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| **Title and code** of the subject: **Applied Hydrology and Hydraulics, MTMVG7001A** | **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  Number of classes per week: 2 lectures + 2 seminars | |
| **Type of exam**: exam & practical course mark | |
| **Subject in the curriculum:** semester 1 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| Course objectives:  Students learn about the basics of hydrology, water cycle, precipitation and run-off patterns, soil moisture, groundwater and the analysis process, subsurface water sources. Aquifers, flow, analysis and quality are covered. Pollution, and problems are also discussed. In graduate programs, theories are studied, including distribution, testing, movement and contaminants. Contaminants in different water sources is the focus of this course. Students learn about different contaminants in ground water, streams and precipitation. Protection, removal and treatment methods are covered. Students learn about creating models, interpreting models and using models in problem-solving. Different types of models are covered. Students may develop their own models in these courses. Students learn about the storage of water and movement within watersheds. This course may cover watershed modelling and introduce students to watershed manipulation techniques. Introduces the physical statics and dynamics and properties of incompressible fluids and the practical application of fluid power principles involving agricultural and environmental engineering worksites.   1. The subject of hydrology, the water supply of the Earth, the circulation of water, the elements of the cycle. The hydrological cycle and its sub-processes. 2. Knowledge, measurement and description of primary elements of water balance (precipitation, evaporation, infiltration, run-off, ponding). Basic relationships of hydrological elements. 3. Hydraulic Basics I. (physical properties of liquids and hydrostatics) 4. Hydraulic Basics II. (flow laws, pressure flow, gravity flow, pump operation and regulation) 5. Basics of hydrodynamics 1. (closed pipeline water movements and groundwater movement) 6. Basics of hydrodynamics (knowledge of open surface water movements and groundwater movements) 7. Classification of watercourses. Types of river valley, type of stage, estuary types. 8. The formation and morphology of the lakes. Types of lakes. 9. Geometric parameters of the catchment areas, characterization of the catchment areas. 10. Cross section of watercourses, site analysis, types of sections. 11. The groundwater. Forms, characterization and classification of stratified waters. 12. Types and characterization of groundwater. 13. Groundwater contamination and treatment. 14. Characterization and classification of karstic waters. Types of springs. |
| **Summary of content - practice**: |
| Skills to be learnt:   1. The hydrological cycle 2. Water balances 3. Hydrostatics 4. Hydrodynamics 5. Conveyance of channels 6. Estimating the energy of watercourses. 7. Sizing of channels 8. River modelling (HEC-RAS) I. 9. River modelling (HEC-RAS) II. 10. Culverts and Bridges 11. River classification methods 12. Storm water collection systems 13. Precipitation, infiltration measurement 14. Groundwater measurement |
| **Literature, handbooks in English** |
| 1. Han D. (2008) Concise Hydraulics. Ventus Publishing ApS. Bookboon.com. ISBN 978-87-7681-396-3 2. Han D. (2010) Concise Hydrology. Ventus Publishing ApS. Bookboon.com. ISBN 978-87-7681-536-3 |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**  * Students understand and are able to describe and explain the physical principles and processes that govern hydrology. * Students should be able to describe the features of the fundamental and elementary hydrological & hydraulic processes * Students will know the fundamental principles that underpin all hydraulic systems, the function of the major system components, the importance of contamination management * The student has a high level of natural sciences and technical knowledge needed to cultivate agricultural water management fields. * The student knows, understands the special vocabulary of his field.  1. **Skills:**  * Students can apply coupled energy and mass balance equations to calculate hydrological fluxes including runoff and streamflow. * Students can practise how to deal with surface and groundwater, addressing both water quantity and quality in the water and agro-environmental management. * Students can do safe working practices associated with agro environmental and water maintenance procedures. * The student is able to develop and implement climate adaptation solutions in their field.  1. **Attitude:**  * The student is committed to environmental protection and sustainable agriculture. * The student gives his / her opinion on a professional basis and consistently represents them.  1. **Autonomy and responsibility:**  * The student has a high degree of autonomy in developing comprehensive and specialized professional questions, representing professional views. * The student takes responsibility for all this. * The student makes decisions with professional responsibility. |

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| **Responsible lecturer: Dr. Csaba Juhász** |
| **Other lecturer(s): Budainé Bódi Erika, Dr Pregun Csaba PhD.** |

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| **Terms of course completion:** |
| Completing assignments and exercises |
| **Form of examination:** |
| Written and/or verbal |
| **Requirement(s) to get signature:** |
| The implementation of the practices.  You can only miss the practice in accordance with the University of Debrecen Study and Exam Regulations. Active participation in exercises.  Calculation exam task. |

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| **Exam questions:** |
| Hydrology   1. The forms of water on Earth 2. The water cycle 3. The water balance equation 4. The humidity measurement 5. Evaporation, calculation of evaporation 6. The forms of precipitation 7. The precipitation 8. Cloud types 9. Quantities to characterize precipitation, measurement of precipitation 10. the infiltration curve 11. The infiltration measurement 12. The runoff 13. The types of watercourses 14. The hydrological characteristics of rivers 15. The types of lakes 16. The flows and currents in lakes 17. The origin of groundwater 18. The forms of appearance of groundwater 19. The groundwater, groundwater types 20. The groundwater 21. The karstic waters 22. The types of springs   Hydraulics   1. The Physical properties of liquids (compressibility, thermal expansion, density, viscosity, surface tension and capillarity) 2. The Ideal and real fluids 3. The Hydrostatic Pressure. Fluid pressure on a flat surface 4. The Hydrostatic Pressure. Generalized fluid pressure on flat nose 5. The Buoyance, Floating and Swimming 6. Kinematic classification of fluid movement 7. The Dynamic classification of fluid movement 8. The Energy equation for ideal fluid movement 9. The Bernoulli equation for viscous liquids - energy losses 10. Laminar fluid movement in pipeline 11. The Turbulent fluid movement in the pipeline 12. Hydraulic dimensioning of pipelines 13. Water movement in open surface canals 14. The application of Stickler – Manning equation 15. The Reynolds and Froude number 16. The Permanent, smooth water movement in open surface channels 17. Dimensioning open-field channels 18. Dimensioning Gravity Pipe Ducts 19. Permanent, gradually changing water movement 20. Flow through culvert and bridge |