water bodies be characterized (draw the relevant reflectance spectrum)? What are the most relevant wavelength intervals?
4. How can the reflection characteristics of soils be characterized (draw the relevant reflectance spectrum)? What are the most relevant wavelength intervals?
5. What remote sensing devices and data types do you know (group)?
6. Describe MODIS data
7. Landsat data description
8. SPOT data description
9. Describe Sentinel Data
10. Describe AISA DUAL Sensor and Data
11. What are the methods of georeferencing? How does it have to be done?
12. List and describe the most well-known vegetation indices (minimum 5)? Analyze them!
13. Evaluate the supervised and unsupervised image classification methods. What are their advantages and disadvantages, what are their areas of application?
14. What are post-processing, error matrix and kappa-index calculation methods and how to apply them?
15. How to monitor agricultural drought and biomass changes, abiotic stress effects based on multispectral data?
16. What are the main steps in mapping and evaluation of agricultural land?
17. What are the main steps for the evaluation of the spatial distribution of vegetation?
18. How to model a runoff based on remote sensing data?
19. What are the main steps of forest monitoring and tree species composition analysis?
20. How is it possible to measure the water supply of a canopy with non-destructive measurements?
21. Describe the role of thermography in the assessment of water supply in agriculture.
22. Describe the role of non-destructive maturing process monitoring.
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