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| **Title and** of the subject: **Soil Physics, MTMVG7005A** | **ECTS Credit: 3** |
| **Type** of the subject: compulsory / optional |
| **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 classes per week: 2+1 |
| **Type of exam**: exam |
| **Subject in the curriculum:** semester 1 |
| Preliminary requirements:- |

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| **Summary of content - theory**: The aim of the lectures is to provide students with a basic understanding of theoretical and applied soil physics. In the frame of the course students are given an overall and up-to-date knowledge on soil physics involved in water management, soil cultivation and amelioration.Cognition of the most important physical processes in the soil- water- air system and learning the mitigation options of the adverse effects on the soil water regime according to the following themes: |
| Course objectives:1. Soil, as natural resource, functions and composition the soils. Soil forming factors and processes
2. Particle sizes. Physical and physico-chemical properties of particles with different sizes
3. Soil texture. Textural classes of soil particles
4. Soil properties related to soil texture
5. The structure of solid phase in soils. Genesis of soil structure (physical, chemical processes), characterization of soil structure (soil physical and morphological techniques),
6. Total and differential porosity of soils. Functions of pores with different sizes.
7. Soil water principles: Water forms in the soils. Energy concept of soil water (soil water potential, components of water potential).
8. Water movement in soil, saturated flow
9. Transport of soil water under unsaturated conditions
10. Practical aspects of water retention and movement in soils. Soil water management categories.
11. Soil Aeration. Mechanism of soil gas exchange. Air movement in the soils.
12. Pedotransfer rules and functions for estimation of soil properties difficult to measure.
13. Soil compaction and soil structure deterioration
14. Soil physical aspects of amelioration, cultivation and irrigation.
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| **Summary of content - practice**: |
| Skills to be learnt: 1. Soil forming processes in the target areas of the exercises. Selection of areas to be examined individually by students.
2. Assessment of particle size fractions by sedimentation test, using different dispersion agents.
3. Determination of mechanical composition (summation curve, texture triangle, texture calculator)
4. Simple methods for estimating the textural classes
5. Evaluation of soil structure (soil genesis and agronomy concept)
6. Determination of bulk density, calculation of total soil porosity
7. Water retention (pF) curve. Simple ways to determine the main water capacity values (total and field capacity, estimated wilting point). Using pedotransfer functions for estimation of pF curve.
8. Build up devices and measuring saturated water movement. Evaluation the data based on Darcy's law.
9. Measuring unsaturated flow by means of tension infiltrometer.
10. Infiltration measurement with double ring infiltrometer and rainfall simulator. Describing the measurement results with different infiltration equations.
11. Laboratory measurement of air permeability.
12. Estimation of water regime properties by using different pedotransfer models.
13. On-site characterization of the investigated soils (feel method for estimating the textural class, morphology of structural elements, measuring penetrometer resistance). Interviewing researchers of the institutes about the possibilities to reduce the unfavorable physical properties of the investigated soils.
14. Reporting on investigation results.
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| **Literature, handbooks in English**  |
| Compulsory textbooks:1. Várallyay Gy. (2013): Soil Scientific Basis of Agricultural Water Management. http://www.tankonyvtar.hu/hu/tartalom/tamop412A/2011\_0009\_Varallyay\_Gyorgy-Soil\_Scientific\_Basis\_of\_Agricultural\_Water\_Management/ch16.html
2. Manoj K. Shukla (2013) Soil Physics: An Introduction. CRC Press. ISBN 9781439888421

Recommended textbooks:1. Glinski, J., Horabik, J. Lipiec, J. (Eds.) (2011): Encyclopedia of Agrophysics. Springer. ISBN 978-90-481-3585-1
2. Hillel, D. (1980) Fundamentals of Soil Physics ACADEMIC PRESS, INC. Elsevier Inc ISBN: 978-0-08-091870-9
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| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**
* High level of knowledge of soil physics for the soil cultivation, amelioration and agricultural water management
* Detailed knowledge of the features, processes and relationships between processes in the soil-water-air system
* Knowledge and application ability of up to date and soil specific technologies for sustainable soil management
1. **Attitude:**

- Commitment to solving problems on a professional basis - His/her opinion is subject to professional considerations- The opinion is based on knowledge in soil physics, which is consistently represented1. **Autonomy and responsibility:**

- Having knowledge of soil science, he/she decides independently on workflow implementation- He/she makes decisions with professional responsibility. |

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| **Responsible lecturer: Lajos Blaskó prof. emeritus** |
| **Other lecturer(s): -** |

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| **Terms of course completion:** |
| 1. Performing exercises
2. listening to lectures
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| **Form of examination:** |
| Colloquium |
| **Requirement(s) to get signature:** |
| submission of the practical summary, evaluation |

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| **Exam questions:** |
| 1. Describe the size ranges of particle fractions that make up the soil!
2. Describe the typical mineral composition of particles with different sizes!
3. Describe the main features of sand / silt / clay fractions!
4. Describe the principles of defining particle size fractions!
5. Describe the classification of soils by mechanical composition (texture)!
6. Describe some simple test methods for estimating texture!
7. Describe the most important soil characteristics associated with the clay fraction!
8. Describe the mechanism of structure formation!
9. Describe the forces involved in the formation of soil structure!
10. Describe the adhesives of the soil structure!
11. Describe the morphological evaluation of the soil structure!
12. Describe the agronomic evaluation of the soil structure!
13. Describe the meaning of particle density and bulk density!
14. Describe how to determine total and differential porosity of soil!
15. Characterize soil moisture potential and its components!
16. Describe the basic principles of determining the pF curve!
17. Summarize the estimation options of moisture capacity values and the pF curve!
18. Describe the principles of water movement in soil!
19. Characterize the saturated water movement and its measurement possibilities!
20. Characterize the three-phase water movement and its measurement possibilities!
21. Describe the main connections between soil l air permeability and fertility!
22. Describe the possibilities of measuring soil compaction, the limit values for characterization of compaction!
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