University of Debrecen Faculty of Agricultural and Food Sciences and Environmental Management

Agricultural Water Management Engineering MSc Program

2020

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**DEAN’S WELCOME**

On January 1, 2000, the University of Debrecen was born with the need for international competitiveness, which is now the oldest continuously operating higher education institution in the country. It is one of the excellent universities in Hungary, with its 14 faculties and 24 doctoral schools, offering the widest domestic training. Today, the University of Debrecen carries out its agricultural training, research and development activities in three organizational units: the Faculty of Agriculture, Food Science and Environmental Management (MÉK), the Faculty of Economics (GTK) and the Institutes for Agricultural Research and Educational Farm (AKIT). The Faculty of Agriculture, Food Science and Environmental Management - adapting to today's scientific challenges - formulates both its training and research activities according to the circular bioeconomy model, which is based on the recycling of materials and values, by increasing the added value of the produced product, through services and smart solutions. In the ranking of agricultural and higher education institutions in the world, Debrecen is always in the most prominent place, currently it is among the best between 150-200.

The Faculty of Agriculture, Food Science and Environmental Management of the University of Debrecen currently has nearly 1,400 students, and in addition to our Hungarian-language courses, more and more foreign students attend our courses taught in English. Our undergraduate and master's programs, our talent management colleges, and our doctoral schools all play a decisive role in higher agricultural education and scientific supply. It is especially important for us to maintain a wide-ranging system of professional and economic relations with the enterprises of the region, which, on the one hand, provides the conditions for practical training and, on the other hand, helps to utilize the scientific results created at the University. Following the good example of our predecessors, we try to provide students with up-to-date knowledge and practice-oriented knowledge, so that they can enhance and improve the reputation of our institution and Hungarian agriculture.

Dr. László Stündl

associate professor

dean

**HISTORY OF THE UNIVERSITY**

The University of Debrecen, the oldest institution of higher education in the country operated continuously in the same city, is one of the research universities of national excellence in Hungary offering the widest spectrum of educational programs in 14 faculties and 24 doctoral schools.

The roots of higher education in the city reach all the way back to the 16th century and the foundation of the Reformed College of Debrecen in 1538. The College played a central role in Hungarian education and culture for centuries. This is the date featured on the symbol of the university as well, the *gerundium,* a tool originally used by the students of the Reformed College to put out fires, showing respect for ancestors and traditions.

In 1912 with Act XXXVI, originally submitted as a bill by Count János Zichy, Minister of Religion and Public Education, the Hungarian Parliament decided on the establishment of two universities, one in Pozsony [Bratislava] and the other in Debrecen. Thus the Hungarian Royal University of Debrecen was established in the *cívis* town with five faculties (Faculty of Reformed Theology, Faculty of Law, Faculty of Medicine, Faculty of Arts, Linguistics and History, and the Faculty of Mathematics and Science). However, the university opened only two years later, in 1914 with three faculties. First, students studied in the building of the Reformed College, which soon proved to be too small. The city of Debrecen granted a huge (112 acre) land in the Great Forest for the university, and also provided first 5 then an additional 3 million Golden Koronas for the construction of a new building. In 1918 Charles IV inaugurated the central building of the newly founded Faculty of Medicine. The teaching of mathematics and natural sciences started within the Faculty of Arts from the 1923/24 academic year. The independent Faculty of Sciences was opened only in 1949.

In 1921 the university was named after Count István Tisza, former prime minister and statesman who also studied in the Reformed College and who was assassinated on October 31, 1918. Thus the name of the institution was changed to István Tisza Hungarian Royal University of Debrecen.

The construction of the main building of the university started in the 1920s and it was officially opened in 1932. At the time it was the third largest investment project of the country after the building of the Parliament and the Buda Castel Palace. Construction lasted for four years, even so only one third of the original plans could be realized.

After the Second World War the fragmentation of the university (then already having five faculties) was started in 1949 due to political reasons. In the same year the Faculty of Law was temporarily suspended, in 1950 the Faculty of Theology was separated from the university, and it returned to the College with support from the church. Making medical training independent, the Medical University of Debrecen was organized in 1951. The university bore the name of István Tisza until 1945, then it was named University of Debrecen, then from 1952 it operated under the name of Lajos Kossuth University.

In the 1980s negotiations already started about the reunification of fragmented higher education in Debrecen. Events leading to integration, however, accelerated only after 1996 when an amendment stipulated that after December 31, 1998 universities had to provide educational programs of adequate quality in several disciplines.

Finally, on January 1, 2000 the University of Debrecen was established with the integration of the Agricultural University of Debrecen, the Medical University of Debrecen, Lajos Kossuth University, and the István Wargha Teacher Training College of Hajdúböszörmény. The university having an important role and position in Hungarian higher education started its operation with five university and three college faculties organized into three centers, the Center for Agricultural and Applied Economic Sciences, the Medical and Health Science Center, and the Center of Arts and Sciences.

Section 26 of Act CCIII of 2013 on the amendment of particular acts establishing the central budget of Hungary for 2014 included provisions concerning the organizational structure of the university, thus the centers were no longer used as organizational units as of January 1, 2014.

Today the University of Debrecen is a leading and prominent institution of higher education in Hungary. It is not only at the forefront of Hungarian and international education but also active in the fields of research, innovation and development, and enjoys fruitful links with the business sector. The ever-changing social and economic environment demands continuous renewal from the institution and there is a constant need to adapt to new requirements. The University of Debrecen’s mission is to contribute to the education of future generations in cooperation with Hungarian and international partners, with high-quality interdisciplinary programs, and research built on versatile and practical experience.

Besides education, the institution also provides European-quality patient care with comprehensive services to fulfil its obligations in the city, county, and region and often on the national level as well. As of July 1, 2017, with the merger of the Kenézy Gyula Hospital and Clinic, the University of Debrecen Kenézy Gyula Teaching Hospital was established, expanding the capacities of the institution both in patient care and education.

**HISTORY OF THE FACULTY**

The Great Plain and, more broadly, the Tisza River Basin is the center of Hungary's agri-food economy. That is why it was a logical decision from our predecessors to have a higher education and research center in the region to support the production and processing of raw materials, which helps to create and maintain a competitive agriculture by continuously providing qualified human resources and putting scientific results into practice.

In Eastern Hungary, agricultural higher education started in 1868 with the establishment of the Debrecen National Higher School of Economics. Between 1874 and 1906, the institution operated as the Secondary School of Economics, and until 1944 under the name of the Royal Hungarian Academy of Economics. Between 1945 and 1949, our institution operated under the name of the Debrecen Department of the Hungarian University of Agricultural Sciences, Faculty of Agricultural Sciences. In 1953, training resumed at the Debrecen Agricultural Academy. Between 1962 and 1970, specialist training rose to university level at the College of Agricultural Sciences. Between 1970 and 1999, the institution received the “university rank”, the University of Agricultural Sciences in Debrecen served two rural faculties (Szarvas, initially Hódmezővásárhely, later Mezőtúr).

On January 1, 2000, the University of Debrecen was established with five university faculties, three college faculties and three research institutes. The Faculty of Agricultural Economics and Rural Development was established in 2002 and by 2006 the number of faculties of the University had increased to 15. The Faculty of Agriculture, Food Science and Environmental Management (MÉK) and the Faculty of Economics and Rural Development (GVK), as well as three research institutes, formed the Center for Agricultural and Management Sciences (AGTC) until 2014.

# **ADMINISTRATION UNITS FOR INTERNATIONAL PROGRAMMES**

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The Coordinating Centre for International Education supports the international degree programmes of the University of Debrecen in giving new students information on admission and entrance exam. It has tasks in promoting and is in charge of tasks like enrolment, study contracts, modifying student status or degree programme, activating student status, modifying students’ personal data, requesting and updating student cards, providing certificates for the Immigration Office (for residence permit), issuing student status letters and certificates on credit recognition, concluding health insurance contract and providing Health Insurance Card, helping students with visa process application.

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The International Office has been functioning since 2014 in order to ensure the smooth running of the international degree courses. The office is responsible for student administration (full-time students, full-time transfer students, visiting/Erasmus students), providing certificates for students, considering and accepting requests, solving problems related to course registration, giving information about internship, final exam, thesis, etc.

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[**Institute of Animal Science, Biotechnology and Nature Conservation**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22240)

[Department of Animal Husbandry](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22245)

[Animal Genetics Laboratory](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22241)

Department of Animal Nutrition and Food Biotechnology

[Department of Nature Conservation, Zoology and Game Management](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22247)

[**Institute of Crop Sciences**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22210)

Department of Agriculture Botany and Crop Physiology

Department of Crop Production and Applied Ecology

[**Institute of Food Science**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22209)

**Institute of Food Technology**

[**Institute of Horticulture**](http://www.agr.unideb.hu/etk/xsearch.php?lstDep=22250)

[**Institute for Land Utilisation, Technology and Regional Development**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22203)

**Institute of Nutrition**

[**Institute of Plant Protection**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22211)

[**Institute of Water and Environmental Management**](http://www.agr.unideb.hu/etk/xsearch.php?optLang=en&lstDep=22214)

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| Prof. Dr János TamásHead of Institute, Professor | tamas@agr.unideb.huroom 1, building N |
| Dr Csaba JuhászDeputy Head, Associate Professor | blasko@agr.unideb.huroom 10, building N |
| Prof. Dr. Béla BaranyiProfesszor Emeritus | baranyi@agr.unideb.huroom 11, building N |
| Dr Nikolett SzőllősiAssistant Professor | nszollosi@agr.unideb.hu room 22, building N |
| Dr Lajos BlaskóProfessor Emeritus | blasko@agr.unideb.hu room 11, building N |
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| Dr Csaba PregunAssociate Professor | cpregun@agr.unideb.hu room 12, building N |
| Dr. Péter Tamás NagyAssociate Professor | nagypt@agr.unideb.hu room 22, building N |
| Dr Bernadett Farkas-GályaAssistant Professor | bernadett.galya@agr.unideb.hu room 14, building N |
| Dr Tamás MagyarAssistant Professor | magyar.tamas@agr.unideb.huroom 14, building N |
| Erika Budayné- BódiAssistant Lecturer | bodi.erika@agr.unideb.hu room 14, building N |
| Imre Lászlóné HuszkaAdministrative Assistant | huszka.imrene.ildiko@agr.unideb.hu room 1, building N |

**ACADEMIC CALENDAR**

# General structure of the academic year:

|  |  |  |  |
| --- | --- | --- | --- |
| Fall semester | 1st – 2nd week  | Registration\* | 2 weeks |
| 1st – 14th week | Study Periodfor non-graduating students | 14 weeks |
| 1st – 9th week | Study Periodfor graduating students | 9 weeks |
| directly after the study period | Exams for non-graduating students | 7 weeks |
| directly after the study period | Exams for graduating students | 3 weeks |
| Spring semester | 1st – 2nd week  | Registration\* | 2 weeks |
| 1st – 14th week | Study Periodfor non-graduating students | 14 weeks |
| 1st – 10th week | Study Periodfor graduating students | 10 weeks |
| directly after the study period | Exams for non-graduating students | 7 weeks |
| directly after the study period | Exams for graduating students | 5 weeks |

**ACADEMIC CALENDAR OF THE FACULTY OF AGRICULTURAL AND FOOD SCIENCES AND ENVIRONMENTAL MANAGEMENT 2020/2021**

The academic calendar for the given semester can be found on the faculty's website: <https://mek.unideb.hu/en/useful-information-your-study#overlay-context=en>

# **THE AGRICULTURAL WATER MANAGEMENT ENGINEERING GRADUATE PROGRAM**

INTRODUCTION OF THE PROGRAM

|  |  |
| --- | --- |
| Name of graduate program: | Agricultural Water Management Engineer Graduate Program |
| Level: | MSc |
| Qualification: | Agricultural Water Management Engineer |
| Mode of attendance: | Full-time |
| Faculty: | Faculty of Agricultural and Food Sciences and Environmental Management |
| Program coordinator: | Attila Nagy, associate professor |
| Program length: | 4 semesters |
| Credits total: | 120 credits |

 The aim of the training is to train agricultural water management engineers who are able to use creative engineering in the field of sustainable integrated water management within the field of agricultural water management with the knowledge gained in master's degree. With their qualifications they are able to cooperate at a high level in solving domestic and international problems related to their field of expertise. They are suitable for the design and development of engineering, research and leadership positions. They are ready to continue their studies in doctoral training.

Agricultural water management engineers will have the knowledge of

* high level scientific, technical and relevant knowledge required for the agricultural water management.
* the applicability of the latest agricultural water management technologies and procedures and their legal regulations.
* the specificities of agricultural water management and processes, recognition the existing relationships between them.
* the latest IT solutions for agricultural water management and sustainable water resources management.
* international relations, the design, implementation, implementation methods, rules and related features of agricultural water management.
* the specialties of team and project work, with leadership knowledge.
* the different levels of leadership functions, the methods of evaluation, and conflict management techniques.
* modern management theory and applied psychology that can be applied in the field and applicable to the whole agricultural sector.
* the relationship between the economy, the society and the agricultural sector.
* the strategic role of R & D & I in the agrarian economy.
* the specific methods of research, abstraction techniques, and the ways of developing the practical aspects of theoretical questions.
* the professional and effective oral, written and network communication methods and tools.
* the special vocabulary of the field of expertise in English.

 Agricultural water management engineers will have competences on

* developing and implementing climate adaptation solutions.
* using and further developing the latest agricultural water management technologies and processes.
* coordinating the professional task of agricultural water management.
* orientating and providing a professionally based opinion on domestic and international economic policy and social events related to the agricultural economy.
* independently interpreting and applying legislation related to its professional activity.
* defining, planning and organizing the activity of the field of expertise.
* forming its own position and defending it in a debate about general social, agricultural economics, and special issues related to the field.
* following a thorough, analytical approach to the relevant international literature of its field of expertise.
* providing the necessary conditions for the implementation of the specified activities, to continuously manage and control the implementation, and to organize it.
* practicing the various functions of leadership activities, motivating them, evaluating their performance, and legitimate and effective handling of conflicts.
* developing a project team, actively participating in research and development projects.
* analysing the different areas of the ideas that form the knowledge system of the given field of expertise, and of exploring the complex and specific contexts.
* identifying the professional problems, their versatile, interdisciplinary approach, and the detailed, conceptual and practical background needed to solve it.
* agrarian analyses, which can be transposed across sectors, contexts, complex formulas and evaluations.
* applying state-of-the-art IT tools, professional and effective oral and written communication.
* engineering and environmental friendly solutions that support individuals and the health of society.

Main subjects typically include (this list is indicative and subject to change): Applied Hydrology and Hydraulics, Climatology, Hydrogeograpy, Hidrobiology, Water Chemistry, Soil Physics, Melioration and Land Consolidation, Pond Culture and Fisheries Management, Irrigated Crop Production, Floodplain Management, Irrigation for Horticultural Production, Wastewater and Slurry Management, Management and Utilization of Aquatic Habitats, Water Resource Protection – Environmental Damage Prevention, Remote Sensing and GIS in Hydrology, Farm Irrigation Machines , Irrigation Technology , Precision Agriculture, Drought Management, Integrated Water Management and Monitoring, Water Economics, Excess Water Management, Agricultural Water Supply Systems, Agricultural Water Management Planning and Implementation, Water Policy, Water Law and Sectoral Public Administration, Thesis.

Internship, practice: Students should complete a 4-week summer field practice. 65

Career prospects: Postgraduates are qualified for the design and development of engineering, research and leadership positions. They may continue their studies in doctoral training.

**COURSE DESCRIPTIONS FOR AGRICULTURAL ENVIRONMENTAL MANAGEMENT ENGINEERING MSC**

The order of subjects in alphabetical order.

[Academic language skills (scientific language), MTM7NY1](/sites/default/files/upload_documents/mtm7ny1a_0.docx)

[Agricultural water management planning and implementation, MTMVG7022A](/sites/default/files/upload_documents/mtmvg7022a.docx)

[Agricultural water supply systems, MTMVG7021A](/sites/default/files/upload_documents/mtmvg7021a.docx)

[Applied hydrology and hydraulics, MTMVG7001A](/sites/default/files/upload_documents/mtmvg7001a.docx)

[Climatology, hydrogeograpy, MTMVG7002A](/sites/default/files/upload_documents/mtmvg7002a.docx)

[Drought management, MTMKG70026A](/sites/default/files/upload_documents/mtmkg7026a_0.docx)

[Environmental technologies I - Soil remediation, soil protection, biotechnology in agriculture, MTMKG7013A](/sites/default/files/upload_documents/mtmkg7013a_0.docx)

[Excess water management, MTMVG7020A](/sites/default/files/upload_documents/mtmvg7020a.docx)

[Farm Business Management and Project Management, MTMKG7018A](/sites/default/files/upload_documents/mtmkg7018a_0.docx)

[Farm machines of the irrigation, irrigation technology, MTMVG7015A](/sites/default/files/upload_documents/mtmvg7015a.docx)

[Floodplain management, MTMVG7009A](/sites/default/files/upload_documents/mtmvg7009a.docx)

[Hidrobiology, MTMVG7003A](/sites/default/files/upload_documents/mtmvg7003a.docx)

[Integrated water management and monitoring, MTMVG7018A](/sites/default/files/upload_documents/mtmkg7018a_1.docx)

[Irrigated crop production, MTMVG7008A](/sites/default/files/upload_documents/mtmvg7008a.docx)

[Irrigation for horticultural production, MTMVG7010A](/sites/default/files/upload_documents/mtmvg7010a.docx)

[Management and utilization of aquatic habitats, MTMVG7012A](/sites/default/files/upload_documents/mtmvg7012a.docx)

[Melioration and land-consolidation, MTMVG7006A](/sites/default/files/upload_documents/mtmvg7006a.docx)

[Pond culture and fisheries management, MTMVG7007A](/sites/default/files/upload_documents/mtmvg7007a.docx)

[Precision agriculture, MTMVG7016A](/sites/default/files/upload_documents/mtmvg7016a.docx)

[Professional language skills (business language), MTM7NY2](/sites/default/files/upload_documents/mtm7ny2a_0.docx)

[Remote sensing, MTMKG7025A](/sites/default/files/upload_documents/mtmkg7025a.docx)

[Remote sensing and GIS in hydrology, MTMVG7014A](/sites/default/files/upload_documents/mtmvg7014a.docx)

[Soil physics, MTMVG7005A](/sites/default/files/upload_documents/mtmvg7005a.docx)

[Urban hydrology, MTMVG7024A](/sites/default/files/upload_documents/mtmvg7024a.docx)

[Wastewater and slurry management, MTMVG7011A](/sites/default/files/upload_documents/mtmvg7011a.docx)

[Water chemistry, MTMVG7004A](/sites/default/files/upload_documents/mtmvg7004a.docx)

[Water economics, MTMVG7019A](/sites/default/files/upload_documents/mtmvg7019a.docx)

[Water resource protection – environmental damage prevention, MTMVG7012A](/sites/default/files/upload_documents/mtmvg7013a.docx)

[Waterpolicy, water law and sectoral public administration, MTMVG7023A](/sites/default/files/upload_documents/mtmvg7023a.docx)

**Academic Language Skills MTM7NY1A**

ECTS Credit Points: 3

0 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: practical course mark

Requirements:

- for signature: Absence as regards class attendance (3 allowed absences per semester).

- for a grade: Continuous tests orally and written. A term mark to be given at the end of the semester.

**Summary of content - theory**:

To provide students with the knowledge and the skills with which they can confidently and effectively complete their courses. The students get to know the basic grammatical and stylistic requirements and peculiarities of the written genres in higher education, as well as acquire the essential structural and linguistic formulas of debate and sharing of opinions.

 **lectures:**

|  |
| --- |
| Effective source handling (information filtering and evaluation) |
| The purpose, audience, and structure of the writing assignment |
| The most important form requirements of writing assignments (report, thesis, academic article) |
| Punctuation usage |
| Structure, paragraphs, and conjunctions |
| The abstract and the introduction |
| Midterm exam |
| Clear, logically constructed expression of opinion  |
| Constructive debate, reasoning (support of the argument), counter-arguments |
| Brief problem-solving exercises in the foreign language to improve debate skills |
| Complex case studies Part 1  |
| Complex case studies Part 2  |
| Sources and possibilities of independent study |
| End term, Evaluation |

**practices:**

|  |
| --- |
| Academic writing, speaking, reading comprehension and listening comprehension  |
|  Academic vocabulary building, writing, speaking listening and reading comprehension  |
| Presentation skills, reading comprehension and listening comprehension, academic writing |
| Developing academic literacy, speaking, reading and listening comprehension,  |
| Speaking and presenting,, reading comprehension and listening comprehension tasks, and academic writing.  |
| The situational dialogues, reading comprehension and listening comprehension tasks, and writing a formal letter regarding a given topic |
| A survey of the skills and knowledge acquired thus far |
| Poster and presentation, reading comprehension and listening comprehension tasks, and academic writing.  |
| Effective presentation, reading comprehension and listening comprehension tasks, and academic writing |
| Time management, critical thinking, reading comprehension and listening comprehension tasks, and writing essays. |
| Presentation, reading comprehension and listening comprehension tasks, and academic writing |
| Speaking and presentation, reading comprehension and listening comprehension tasks, and academic writing |
| Essay writing, speaking, reading comprehension and listening comprehension |
| A survey of the skills and knowledge acquired throughout the semester |

**Literature**

[Martin Hewings](http://www.cambridge.org/gb/cambridgeenglish/authors/martin-hewings): Cambridge Academic Skills B2 Upper Intermediate. CUP, 2012. ISBN 97 80521165204

REID, Joy M. *The Process of Composition.* 3rd Edition. Longman: White Plains, NY., 2000. ISBN: 0-13-021317-9.

WIWCZAROSKI, Troy B. *Writing and Professional Communication*. Debrecen, 2007.

**Agricultural water management planning and implementation, MTMVG7022A**

ECTS Credit Points: 3

14 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: colloquium

Requirements:

- for signature: A report including the objective interpretation of roles, methods and the results of field scale and GIS laboratory exercises on the field of agricultural water management planning.

- for a grade: written exam

**Summary of content – theory**

In order to get acquainted with agricultural production security and with the adaption to climate change students will study water retention, sustainable management of water resources, water saving irrigation technology planning, design, production methods adapted to climate change and sustainable land use planning processes. Students will acquire the appropriate methods, tools and effects of irrigation technology for the creation of a sustainable irrigated crop management conditions.

Students will be able to evaluate the water capacity of soils at agricultural sites, analyzing the water balance of agricultural sites, identification of sites with erosion risk, assessment and application of agronomic, technical and forestry practices of hilly drainage, lowland drainage, analyzing and planning amelioration. Identification of sites with excess water, creating irrigation fertigation scheduling, and irrigation planning.

**lectures:**

1. Water drainage on hilly regions.

2. Delineation of areas at risk of erosion, evaluation and applicability of agronomic, technical and forestry practices of hilly drainage

3. Plains water management, excess water drainage.

4. Channeling, channel planning

5. Methods of soil pipe drainage network planning and design. Soil and groundwater investigations methods in correspondence with soil piping, the soil pipe network construction, operation and maintenance.

6. Structure and planning of Micro Irrigation Systems

7. Structure and planning of Sprinkler Systems

8. Structure and planning of Surface Design of irrigation systems

9. Irrigation and fertigation planning.

**Summary of content - practice**:

The purpose of the practice is to enable students to understand the water balance of arable land and orchards. In addition, Student will be able to delineate erosion risk areas, landscaping on hilly sites by agro technical, technical and forestry methods, melioration options and design. In addition, vulnerable areas can be delineated for the preparation of irrigation plans and planning of irrigation turns for nutrient solution.

**practices:**

1. Geospatial delimitation of excess water effected areas, drainage collection calculation modeling

2. Channel measurement

3. Methods of designing the piping networks. Soil and groundwater studies related to soil piping.

4. Designing, operating and maintaining pipeline networks.

5. Design of surface irrigation systems

6. Preparation of irrigation and nutrient plan for sprinkling irrigation systems

7. Assessment of irrigation and nutrient management plan for sprinkling irrigation systems

8. Preparation of irrigation and nutrient plan for sprinkling micro-sprinkling systems

9. Assessment of irrigation and nutrient management plan for sprinkling micro-sprinkling systems

**Literature, handbooks**

Uhlig, U. (2011): Current Issues of Water Management. InTech Published. 340 p. ISBN: 978-9533074139.

Kumar, M. D., Sivamohan, M. V. K., Bassi, N. (2012): Water Management, Food Security and Sustainable Agriculture in Developing Economies (Earthscan Studies in Water Resource Management). Routledge. 256 p. ISBN: 978-0415624077.

Tanji, K. K., Kielen, N. C. (2006): Agricultural Drainage Water Management in Arid and Semi-arid Areas. FAO. ISBN: 978-8172334567.

H. Bjornlund, C. A. Brebbia, S. Wheeler: Sustainable Irrigation and Drainage IV: Management, Technologies and Policies. WIT Press / Computational Mechanics. 2012. ISBN-13: 978-1845646486

Chaudhry, M. H. (2007): Open-Channel Flow. Springer. 2nd edition. 540 p. ISBN: 978-0387301747.

Majumdar, D. K. (2012): Irrigation Water Management: Principles and Practice. PHI Learning Private Limited. 570 p. ISBN: 978-8120317297.

**Agricultural water supply systems, MTMVG7021A**

ECTS Credit Points: 4

28 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: colloquium

Requirements:

- for signature: Exercise attendance and active participation in exercises.

- for a grade: Written exam

**Summary of content – theory**

Acquiring theoretical and practical knowledge of agricultural water supply systems (mainly of their technical tasks and legislation).

**lectures:**

1. The basics and tasks of water management planning. The most important separate provisions of water licensing and the water management planning process.
2. The water management and water protection authorities
3. Water legislation
4. The elements of water supply for agricultural purposes
5. Authorization of agricultural water facilities
6. Watercourses, channels, reservoirs
7. Flood protection, readiness states, flood barriers, water meadows
8. Legislation of maintain river basins and sides
9. The water use charge, and the agricultural water supply fee. Agricultural water management sector development.

**practices:**

1. GIS and remote sensing in water management planning
2. The water management and water protection authorities
3. Water legislation
4. The elements of water supply for agricultural purposes
5. Authorization of agricultural water facilities
6. Inland water channel design
7. The concept, purpose and means of flood protection, readiness states, flood barriers, water meadows
8. Legislation of maintain river basins and sides
9. The water use charge, and the agricultural water supply fee.

**Literature, handbooks**

M. Gupta, P. Srivastava, G. Tsakiris, N. Quinn.: 2019. Agricultural Water Management. Theories and Practice. Academic Press. 416 p.

A. Iglesias, L. Garrote, A. Cancelliere, F. Cubillo, D. Whilhite.: 2009. Coping with Drought Risk in Agriculture and Water Supply Systems. Springer. 356 p.

S.N. Ghosh.: 2018. Flood Control and Drainage Engineering. CBC Press. 400 p.

**Applied Hydrology and Hydraulics, MTMVG7001A**

ECTS Credit Points: 4

28 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: exam & practical course mark

Requirements:

- for 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 of exam tasks.

- for a grade: colloquium

**Summary of content – theory**

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.

 **lectures:**

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..

**practices:**

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:**

Han D. (2008) Concise Hydraulics. Ventus Publishing ApS. Bookboon.com. ISBN 978-87-7681-396-3

Han D. (2010) Concise Hydrology. Ventus Publishing ApS. Bookboon.com. ISBN 978-87-7681-536-3

**Climatology and Hydrogeography, MTMVG7002A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: Oral exam

Requirements:

- for signature: Completing assignments / exercises (60%), submitting essay or giving presentation (00%).

- for a grade: Oral exam

**Summary of content – theory**

The aim of the course is to provide knowledge on the terminology of climatology; to understand the basics of the functioning of the climate system, to understand the interactions between climate forming factors and their impacts; to gain a picture on the temporal and spatial patterns of climate elements and on the anomalies in the climate system of the Earth.

 **lectures:**

1. Definitions of meteorology, processes of the atmosphere
2. Structure and component of the atmosphere. Changes of components of the atmosphere. Solid and liquid components of the atmosphere
3. Dry and wet air. Measures of the humidity
4. Universal gas equation for wet air. Adiabatic processes of wet air. Barometric formula and its practical applications
5. Precipitation forming, types. Acidic rain
6. Weather fronts
7. Atmospheric forces and balance. Condensation. Cloud types
8. Subsurface waters
9. Morphometric background of watersheds. Classification of rivers, headwaters and valley networks
10. River drainage networks, classification of river channel types. The flow regime. Processes of erosion, transportation and accumulation. Sediment transport of fluvial systems
11. Floods and flash floods. Overview of the Danube watershed and the main rivers of Hungary. Problems of Inland excess water
12. Managing river channels
13. The application of Remote Sensing and Geographic Information Systems in hydrogeography

**practices:**

1. Devices of the meteorological measurements. The weather station
2. Ombrometer, ombrograph and the modern alternatives
3. Measuring temperature and the requirements
4. Measuring humidity
5. Potential and real evapotranspiration
6. Possibilities of the prediction and measurements
7. Measuring practice
8. Visiting an active meteorological station
9. Flume experiments: basic concepts, development of different channel types
10. Flume experiments: formation of alluvial fans and delta estuaries.
11. Flume experiments: concepts of surface development in lowland areas.
12. Remote sensing of fluvial environments – delineation of water-related areas by spectral indices.
13. GIS-based methods for determining flow patterns
14. GIS-based methods for determining flow patterns, scenario analyses

**Literature:**

Charlton, R. (2008). Fundamentals of Fluvial Geomorphology. Routledge, New York.

Brierley, G.J., Fryirs, K.A. (2005). Geomorphology and River Management: Applications of the River Styles Framework. Wiley-Blackwell Publishing.

John E. Oliver (ed) (2005): Encyclopedia of wolrd climatology. Springer

C Donald Ahrens: Metorology today. An introduction to weather, climate, and the environment.

**Drought management, MTMKG7026A**

ECTS Credit Points: 4

28 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: written exam

Requirements:- for signature: A report, including the objective interpretation of roles, methods and the results of field scale and GIS laboratory exercises. Active participation the lessons (at least 11), completing exercises.

- for a grade: practical course mark in written exam

**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.

**practices:**

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 analyzing 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**

Paul A. DeBarry (2004): Watersheds: Processes, Assessment and Management. John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN-13: 978-0471264231

Isobel W. Heathcote (2009): Integrated Watershed Management: Principles and Practice. John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN-13: 978-0470376256

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.

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.

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

**Environmental technologies I - Soil remediation, soil protection, biotechnology in agriculture, MTMKG7013A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: A report, including the objective interpretation of roles, methods and the results of field scale and GIS laboratory exercises on the field of remediation and soil conservation.

- for a grade: written exam

**Summary of content - theory**:

This course reviews the basic knowledge of soil pollution, characterization methods of polluted sites, regulations of remediation in Hungary, contamination transport processes in soils, and biological, chemical, physical, phytoremediation (clean-up) technologies in details. Introduction of the reasons and consequences of the main soil degradation processes. Introduction of the technical, agronomical, soil protection, chemical, mechanical, complex amelioration and recultivation methods suitable for the moderation of the unfavourable effects.

**lectures:**

1. Definition of remediation, national and international background and main steps of remediation plans and environmental status assessment

2. Requirements of site characterization, regulation for underground water and geological medium in EU

3. Sampling methods, impoundment methods for contaminated sites

4. Pollution transport in soil and pollution distribution and transformation in soil

5. Aspects of appropriate remediation technologies

6. In-situ and ex-situ physical remediation methods

7. In-situ and ex-situ chemical remediation methods

8. In-situ and ex-situ biological remediation methods, Phytoremediation methods

9. The soil conservation, land reclamation, environmental and soil acidification, salinization, secondary salinization, soil structure degradation, soil compaction.

10. Improving acidic and saline soils.

11. Improve sandy soils, improving soil physical properties of deep ploughing.

12. Water erosion. Technical and agronomic possibilities of protection against erosion.

13. Wind Erosion. Protection against deflation agronomic possibilities.

14. Complex amelioration (soil improvement, drainage, surface drainage and subsurface drainage).

**Summary of content - practice**:

The aim of the practice is to provide students with the skills they need to explore and interpret at a high level, to analyze complex problems in remediation and soil protection with advanced tools. In addition, they are able to interpret legal issues and plan their management.

**practices:**

1. Field practice: Sampling of a polluted site
2. Laboratory and GIS practice: Defining underground contaminant transport by measuring and calculating of ground water flow speed and directions based on field survey data
3. Laboratory and GIS practice: Defining underground contaminant transport by measuring and calculating of ground water flow speed and directions based on field survey data
4. Laboratory practice: Analyze the basic characteristics and pollutants of soil samples (i.e. with XRF)
5. Pollution Distribution Modeling - GIS Applications
6. Laboratory Exercise: Preparation of environmental toxicological and bioaccumulation tests
7. Measuring the environmental toxicological tests
8. Analysing the results of environmental toxicological tests
9. Measuring the bioaccumulation test, dividing roots and shoots and drying it
10. Analyzing the results of bioaccumulation
11. Soil Loss Modeling with RUSLE
12. Field trip: Visiting heavy metal and organic polluted sites with ongoing remediation process
13. Field trip: Visiting heavy metal and organic polluted sites with ongoing remediation process
14. Field trip: Visiting heavy metal and organic polluted sites with ongoing remediation process

**Literature, handbooks:**

Prasad, MNV. 2005. Trace Elements in the Environment: Biogeochemistry, Biotechnology, and Bioremediation CRC Press/Taylor & Francis Group Boca Raton FL 33487 USA 744 ISBN 978-1-56670-685-8

P Lens, T Grotenhuis, G Malina, H Tabak 2005. Soil and Sediment Remediation. IWA Publishing London SW1H 0QS United Kingdom 544 ISBN 9781843391005

Neilson, Alasdair H. 2007. Environmental Degradation and Transformation of Organic Chemicals. Taylor & Francis (USA) Philadelphia, PA 19106 USA ISBN 9780849372414

Mirsal I.A. 2004. Soil pollution: Origin, Monitoring and Remediation Spreinger 312. ISBN: 978-3-540-70775-5

Saligram Bhatt (2004): Environment Protection and Sustainable Development. APH Publishing. 241. p. ISBN 9788176485128

**Excess water management, MTMVG7020A**

ECTS Credit Points: 4

28 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: Oral exam

Requirements:

- for signature: Completing the exercises in due time, taking part actively in the practices and field trips and completing home work individually are compulsory. Student may skip class maximum 3 times during the semester.

- for a grade: Oral exam is taken in the examination period of the semester focusing on the knowledge gained.

**Summary of content – theory**

Causes and conditions of forming of excess water. Excess water systems and water shed areas in plain lands. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration. Tools of implementation, technical, agrotechnical and agronomical measures aiming at excess water management. Designing and setting of outlet systems. Setting and maintaining excess water outlet canals. Objects of excess water outlet canals – sluices, water controlling objects – objects serving outlet water control. Preparation of water shed management plans. Retaining and fast outlet of excess waters in a particular area. Utilisation of excess waters for the decrease of water demand of irrigation. Reutilisation of waters, the quality of retained, stored water. Management focusing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.

**lectures:**

1. Basic definitions of excess water management.
2. Causes and conditions of forming of excess water.
3. Controlled outlet of excess waters taking the changeable hydrological conditions for a longer term into consideration.
4. Tools of implementation, technical, agrotechnical and agronomical measures aiming excess water management.
5. Excess water systems and watershed areas.
6. Technical, agrotechnical and agronomical measures of excess water management.
7. Objects of excess water outlet canals, objects serving outlet water control.
8. Designing and setting of outlet systems.
9. Setting, maintaining and objects of excess water outlet canals.
10. Preparation of water shed management plans.
11. Utilisation of excess waters for the decrease of water demand of irrigation.
12. Management focusing on retaining excess waters in order to mitigate the harmful effects of climate change and droughts.
13. Reutilisation of waters, the quality of retained, stored water.
14. Basic principles of law governing water use management.

**Summary of content - practice**:

Students will practice the implementation of principles, and application of procedures as well as interpretation methods in the fields of basic hydrology, water resources, watershed management, surface and subsurface drainage, agrometeorology, lysimetry, basics of GIS, soil-water-plant relations.

**practices:**

1. Principles of designing a discharge system in an area regularly endangered by excess water.
2. Hydrological analysis that provides the input parameters essential for the design of a discharge system.
3. Watershed and river basin planning.
4. The components of the hydrologic cycle, including precipitation, evapotranspiration, infiltration, subsurface flow, runoff.
5. Simulation of the hydrologic cycle by means of lysimeters.
6. Basic concept of meteorological phenomena especially which related to agriculture and climate analysis.
7. Introduction of water resources.
8. Principles, methods of water regulation and distribution of flow through different hydraulic structures
9. Social, political and economic dimensions of water-supply development.
10. Improved operation of sustainable watershed management.
11. Basic hydraulics and hydrology.
12. The effects of physical soil properties on crop growth and soil water movement.
13. Designing a subsurface drainage system
14. Practical and methodological fundamentals and techniques on hydrobiology and water ecology.
15. Finding the latest scientific articles in relation to drainage.

**Literature, handbooks**

Larry W. Mays (2011): Water resources engineering. ISBN-13: 978-0470460641, ISBN-10: 0470460644

Nakagami, Ken’ichi, Kubota, Jumpei, Setiawan, Budi Indra (Eds.) (2016): Sustainable water Management. Springer. ISBN: 9789811012044 9811012040 9811012024 9789811012020

Cech, Thomas. 2005. Principles of Water Resources: History, Development, Management, and Policy. 2nd Edition. Wiley.

Todd, D.K., Groundwater Hydrology, 2nd ed., Wiley, New York, 1980.

**Farm Business Management and Project Management , MTMKG7018A**

ECTS Credit Points: 3

0 hour(s) lecture and 1 hour(s) seminar per semester

Type of exam: Colloquium

Requirements:

- for signature: Completing exercises

- for a grade: Colloquium

**Summary of content - theory**:

Farm business management combines study in agricultural production and science with a variety of business disciplines, preparing students for entrepreneurial, management and leadership roles in the agricultural sector.

Introduction of the basics methodology and most important functions of project management (project design, organization, implementation monitoring and evaluation). After mastering the subject the students will be able to prepare and undertake projects and acquire the basic skills necessary for developing projects.

**lectures:**

1. Farm management, Farm business and enterprises, income costs and profitability
2. Production economic principles and concepts, financial analyses, investment analysis and decision making
3. Marketing, value adding, Human Resource Management, Risk Management
4. The Business Plan, key economic concepts
5. Economics and the market
6. Structure and dynamics of EU farms, CAP Reform 2014-2020
7. European farmers’ intentions to invest in 2014-2020, CAP 2014-2020 Policy Instruments and Precision Agriculture
8. Project Management, Project Life Cycle, PM Principles, Project types, Project characteristics
9. Project Team, Personal Skills in Project Management
10. Project Plan, Step by Step (Scope Management, Time Management, Cost Management)
11. Dealing with Risks and Uncertainties,
12. Project Execution, communication activities, documentation
13. Project reports, conclusion, dissemination
14. Programs, call for tenders related to agricultural and environmental sector in EU

**practices:**

1. Set up a new business
2. Strategical planning
3. Risk management
4. Resource planning
5. Production structure and production technology
6. Production value (Revenue)
7. Production cost
8. Income
9. Project management goals
10. Working in group
11. Communication plan
12. Budget planning
13. Strategical analysis
14. Risk assessment

**Literature, handbooks**

S van Zyl, PG Strauss & JB Stevens 2012. Training material for extension advisors in irrigation water management Volume 2: Technical Learner Guide Part 7: Irrigation economics. Water Research Comission. ISBN 978-1-4312-0342-0. p. 155.

Andrew Woodend 2010. Definitions of Terms used in Farm Business Management. Department for the Environment, Food and Rural Affairs, Crown Copyright. p. 47.

Gary R. Heekens, PMP: Project Management. McGraw-Hill. 0-07-137952-5.
DOI: 10.1036/0071394494. p. 249.

**Farm machines of the irrigation-irrigation technology, MTMVG7015A**

ECTS Credit Points: 3

14 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: exam

Requirements:

- for signature: Giving presentation.

- for a grade: Completing exercise

**Summary of content – theory**

The aim of the course is to learn the structural elements of irrigation systems and the settings of the equipment. The aim of the course is to learn how to control the operation of the irrigation system. Based on the studies students able to control the workflow of an irrigation system.

**lectures:**

1. Mechanics of fluids I.
2. Mechanics of fluids II.
3. Type of pumps. Water pump features.
4. Operation of water pump.
5. Pipes and pipelines.
6. Couplings, pipe fittings. Pipe shut-off devices.
7. Water supply systems in agriculture.
8. Parts of irrigation equipment.
9. Sprinkler head irrigation system.
10. Reel drum irrigation system.
11. Linear, centre pivot irrigation system.
12. Micro spray and drip irrigation system.
13. Water power stations.
14. Water power turbines.

**practices:**

1. Mechanics of fluids I.
2. Mechanics of fluids II.
3. Type of pumps. Water pump features.
4. Operation of water pump.
5. Pipes and pipelines.
6. Couplings, pipe fittings. Pipe shut-off devices.
7. Water supply systems in agriculture.
8. Parts of irrigation equipment’s.
9. Sprinkler head irrigation system.
10. Reel drum irrigation system.
11. Linear, centre pivot irrigation system.
12. Micro spray and drip irrigation system.
13. Water power stations.
14. Water power turbines.

**Literature, handbooks**

Glenn J. Hoffman, Robert G. Evans, Marvin Eli Jensen, Derrel L. Martin, Ronald L. Elliott: Design And Operation Of Farm Irrigation Systems ISBN-13: 978-1892769640, ISBN-10: 1892769646

Brian Bell: Farm Machinery ISBN 1903366682

John Carrol: Tractors and Farm Machinery ISBN-13: 978-0754826583

**Floodplain management, MTMVG7009A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: Written and/or verbal

Requirements:

- for 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.

- for a grade: Written and/or verbal

**Summary of content – theory**

The purpose of the course is to provide the student with an understanding of the principles and current practices for managing floodplains, and other flood hazard areas, to bring about flood-loss reduction and natural resource protection, emphasizing multi-disciplinary approaches to management. Students will learn the relationship between the hydrology, hydraulics, ecology, river morphology. Students gain knowledge about the impacts of human activities on floodplains and the basic possibilities of river corridor restoration. Within integrated river basin management, river valley is presented as an ecological entity along with its flood and inland water protection, water resource management and environmental and nature conservation aspects. The latter are concerned with the role of floodplain and backwaters in landscape protection, in the ecological corridor network, in recreation, in aquatic and ecotourism. The possibilities for river and wetlands restoration are also reviewed.

**lectures:**

1. The concept of floodplain. History of flood management. Floodplain management as part of water resources management. Integrated river basin management and water resource management in the river valley.
2. The hydraulics of the streams.
3. The fluvial geomorphology of the streams and river corridors.
4. Geomorphological and ecohydrological properties of the rivers and river valley.
5. River ecology. The river as a living ecosystem (River continuum and Flood Pulse Concept)
6. The types of floods and floodplains;
7. The river and floodplain classification. The Rosgen classification.
8. The hydrologic computational techniques. Risk assessment.
9. Flood hazard studies; discussion of floodplain management plan.
10. Flood damage reduction strategies and tools.
11. Natural functions and resources of floodplains and their value.
12. Strategies and tools to preserve and/or restore natural and beneficial floodplain resources.
13. Floodplain Management and Protection of Wetlands.
14. River corridor and watershed management

**Summary of content - practice**:

The general purpose of the exercises is to give students a realistic picture of the situation and opportunities of flood management, the relationship between the agricultural and water management, flood management, environmental and nature protection activities on the floodplains.

**practices:**

1. Assessment of the general characteristics of watercourses
2. Geomorphology of streams
3. Stream hydrology and hydraulics
4. Ecohydrology of streams
5. Stream & floodplain ecology I
6. Stream & Floodplain Ecology – Water Quality and Health II
7. Arrangement of rivers and river valleys (Rosgen)
8. The pattern of streamflows
9. Floodplain formation
10. Modelling of aquatic structures
11. Watershed and river basin
12. Water flow in the floodplain
13. Summary and control questions

**Literature, handbooks**

The theoretical and practical material of the course is available in pdf and ppt format.

 FISRWG (10/1998). Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group (FISRWG)(15 Federal agencies of the US gov't). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN3/PT.653. ISBN-0-934213-59-3.x

**Integrated water management and monitoring, MTMVG7018A**

ECTS Credit Points: 5

42 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: Active participation in lectures and exercises, and a successful fulfilment of the tasks defined by the lecturer.

- for a grade: written exam

**Summary of content – theory**

Within this subject the students get acquainted with the Hungarian and international management systems of water catchment areas and the evaluation methods of these systems as well. They learn the planning specifications of water catchment areas of the Carpathian basin and other international catchment areas. With this subject the students will be able to solve water management tasks alone, and they will be able to coordinate the planning and implementation phases of minor catchment areas.

**lectures:**

1. Definition and development of integrated watershed management
2. International management systems of catchment areas, Catchment areas of the Carpathian basin
3. Elaboration of monitoring systems, data collection and data analysis
4. Specifications of catchment area management of Tisza
5. Danube - Drava river basin management
6. Watershed management of the Lake Balaton and its area
7. Industrial water use – Alternative water resources
8. Urban water management
9. Waterways regulation
10. Drainage and reserving of water
11. Irrigation – drought management
12. HEC-RAS
13. SWAT
14. DHI

**practices:**

1. DanubeGIS concept
2. DanubeGIS structure
3. DanubeGIS metadata
4. Inspire directive and hydrology
5. Data management of DanubeGIS
6. SQL and WMS of DanubeGIS
7. Tisza water quality
8. Tisza water quantity
9. Tisza water monitoring
10. Hungarian Drought Monitoring
11. Use Global Precipitation Measurement (GPM) system
12. Earth Observation System
13. IMERG - STRORM system
14. MODIS -Evapotranspiration

**Literature, handbooks**

Chow, V. T., Maidment, D. R., Mays, L. W. (1988) Applied Hydrology. McGraw-Hill Book Company. 558 p. (ISBN: 978-007-010-810-3)

ICPDR (2015): The Danube River Basin District Management Plan. International Comission for the Protection of the Danube River – ICPDR. <https://www.icpdr.org/>

Lawson, J. (2005): River Basin Management. CRC Press. 369 p. (ISBN: 0415392004)

**Irrigated crop production, MTMVG7008A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: Written exam

Requirements:

- for signature: Attendance and active work on the practices, giving a short presentation - for a grade: Written exam

**Summary of content – theory**

The main goals are to give effective academic and practical knowledge connected to irrigated crop production: Interaction between water management and crop production in agriculture. Knowledge about water balance and water requirement of plants. Learning about the significance of environment friendly and economic irrigation. Effects of the irrigation on soil and plant and environment. Principles of irrigation, main functions of irrigation and crop production. Irrigation regime of main crops.

**lectures:**

1. Interaction between water management and crop production in agriculture.
2. Water balance of plants, water demand of plants.
3. Bases of water regulation in crop production.
4. Learning of significance of environment friendly and economic irrigation.
5. Effect of irrigation on soil and plants.
6. Aims of irrigated crop production.
7. Necessity of irrigation, efficiency of water use.
8. Principles of fertilization in irrigated fields.
9. Evaluation of irrigation patterns.
10. Main functions of irrigation and crop production.
11. Correlations between irrigation and yield stability, yield quality.
12. Irrigation regime of main crops I (green peas, alfalfa, red clover).
13. Irrigation regime of main crops II (corn, sweet corn, corn seed).
14. Irrigation regime of main crops III (rice, potato, sugar beet).

**Summary of content - practice**:

The main goals are to give effective practical knowledge connecting to the irrigated crop production.

**practices:**

1. Interaction between water management and crop production in agriculture.
2. Water balance of plants, water demand of plants.
3. Bases of water regulation in crop production.
4. Learning of significance of environment friendly and economic irrigation.
5. Effect of irrigation on soil and plants.
6. Aims of irrigated crop production.
7. Necessity of irrigation, efficiency of water use.
8. Principles of fertilization in irrigated fields.
9. Evaluation of irrigation patterns from the point of view of crop production.
10. Main functions of irrigation and crop production.
11. Correlations between irrigation and yield stability.
12. Practical knowledge on irrigation regime of main crops I (green peas, alfalfa, red clover)
13. Practical knowledge on irrigation regime of main crops II (corn, sweet corn, corn seed)
14. Practical knowledge on irrigation regime of main crops III (rice, potato, sugar beet)

**Literature, handbooks**

Burton, M. (2010): Irrigation Management: Principles and Practices, CAB Intl. ISBN: 9781845935160

Lee, T. S. (2012): Irrigation Systems and Practices in Challenging Environments, Intech, Rijeka, Croatia ISBN 978-953-51-0420-9

Esteve, Y.V, Brebbia, C.A. Rico, D.P. (2008): Sustainable Irrigation Management, Technologies and Policies II WIT Press, Southampton, UK ISBN: 978-1-84564-116-0

Brebbia, C.A, Marinova, M, Bjornlund, H (2010): Sustainable Irrigation Management, Technologies and Policies III, Wit Press/Computational Mechanics, Billerica, USA, ISBN: 9781845644468

M. H. Ali (2010)-Fundamentals of Irrigation and On-farm Water Management-Springer-Verlag New York ISBN 978-1-4419-6334-5

**Irrigation for horticulture production, MTMVG 7010A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: Active participation in lectures and exercises is a successful fulfilment of the tasks defined by the lecturer. Submitting essay, giving presentation.

- for a grade: written exam

**Summary of content – theory**

Production of appropriate quality and quantity horticultural products is provided by excellent irrigation technological practices. The main purpose is the irrigation for the water demand of cultivated plants. The aim of the subject is to introduce the students to the basics of vegetable and fruit irrigation, to recognize the most effective irrigation methods in horticultural crop production, to recognize the irrigation water requirement of horticultural plants and the opportunities of irrigation modelling in horticulture.

**lectures:**

1. The role of water management. The historical overview of irrigation. Situation of irrigation in the world.

2. Basic irrigation concepts and principles of irrigation planning. Recognition of water forms in soil.

3. Measuring of water resources in soil and water status in plants.

4. Technical basics of irrigation (water acquisition, pumps, pipe networks).

5. Technical basics of irrigation (fertigation, fertilizer delivering and dosing).

6. Irrigation methods and purposes in vegetable production.

7. Irrigation methods and purposes in fruit production.

8. Irrigation opportunities in field vegetable production.

9. Irrigation opportunities in greenhouse vegetable production.

10. Irrigation properties of certain fruit species.

11. Irrigation properties of vineyards.

12. Relationship between irrigation and plant protection in vegetable and fruit production.

13. The role of irrigation quality.

14. Remote sensing and GIS in precision irrigation techniques.

**Summary of content - practice**:

The general aim of the practice is that students learn modern irrigation systems in vegetable and fruit plantation and such greenhouse systems, where effective growing is provided by developed irrigation control and fertigation system.

Students adopt irrigation scheduling, quantity, quality and temporal issues of irrigation practices. In order to determine irrigation water requirement, the moisture content of soil, practical calculations are learnt. Students learn the applicability of the most modern irrigation simulation programs in horticulture.

**practices:**

1. Soil moisture calculation, practical application of pF curve in horticulture.
2. Calculation of irrigation requirement of horticultural plants.
3. Water abstraction planning.
4. The role of FAO Cropwat 8.0 and AquaCrop 6.0 software in irrigation modelling.
5. Applicability of FAO Cropwat 8.0 irrigation modelling software in horticulture I.
6. Applicability of FAO Cropwat 8.0 irrigation modelling software in horticulture II.
7. Applicability of FAO Cropwat 8.0 irrigation modelling software in horticulture III.
8. Field exercise/farm visit I.
9. Field exercise/farm visit II.
10. Field exercise/farm visit III.
11. Field exercise/farm visit IV.
12. Field exercise/farm visit V.
13. Field exercise/farm visit VI.
14. Consultation about compulsory practical report.

**Literature, handbooks**

Allen, R. G., Pereira, L. S., Raes D., Smith M. (1998): Crop evapotranspiration: guidelines for computing crop water requirements. Irrigation and Drainage Paper no. 56. FAO. Rome, Olaszország, 300 p.

Christen, E., Ayars, J., Hornbuckle, J., Hickey, M. (2006): Technology and practice for irrigation in vegetables. NSW Department of Primary Industries. State of New South Wales. 59 p.

Stetson, L. E. (2011): Irrigation. 6th edition. Irrigation Research Institute. 1089 p.

Wickson, E. J. (2015): Irrigation in Fruit Growing. Scholar's Choice, 166 p. (ISBN: 978-129-809-435-3)

**Management and utilization of aquatic habitats. MTMVG7012A**

ECTS Credit Points: 3

14 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: exam and personal presentation

Requirements:

- for signature: Participation at the study trips, give a presentation of a case study. Being active during the classes & group works.

- for a grade: Essay type written exam.

**Summary of content – theory**

The general aim of the course is to transfer the basic knowledge necessary for the management of wetlands directly or indirectly affected by the water management practice of agriculture, which helps the agricultural water management engineer’s work in accordance with the regulation of the nature conservation authority and the conservation biological principles.

**lectures:**

1. The basics of the conservation biology.
2. Natural conservation assessment, treatment.
3. The status and situation of wetlands in Hungarian and in international approaches.
4. The Hungarian and international law background of conservation of wetlands.
5. The conceptual bases of habitat management, its legal and economic background.
6. The types of river controls, their history and consequences of the interventions.
7. Revitalization of streaming waters.
8. Types of still waters, their protection and management.
9. Conservation and management of fountains, moorlands, marshes and small astatic and eustatic waters.
10. Conservation and management of reeds.
11. Conservational approaches of fish management in wild waters and fishponds.
12. Situation, conservation and management of soda pans.
13. Hunting and other recreational management of wetlands.
14. Sample projects on wetland management.

**practices:**

1. Field practice.
2. Field practice.
3. Field practice.
4. Field practice.
5. Field practice.
6. Field practice.
7. Field practice.
8. Field practice.
9. Field practice.
10. Field practice.
11. Student presentation.
12. Student presentation.
13. Student presentation.
14. Student presentation.

**Literature, handbooks**

Ian F. Spellerberg (1996): Conservation Biology. Longman. ISBN 0-582-22865-4

C. M. Finlayson et al. (edit) (2018): The Wetland Book, Springer, ISBN 978-90-481-3493-9.

Paul Keddy (2000): Wetland Ecology: Principles and Conservation ISBN 978-0521739672

Lauchlan H. Fraser &Paul Keddy (2005): The World’s Largest Wetlands: Ecology and Conservation.

Boros, Z. Ecsedi and J. Oláh (2013): Ecology and management of soda pans in the Carpathian Basin. Kiadó HTE, Balmazújváros. ISBN 978-963-08-9471-5

**Melioration and Land Consolidation, MTMVG7006A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: Written exam

Requirements:

- for signature: The students must attend the exercises, and absence can only be in accordance with the Study and Exam Rules of the University of Debrecen. Active participation in exercises is also a condition. Students have to perform a computational design examination task. Completing assignment /exercises, submitting essay, giving presentations.

- for a grade: Written exam.

**Summary of content – theory**

To get acquainted with the technical tasks and works of land reclamation and land management activities related to agricultural water management, to learn the related theoretical and practical knowledge.

**lectures:**

1. Melioration, Complex Land Development.
2. Atmospheric-, terrestrial-, hydro- and biomeloration interventions.
3. Regional water management.
4. Lowland water management.
5. Surface water management.
6. Subsurface water management.
7. Design and construction of drainage systems, reservoir systems and soil drainage systems.
8. Highland water management.
9. Agrotechnical, forestry and technological tasks of soil protection.
10. Water catchment management and water management of line-shaped features.
11. Regulation of small watercourses, river basins, protective structures, gully management.
12. Land consolidation (spatial planning).
13. Land consolidation (landscaping).
14. Field trip.

**Summary of content - practice**:

1. The aim of the exercise is for students to work on a topic related to melioration and land consolidation independently and then present them in an oral presentation form.

2. In addition, students can gain practical experience on professional field trips and business visits.

3. In the second half of the semester, students perform soil drainage and related calculations and planning.

**Literature, handbooks**

A. V Al'benskij, P. D Nikitin, A Gourevitch: Handbook of Afforestation and Soil Melioration, Israel Program for Scientific Translations (January 1, 1967) ASIN: B006XBP6Y0-

Boris Stepanovich Maslov (ed.): Agricultural land improvement: a-melioration and reclamation, Eolss Publishers Co. Ltd., Oxford, UK, (2009) ISBN: 978-6

Peter Waller and Muluneh Yitayew: Irrigation and Drainage Engineering, Springer, 2016, ISBN: 978-3-319-05698-2

Rupesh Jarayam Patil: Spatial Techniques for Soil Erosion Estimation Remote Sensing and GIS Approach, Springer, 2018, ISBN: 978-3-319-74285-4

**Pond culture and fisheries management, MTMVG7007A**

ECTS Credit Points: 4

28 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: Oral or written exam

Requirements:

- for signature: Completion of the assignments / exercises and submission of essays on practical topics.

- for a grade: Oral or written exam

**Summary of content – theory**

To provide theoretic information on pond fish culture and fisheries management including key species, fish propagation, extensive and intensive technologies, including feeding as well as the significance of stock assessment and the factors influencing fish production in inland fisheries management.

**lectures:**

1. Current status and tendencies in pond fish culture
2. Pond construction, engineering and water management
3. Applied hydrobiology – plankton management
4. Fish biology propagation and larvae management
5. Feeding and nutrition
6. Pond management and harvesting
7. Multifunctional and integrated aquaculture
8. Aquatic and fisheries resources
9. Key fish species
10. Fish biology: growth, recruitment and management
11. Fish population ecology and dynamics
12. Stock assessment and management
13. Inland fishing methods and equipment
14. Inland fisheries engineering and construction

**Summary of content - practice**:

Information will be provided for the practical application of theoretic skills. The essays, calculations, plans to be submitted are closely related to the topics below:

**practices:**

1. Basics of construction design and calculations for a pond farm
2. Plankton sampling, evaluation and calculations of plankton yield
3. Propagation and larvae rearing of selected freshwater fish species
4. Feed design and formulation
5. Management plan of a pond farm
6. Management plan of an intensive aquaculture system
7. Business plan of a conventional aquaculture enterprise (pond farm or intensive system)
8. Business plan of a multifunctional or integrated aquaculture enterprise
9. Stock assessment calculations for freshwater
10. Population dynamics estimation – yield & recruitment prediction
11. Technical details of inland fisheries structures (dam, waste dam, fish passage, etc.)
12. Financial sources and funding opportunities for fisheries and aquaculture investment and operation

**Literature, handbooks**

FAO (2016): The State of World Fisheries and Aquaculture 2016. Contributing to food security and nutrition for all. Rome. 200 pp.

Boyd, C.E., Lim, C., Queiroz, J., Salie, K., de Wet L., McNevin, A. (2012): Best Management Practices for Responsible Aquaculture. Aquaculture Collaborative Research Support Program [ACRSP]

Burke, D., Goetze, B., Clair D., Egna H. (1996): Pond Dynamics/Aquaculture. Collaborative Research Support Program. Office of International Research and Development Oregon State University, USA

Allan, G., Heasman H., Ferrar P. (2006): Aquaculture Nutrition: Report on the Aquaculture Nutrition Master Class held at Asian Institute of Technology, Bangkok Thailand 7-19 August 2006 ISBN 0 7347 1771 7

**Precision agriculture, MTMVG7016A**

ECTS Credit Points: 3

14 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: Active participation in lectures and exercises, and a successful fulfilment of the tasks defined by the lecturer.

- for a grade: written exam

**Summary of content – theory**

The main aim of this course is to acquire theoretical and practical skills of precision agriculture. Students learn the precision technologies of data collection, data integration, and spatial decision support methods, including precision arable agriculture, precision horticulture and precision livestock farming. Students will be qualified for the application of the precision agriculture principles in environmental management and/or agriculture.

**lectures:**

1. Historical and theoretical background of precision agriculture. Parts and integration of precision agriculture into the practice.
2. Reasons of spatial variability in agriculture
3. Global Positioning System and its complementary systems
4. The role of GIS in precision agriculture
5. Usability of remote sensing data in precision agriculture
6. Databases, data infrastructure and map servers
7. Sensors, monitors, additional instruments
8. Precision plant protection
9. Precision nutrient management
10. Precision water management
11. Precision horticultural
12. Precision animal husbandry
13. Yield monitoring, site specific information after harvest
14. Economical aspects of precision agriculture

**Summary of content - practice**:

Students use spatial data from different data acquisition devices and map spatial and temporal heterogeneity of the soil and vegetation by GIS software and evaluate the maps. Created maps can provide help in decision support in precision agriculture. An important part of the practice is that students become familiar with the most relevant members of Hungarian precision agricultural corporations and their locations throughout the world. Students can visit the service and the precision agriculture tools, which can be provided for the farmers.

**practices:**

1. Job computer – tractor mounted sensors – big data
2. Database management
3. Spatial heterogeneity in self-created digital maps I.
4. Spatial heterogeneity in self-created digital maps II
5. Spatial heterogeneity in self-created digital maps III.
6. Geo-statistically examination for more effective decision support
7. Processing of airborne survey (LiDAR and spectral remote sensing) data for precision agriculture I.
8. Processing of airborne survey (LiDAR and spectral remote sensing) data for precision agriculture II.
9. Processing of airborne survey (LiDAR and spectral remote sensing) data for precision agriculture III.
10. Processing of satellite remote sensing data for precision agriculture I.
11. Processing of satellite remote sensing data for precision agriculture II.
12. Processing of satellite remote sensing data for precision agriculture III.
13. Field exercise/farm visit I.
14. Field exercise/farm visit II.

**Literature, handbooks**

Brase, T. (2005): Precision agriculture. Delmar Cengage Learning. 1st edition. 288 p.

Kennedy, H. (2009) Introduction to 3D Data: Modelling with ArcGIS 3D Analyst and Google Earth. Wiley. 360 p.

Qin, Z. (2015): Precision Agriculture Technology for Crop Farming. Taylor & Francis. 374 p.

Srinivasan, A. (2006): Handbook of precision agriculture: Principles and applications. CRC Press. 683 p. (ISBN: 978-156-022-954-4)

Tamás, J. (2011): Precision Agriculture. University of Debrecen. Centre for Agricultural and Applied Economic Sciences. Debrecen. 126 p.

(<http://www.tankonyvtar.hu/hu/tartalom/tamop425/0032_precizios_mezogazdasag/adatok.html>

**Professional Language Skills, MTMK7NY2A**

ECTS Credit Points: 3

28 hour(s) lecture and 0 hour(s) seminar per semester

Type of exam: exam mark

Requirements:

- for signature: Absence as regards class attendance (3 allowed absences per semester)

- for a grade: Completing assignments / exercises. Continuous tests orally and written. A term mark to be given at the end of the semester

**Summary of content - theory**:

The main goal of the classes is to acquire the essence of oral communication, its general connection system, as well as the components of communication, and to get introduced to the professional and human communication. Students will get acquainted with the rhetorical and the negotiation technique methods, and based on these, with practice through profession related situations.

 **lectures:**

|  |
| --- |
| Presentation techniques I (definitions, layers, types) |
| Presentation techniques II (professional presentation methods) |
| The logical construction of presentation, the effective approach of a target group |
| The SPAM method, 1st Student Presentation practice |
| Workshop-training |
| Practice for professional writing |
| Midterm exam |
| Strategies for reading profession related texts |
| The use of the logical matrix and the SWAT analysis in the presentation technique |
| Exercises to improve debate skills |
| Profession related listening exercises |
| Profession related listening exercises |
| Sources and possibilities of independent study |
| End term, Evaluation |

**practices:**

|  |
| --- |
| Profession-related writing, speaking, reading comprehension and listening comprehension  |
|  Profession-related vocabulary building, writing, speaking listening and reading comprehension  |
| Presentation skills, reading comprehension and listening comprehension, profession-related writing |
| Developing profession-related literacy, speaking, reading and listening comprehension,  |
| Speaking and presenting,, reading comprehension and listening comprehension tasks, and profession-related writing.  |
| The situational dialogues, reading comprehension and listening comprehension tasks, and writing formal letters on a given topic |
| A survey of the skills and knowledge acquired thus far |
| Presentation, reading comprehension and listening comprehension tasks, and profession-related writing.  |
| Profession-related conversation, reading comprehension and listening comprehension tasks, and profession-related writing |
| Profession-related conversation, critical thinking, reading comprehension and listening comprehension tasks, and writing essays. |
| Presentation, reading comprehension and listening comprehension tasks, and profession-related conversation writing |
| Speaking and presentation, reading comprehension and listening comprehension tasks, and profession-related conversation writing |
| Essay writing, speaking, reading comprehension and listening comprehension |
| A survey of the skills and knowledge acquired throughout the semester |

**Literature:**

ANDREWS, P. H. & BAIRD, J. E. (2000): Communication for Business and the Professions 8th Edition. Waveland Press, Long Grove, IL. ISBN-13: 978-1577663799, 720 old.

COOPMANN, S. J. & LULL, J. (2015): Public Speaking: The Evolving Art, 3rd Edition. Boston, MA. ISBN-10: 1285432827, 416 old.

HOSTETLER, M. & KAHL, M. (2012): Advanced Public Speaking: A Leader's Guide. Routledge: N.Y. ISBN-10: 0205740014, 240 old.

WIWCZAROSKI, T.B. (2007): Writing and Professional Communication. Debrecen, 97 old.

ZAREFSKY, D. (2011). Public speaking: strategies for success. Boston, Allyn & Bacon. ISBN-13: 978-0205857265, 528 old.

**Remote sensing MTMKG7025A**

ECTS Credit Points: 3

0 hour(s) lecture and 42 hour(s) seminar per semester

Type of exam: oral exam

Requirements:

- for signature: A report, including the objective interpretation of roles, methods and the results of field scale and GIS laboratory exercises. Active participation in the lessons (at least 11). Completing exercises.

- for a grade: practical course mark in written exam

**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 of agricultural, environmental management applications. The subject covers the topics of multispectral, hyperspectral remote sensing, thermography and laser scanning.

**Summary of content - practice**:

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.

**practices:**

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

**Literature, handbooks**

Campbell, J. B., Wynne, R. H. (2011): Introduction to Remote Sensing. The Guilford Press. 5th Edition. 667 p. ISBN: 978-1609181765.

Jones, H. G., Vaughan, R. A. (2010): Remote Sensing of Vegetation: Principles, Techniques, and Applications. Oxford University Press. 1st edition. 400 p. ISBN: 978-0199207794.

Weng, Q. (2009): Remote Sensing and GIS Integration: Theories, Methods, and Applications. McGraw-Hill Professional. 1st edition. 416 p. ISBN: 978-0071606530

**Remote sensing and GIS in hydrology, MTMVG7014A**

ECTS Credit Points: 4

28 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: Active participation in lectures and exercises, plus a successful fulfilment of the tasks defined by the lecturer.

- for a grade: written exam.

**Summary of content – theory**

The goal of this subject is to make it possible 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.

**lectures:**

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

**practices:**

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**

Li, Z., Zhu, Q., Gold, C. (2005): Digital terrain modelling: Principles and Methodology. CRC Press. 318 p. (ISBN: 0-415-32462-9)

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)

Maquire, D. J. (2005): GIS, Spatial Analysis and Modeling. ESRI Press. 479 p. (ISBN: 978-158-948-130-5)

**Soil Physics, MTMVG7005A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: Colloquium

Requirements:

- for signature: Submission of the practical summary, evaluation.

- for a grade: Colloquium

**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:

**lectures:**

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

Soil physical aspects of amelioration, cultivation and irrigation.

**practices:**

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.

Reporting on investigation results.

**Literature, handbooks**

Compulsory textbooks:

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

Manoj K. Shukla (2013) Soil Physics: An Introduction. CRC Press. ISBN 9781439888421

Recommended textbooks:

Glinski, J., Horabik, J. Lipiec, J. (Eds.) (2011): Encyclopedia of Agrophysics. Springer. ISBN 978-90-481-3585-1

Hillel, D. (1980) Fundamentals of Soil Physics ACADEMIC PRESS, INC. Elsevier Inc ISBN: 978-0-08-091870-9

**Urban Hydrology , MTMVG7024A**

ECTS Credit Points: 3

14hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: Active participation in lectures and exercises, is a successful fulfillment of the tasks defined by the lecturer.

- for a grade: written exam

**Summary of content – theory**

Students are acquainted with urban environment, hydrological loop and hydrological cycle. The design and management of the urban water system based on an analysis of the entire system will lead to more sustainable solutions than separate design and management of the elements of the system. A crucial aspect of integrated urban water management (IUWM) is the early and effective involvement of stakeholders based on explored critical decision factors of local urban watershed. This course presents an overview of IUWM and the phases necessary for developing a strategic plan to move towards it. It provides assistance for shifting from a conventional approach in urban water management towards an approach based on integration that is more suitable to meet current requirements and cope with future developments more sustainably.

**lectures:**

1. Introduction - concept, urbanization - megacities
2. Definition, climate change
3. Urban microclimate
4. Urban water balance
5. Precipitation – Runoff, Infiltration
6. Grey water – water harvesting (non - structural management)
7. Evapotranspiration – Green surface, urban landscape
8. Flood management
9. Sewer network
10. Wastewater treatment
11. Biological wastewater treatment and sewage sludge management
12. Bioenergy, alternative water resources
13. Urban hydrology monitoring, smart cities
14. Decision support modeling in IUWM

**practices:**

1. Team work – focus area
2. Team work –focus area
3. Team work – stakeholders
4. Remote sensing – Urban hydrology
5. Team work – Precipitation, runoff
6. Team work – Flood management
7. Case study - drinking water
8. Case study- sewer network
9. Case study- WWTP
10. Data acquisition – Land use, urban mapping
11. UH indexing
12. 3D urban environment models
13. UH landscape models
14. Reporting

**Literature:**

Musco, F. Counteracting urban heat island effects in a global climate change scenario

Urban Hydrology for small watershed TR55 USDA

New Urban Agenda ENSZ, Quito 2016.

SWIFT – IURWM decision package

**Wastewater and slurry management, MTMVG7011A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: Active participation in lectures and exercises, is a successful fulfilment of the tasks defined by the lecturer.

- for a grade: written exam

**Summary of content – theory**

The wastewater and slurry management course introduces students to modern wastewater treatment objectives, concepts and its importance. Furthermore, water pollution forms caused due to human action and the methods of water purification and treatments are also introduced. Students learn the objectives and procedures of modern slurry treatments and recovery. It promotes the formation of new agro-environmental approach. Students will be able to determine the likely impact of water pollution, and its degree and danger, they can make a decision about the need for intervention. Important information will be scored in the topic of sewage, sludge, sewage sludge compost and manure storage and agricultural utilization, and their legal background. The students become proficient for the selection of the necessary wastewater cleaning, treatment and particularly the utilization technology based on the relevant legal requirements. The students will have theoretical and practical background knowledge about the necessary wastewater qualification methods.

**lectures:**

1. The objectives of wastewater treatment technology. The production and characterisation of wastewater; General wastewater quality requirements.
2. The degree of wastewater treatment (mechanical, physical-chemical, biological wastewater treatment operations). Theoretical basis, their conditions and implementation;
3. Chemical treatment degree of wastewater treatment. Theoretical basis, their conditions and implementation
4. The conditions and microbiological background of aerobic wastewater treatment processes, and their practical implementation; Trickling water treatment, biological nitrogen and phosphorus removal;
5. The conditions and microbiological background of anaerobic wastewater treatment processes, and their practical implementation; Digesters;
6. Natural Technologies of Wastewater Treatment; Aquatic plants systems and Bioeliminators.
7. Visiting of Wastewater Treatment Plant of Debrecen, Hungary
8. Calculations and sizing of the wastewater treatment technologies; Examination of models of activated sludge and fixed film systems. Options of intensification for sludge anaerobic digestion.
9. Presentation of specific wastewater treatment processes used in industrial plants: Ion exchange, reverse osmosis, membrane filtration.
10. Presentation and comparing methods of sewage sludge treatment and recovery processes (agricultural utilization, composting, biogas production, incineration); Sludge dewatering and sizing of its equipment.
11. International and national position, proportions and practical implementation of sewage sludge utilization; Legal background and framework of sludge storage, utilization and transport;
12. Concept of slurry, conditions of slurry production, the quality and composition of slurry. Presentation and comparing of the slurry-treatment processes;
13. Slurry-utilization methods (agricultural utilization, biogas production, etc.). Legal background of slurry storage and utilization; Presentation of Nitrate Directive rules.
14. Visiting of Regional Biogas Plant of Nyíbátor, and Cattle Farm of Bátortrade Ltd., Hungary

**Literature, handbooks**

Crites, R. W., Middlebrooks, J. Reed, S. R. (2006): Natural Wastewater Treatment Systems. CRC Press. 549 p. (ISBN: 978-146-658-326-9)ű

Gerardi, M. H. (2006): Wastewater bacteria. John Wiley & Sons, Inc., Hoboken, New Jersey. 272 p. (ISBN: 978-047-197-991-3)

Hettiarachchi, H., Ardakanian, R. (2016): Safe Use of Wastewater in Agriculture: Good Practice Examples. UNU-Flores. United National University. Institute for Intergrated Management of Material Fluxes and of Resources. (ISBN: 978-394-486-330-6).

Sastry, C. A., Hashim, M. A., Agamuthu, P. (1995): Waste Treatment Plants 1st Edition. Wiley. 435 p. (ISBN: 978-047-114-301-7)

Tamás J., Kovács E. (2008): Environmental technology. University of Debrecen, Institute of Water- and Environmental Management. TÁMOP 4.1.2.

<http://www.tankonyvtar.hu/en/tartalom/tamop425/0032_kornyezettechnologia_en/ch03.html>

**Water chemistry, MTMVG7004A**

ECTS Credit Points: 4

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: oral exam

Requirements:

- for signature: Completing assignments / exercises, giving presentation.

- for a grade: oral exam

**Summary of content - theory**:

In the framework of the practice students become familiar with the applied classic and modern laboratory measuring techniques. Lab rules will be discussed. Basic devices will be presented. Weight and volume measuring techniques use in lab are discussed, furthermore, basic chemical calculations will be made. They will be able to use mobile, rapid water analytical methods and the related water quality protection regulations and legal background. Students will be able to determine water quality and thus the likely impact and danger of pollutions and can make a decision needed for intervention. Students acquire specialized knowledge in the measurement of drinking, municipal, agricultural and industrial water samples and their analytical background. They receive useful knowledge about sampling methods (water) and sample pre-treatment.

**Summary of content - practice**:

Wworking individually and in team; basic knowledge of classic and modern analytical measurements.

**practices:**

Exercise 1: Lab safety, basic lab equipment

Exercise 2: Chemical calculations

Exercise 3: Water sampling and analysis steps

Exercise 4: Determination of total dissolved and suspended solids in water samples

Exercise 5: Determination of the pH of different water samples

Exercise 6: Determination of the conductivity of different water samples

Exercise 7: Determination of the acidity of different water samples

Exercise 8: Determination of the chloride concentration of different water samples

Exercise 9: Determination of the hardness of different water samples

Exercise 10: Determination of the dissolved oxygen concentration of different water samples

Exercise 11: Determination of turbidity of different water samples

Exercise 12: Determination of nitrate, nitrite and ammonium content of different water samples

Exercise 13: Determination of sulphate ion concentration in different water samples

Exercise 14. Determination of phosphorus and potassium content of water samples

**Literature, handbooks in English**

Patrick Brezonik, William Arnold (2011): Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems Oxford University Press, 2011. pp. 808. ISBN 019981354X, 9780199813544; FC On line: GB855 .B744 2011eb

Frank R. Spellman (2017): The Drinking Water Handbook. 3rd Edition, CRC Press pp. 356. ISBN 9781138066472 - CAT# K33428

Barbara Hauser (2001): Drinking Water Chemistry: A Laboratory Manual. 1st Edition, CRC Press pp. 214. ISBN 9781566704861 - CAT# LA4129

**Water economics, MTMVG7019A**

ECTS Credit Points: 3

14 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: Colloquium

Requirements:- for signature: Completing exercises, giving presentation

- for a grade: Colloquium

**Summary of content – theory**

Students get a knowledge about irrigation from a micro and macro-economic point of view. Water supply directly increase yield, in addition, it also has indirect effect on profitability, which provides additional economic benefits - students are introduced to this and other aspects, as well.

**lectures:**

1. Farm management, Farm businesses and enterprises, income costs and profitability
2. Production, economic principles and concepts, financial analyses, investment analysis and decision making
3. Marketing, value adding, human resource management, risk management
4. The business plan
5. The multiple dimensions of water management (Micro-level, Regional, Interregional)
6. Handling drought and inland waters
7. The benefits and costs of irrigation
8. The theory of the production function (Physical production functions, Spil’man function, Marginal rate of substitution, Profit maximization) water-plant relationships
9. Irrigation systems and characteristics, costs
10. Decision support system
11. Irrigation economics
12. Protecting orchard from frost and freeze, hail protection net system in orchard, (investment costs, annual costs)
13. Economic and environmental characteristics of bottled water production
14. Agricultural Water Management for Sustainable Rural Development

**Summary of content - practice**:

Thinking in system approach and connect different aspects

**practices:**

1. Importance of water in agriculture, hydrological cycle
2. Importance of irrigation
3. Agri-Environmental indicators and irrigation in EU
4. European Irrigation Association
5. Water and energy advanced management for irrigation
6. Irrigation systems
7. Micro irrigation systems
8. Economics of irrigation systems
9. Frost and freeze protection in orchard
10. Ice storm challenges in orchard
11. Precision irrigation
12. Irrigation solutions in practice (irrigation in cropland)
13. Irrigation solutions in practice (precision irrigation)
14. Presentation

**Literature, handbooks**

Viktor Szabó 2016. Economics of hail protection net installation in super intensive apple orchards. Agrártudományi Közlemények, vol. 68. p. 27-35.

S van Zyl, PG Strauss & JB Stevens 2012. Training material for extension advisors in irrigation water management Volume 2: Technical Learner Guide Part 7: Irrigation economics. Water Research Comission. ISBN 978-1-4312-0342-0. p. 155.

International Commission on Irrigation and Drainage (ICID) 2016. Agricultural Water Management for Sustainable Rural Development. p. 84.

Karina Schoengold and David Zilberman 2007. The economics of water, irrigation, and development. (In: Handbook of Agricultural Economics, Volume 3 Edited by Robert Evenson and Prabhu Pingali) DOI: 10.1016/S1574-0072(06)03058-1. p. 2939-2984.

Alan Pilling Kleinman 1969. The production function and the imputation of the economic value of irrigation water. Retrospective Theses and Dissertations. Paper 4122. Digital Repository @ Iowa State University. p. 133.

**Water resource protection and water damage prevention, MTMVG7013A**

ECTS Credit Points: 4

28 hour(s) lecture and 28 hour(s) seminar per semester

Type of exam: Written and/or verbal

Requirements:

- for 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.

- for a grade: Written and/or verbal

 **Summary of content – theory**

The objective of this course is to develop an understanding of the problems related to water resource management and water damage prevention. This course is based on an integrated approach to the water resource protection, flood control, water pollution prevention and erosion control. The students learn the main principles of EU flood directive and have knowledge about European experience in flood risk management.

**lectures:**

1. The concept and types of groundwater. The basic concepts of hydrostratigraphy, hydrostratigraphic classification
2. Characterization of groundwater. Classification of aquifers by formation
3. Groundwater contaminants, Aquifer vulnerability and sensitivity
4. The supply of bank-filtered waters from surface and groundwater. The bank-filtered water recharge of surface and ground water. Factors affecting the quality of bank-filtered water
5. Concept of water base and water base protection. Main areas of activity for water base protection. Defining the protection zones of the water base. Legally Prohibited Activities in Zones A, B and C.
6. The concept of water resources and protection of water resources
The main fields of water resource protection activities
7. The types of floods and floodplains. The causes of floods
8. The flood risk assessment and modelling.
9. The technological methods of flood protection.
10. The oil pollution treatment. The Options for Minimizing Environmental Impacts of Freshwater Spill Response
11. The types and causes of excess water. The excess water control. The lowland drainage
12. The erosion control and the hillside water management.
13. The water pollution prevention. The wastewater treatment.
14. The eutrophication control, prevention, and treatment.

**Summary of content - practice**:

The participant should be able to: understand and explain the main principles of flood risk management, understand the Hydroinformatics tools available for flood risk management, understand and explain the main principles of flood forecasting and warning and uncertainty issues associated with flood forecasts.

**practices:**

1. Introduction, Quizzes, Definitions & Explanations
2. Subsurface Water Quizzes & Explanation
3. Calculation of Flow Characteristics
4. Energy Principles. Application of Energy Principles in Flood Protection
5. The Orifice Equation Application for the Dam Breaking
6. The Weir Equation for Regulating High-Return Event Flows Overtopping Dams
7. Flood Risk Estimation Quizzes & Explanations
8. The Weir Equation for the Rectangular Weir
9. Uniform Flow of Concrete Trapezoidal Channel
10. Summary and Control Quizzes
11. Critical Depth of a Grassy Channel
12. Water and Nutrient Exchange of Lakes
13. Manning Formula for Discharge
14. Control Measures of Water Pollution. Quizzes and Explanations

**Literature, handbooks**

The theoretical and practical materials of the course are available in pdf and ppt format.

Recommended

Options for Minimizing Environmental Impacts of Freshwater Spill Response. National Oceanic Atmospheric Administration, Hazardous Materials Response & Assessment Division, American Petroleum Institute, September 1994

**Water policy, water law and sectoral public administration, MTMVG7023A**

ECTS Credit Points: 3

28 hour(s) lecture and 14 hour(s) seminar per semester

Type of exam: written exam

Requirements:

- for signature: Completing exercises, giving presentation.

- for a grade: Colloquium

**Summary of content - theory**:

In the frame of global environmental problems, students get detailed information about water related environmental issues. Students gain knowledge about the legal background of water as natural resource. In addition strategic planning and implementation in EU.

**lectures:**

1. Water related environmental problems and achievements, Global Water Framework for Action
2. Water and sustainable development, World Water Development Report
3. Availability and sustainable management of water, Action Plan by High Level Panel On Water
4. Ecosystem based management approaches for water related infrastructure solutions
5. Environment Policy in EU, Climate change and the environment, Water protection and management
6. Status of EU waters (policy context, Land use and the ecological status of EU waters, pollution and targets, EU water efficiency, vulnerability of EU waters) and related regulations
7. European Water Charter, Water Framework Directive, Flood Risk Management Guidelines for Planning Authorities, Nitrates Directive, water in law, water management
8. Quality of water intended for human consumption, requirements for the protection of the health of the general public, irrigation
9. The 2030 Agenda for Sustainable Development, 7th EAP General Union Environment Action Programme to 2020

**Summary of content - practice**:

Thinking in system approach and connect different aspects.

**practices:**

1. Importance of water, water and environmental problems
2. Global Organisations
3. Global Organisations
4. Global Organisations
5. EU, Water Framework Directive, River Basin Plans
6. Ground water protection, Nitrate Directive
7. Sectoral administration – Nature conservation, Natura 2000
8. Sectoral administration – Soil protection
9. Sectoral administration – Air protection

**Literature, handbooks**

Groundwater Governance 2016. Global Framework for Action to achieve the vision on Groundwater Governance, p. 115.

UNESCO 2016. The United Nations World Water Development Report 2016. ISBN 978-92-3-100146-8, ePub ISBN 978-92-3-100155-0, p. 148.

United Nations Environment Programme 2014. Green Infrastructure Guide for Water Management: Ecosystem-based management approaches for water-related infrastructure projects. ISBN: 978-92-807-3404-1 p. 75.

HIGH LEVEL PANEL ON WATER 2016. Action Plan. p. 23.

European Commission 2014. General Union Environment Action Programme to 2020 Living well, within the limits of our planet. European Union. ISBN 978-92-79-34724-5 doi:10.2779/66315 p. 87.

**Internship requirements**

Water Management Engineering MSc Students have to carry out a 4-week internship involved in the model curriculum. The internship course must be signed up in the NEPTUN study registration system in the autumn semester (3th semester) and should be undertaken in summer after 2nd semester. Its execution is the criteria requirement of getting the pre-degree certificate (absolutorium).

**The objective of the internship, competences**

Students get acquainted with professional work in conformity with their degree program at the company or institution and join the daily work process. They have to resolve tasks individually assigned by their supervisor and gain experiences which may be utilized later in the labour market.

During the internship general and specific competences may be acquired. General competences: precisely work to schedule either individually or in team, applying correct technical terms. Specific competences: practical application of the professional skills acquired during the studies and acquiring new knowledge.

**Places suitable for internship**

All the organizations, institutions and companies which provide students with the opportunity to acquire proficiency in accordance with their specialization in the field of precision agriculture, agricultural water management, irrigation technologies, irrigated crop production or horticulture, river basin management, water engineering may be a suitable place.

Initiating internship at the company and providing for the documents from the company is the student’s duty. If the student does not specify the receiving company or does not provide the documents on time, the responsible person for internship will refuse the internship papers.

In case of any questions arising from internship, please kindly turn to Budayné Bódi Erika (e-mail: bodi.erika@agr.unideb.hu).

# **Thesis**

A Thesis is the creative elaboration of a professional task in written form. By solving the task, the student relies on his/her studies using national and international literature under the guidance of an internal and external supervisor. By solving the task, the Water Management Engineering MSc student certifies that he/she is capable to apply the acquired knowledge in practice and to summarize the completed work and its results in a professional way, to solve the tasks related to his/her topic creatively and to complete individual professional work. By preparing and defending thesis students who complete the Water Management Engineering MSc program prove that they are capable of the practical applications of the acquired skills, summarizing the work done and its results in a professional way, creatively solving the tasks related to the topic and doing individual professional work. The faculty academic calendar sets the thesis submission deadline.

A student in master program has to prepare a thesis as a prerequisite of the final exam. The requirements of the thesis content, the general aspects of evaluation and the number of credits assigned to the thesis are determined by the requirements of the program. In Water Management Engineering MSc program the credits assigned to the thesis is 30.

 Thesis topics are announced by the departments for the students in each semester. A thesis topic can be suggested by the student as well and the head of department shall decide on its acceptance.

Thesis is evaluated by the referee, and it is evaluated and qualified individually by the department. The Head of the Department makes suggestion on its qualification to the Final Exam Board.

If the thesis is evaluated with a fail mark by the referee, and the student is not allowed to take the final exam and is supposed to prepare a new or modified thesis. The student has to be informed about it. Conditions on resubmitting the thesis are defined by the program coordinator.

# **Final examination (Final Exam)**

Students having obtained the pre-degree certificate will finish their studies by taking the final exam. Final exam can be taken in active student status in the forthcoming exam period after gaining the pre-degree certificate then after termination of student status in any exam period within two years according to the valid education requirements. After the fifth year of the termination of student status the candidate is not allowed to take the final exam. Only students who do not have outstanding charges are allowed to take the final exam. (E.g.: Students who obtained a pre-degree certificate until 1 September 2020 can take the final exam until 1 September 2022.)

A student having obtained the pre-degree certificate (absolutorium) will finish his/her studies training by taking the final exam. A final exam is the evaluation and control of the knowledge and skills acquired in tertiary education during which the candidate has to certify that he/she is able to apply the obtained knowledge in practice.

A final exam can be taken in the forthcoming exam period after obtaining the pre-degree certificate. The Department announces two final exam dates in a year, one at the beginning of January and one at the end of June. A final exam has to be taken in front of the Committee on the fixed date. If a candidate does not pass his/her final exam by the termination of his/her student status, he/she can take his/her final exam after the termination of the student status on any of the final exam days of the relevant academic year according to existing requirements on the rules of the final exam.

The Final exam consists of two parts according to the curriculum.

1. Written and oral exam on the given topics.
2. Thesis Defence (a presentation of the thesis, answering questions, comments then answering questions based on the knowledge related to the thesis topic)

A final exam can be started if the candidate can be submitted to the final exam on the basis of definite opinion of the referees. The two parts must be held on the same day.

The parts of the final exam are evaluated on a five-point scale by members with voting rights in the Final Exam Board. The final grade for the final exam will be decided on by voting in a closed sitting after the final exam, then. In case of equal votes, the committee chair will make the decision. Final exam results will be announced by the committee chair. Results of the final exam and thesis defence will be announced at the end of the given exam day (when all candidates finished final exam and thesis defence on the given day). A note of the final exam will be taken.

*Improving failed final exam*

If a thesis is evaluated with a fail mark by the Final Exam Board a final exam has to be retaken with a new or modified thesis.

If any of part if the final exam is a fail it must be retaken according to the existing rules of the university. Final exam can be retaken twice. The ensuing final exam period is the soonest that the re-sit is allowed.

*Final exam board*

Committee chair and members of the committee are called upon and mandated by the dean with the consent of the Faculty Council. They are selected from the acknowledged internal and external experts of the professional field. Traditionally, it is the chair and in case of his/her absence or indisposition the vice-chair who will be called upon, as well. The committee consists of – besides the chair – at least one member (a professor, an associate professor or college professor) and at least two questioners (instructors) and the examiner. In controversial cases the chair makes the decision. The mandate of a Final Examination Board lasts for three years. The division of the candidates to the mandatory final exam board is announced by the Registry Office.

# **DIPLOMA**

Within 30 days of the successful final exam the diploma is issued and given out by the Faculty at the graduate’s special request. Otherwise, the diploma will be awarded to him/her at the graduation ceremony of the Faculty.

The diploma is an official document decorated with the coat of arms of Hungary which verifies the successful completion of studies in the graduate program. The diploma contains the following data: name of HEI (higher education institution); institutional identification number; serial number of diploma; name of diploma holder; date and place of his/her birth; level of qualification; training program; specialization; mode of attendance; place, day, month and year issued. Furthermore, it has to contain the dean’s (or vice-dean’s) original signature and the seal of HEI. It has to contain the dean’s (in case of being prevented from attending the vice- dean for educational affairs) original signature and the imprint of the official stamp of the tertiary institute.

At the graduate’s special request a certificate on the completion of studies is issued. The document does not contain any reference to qualification, it merely proves that the candidate has taken a successful final exam. The Faculty keeps a record of the certificates issued.

Calculation of a diploma grade according to this formula:

The qualification of the diploma is the simple arithmetic average results of the weighted academic average of all semesters of the given training, the result of the oral complex final exam, and the thesis.

Grade=(A+B+C)/3, where
A: Weighted academic average of all semesters of the given training

B: Grade of the oral complex final exam
C: Grade awarded for defending the thesis

On the basis of the calculated average grade the classification of the award: With honours 4,81 – 5,00

Excellent 4,51 – 4,80

Good 3,51 – 4,50

Satisfactory 2,51 – 3,50

Pass 2,00 – 2,50

Award with Distinction

An award with Distinction is permitted where a student obtained grade 5 in all subjects of the final exam. The average of thesis grade, his/her exam grades and mid-semester grades during his/her studies is at least 4.00. Moreover, he/she is not permitted to have a grade worse than grade 3 during his/her studies.

**MODEL CURRICULUM OF AGRICULTURAL WATER MANAGEMENT ENGINEERING MSC**

The curriculum of the program is available in excel format on the webpage of the Faculty of Agricultural and Food Sciences and Environmental Management:

(https://mek.unideb.hu/en/agricultural-water-management-engineering).

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| --- | --- |
|  | *Head of Program: Dr. Attila Nagy, Associate Professor* |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | valid from 04.04.2017. |
| **Code** | **Subject name** | **semester I** | **semester II** | **semester II** | **semester IV** | Lecturer |
| 14 | 14 | 14 | 10 |
| lec | prac | type | credit | lec | prac | type | credit | lec | prac | type | credit | lec | prac | type | credit |
|   | *Compulsory subjects* |   |   |   |   |   |
| MTMVG7001A | Applied hydrology and hydraulics | 2 | 2 | K | 4 |  |  |  |   |   |  |  |   |   |  |  |  | Dr. Juhász Csaba |
| MTMVG7002A | Climatology, hydrogeograpy | 2 | 1 | K | 3 |  |  |  |   |   |  |  |   |   |  |  |  | Dr. Szabó Szilárd |
| MTMVG7003A | Hidrobiology | 2 | 1 | K | 3 |  |  |  |   |   |  |  |   |   |  |  |  | Dr. Pregun Csaba |
| MTMVG7004A | Water chemistry | 2 | 1 | K | 4 |  |  |  |  |   |  |  |   |   |  |  |   | Dr. Kovács Elza |
| MTMVG7005A | Soil physics | 2 | 1 | K | 3 |  |  |  |  |   |  |  |   |   |  |  |   | Dr. Blaskó Lajos |
| MTMVG7006A | Melioration and land-consolidation | 2 | 1 | K | 3 |  |  |  |   |   |  |  |   |   |  |  |  | Dr. Juhász Csaba |
| MTMVG7007A | Pond culture and fisheries management | 2 | 2 | G | 4 |  |  |  |   |   |  |  |   |   |  |  |  | Dr. Stündl László |
| MTMVG7008A | Irrigated crop production | 2 | 1 | K | 3 |  |  |  |   |   |  |  |   |   |  |  |  | Dr. Csajbók József |
|   | *Total number of hours:* | 16 | 10 | 27 |   |   |   |   |   |   |   |   |   |   |
| MTMVG7009A | Floodplain management |   |  |  |   | 2 | 1 | K | 3 |  |  |  |   |   |  |  |   | Dr. Pregun Csaba |
| MTMVG7010A | Irrigation for horticultural production |   |  |  |   | 2 | 1 | K | 3 |  |  |  |   |   |  |  |   | Dr. Riczu Péter |
| MTMVG7011A | Wastewater and slurry management |   |  |  |   | 2 | 1 | K | 3 |  |  |  |   |   |  |  |   | Dr. Tamás János |
| MTMVG7012A | Management and utilization of aquatic habitats |   |  |  |   | 1 | 2 | G | 3 |  |  |  |   |   |  |  |   | Dr. Kozák Lajos |
| MTMVG7013A | Water resource protection – environmental damage prevention |   |  |  |   | 2 | 2 | G | 4 |  |  |  |  |   |  |  |   | Dr. Kovács Elza |
| MTMVG7014A | Remote sensing and GIS in hydrology |   |  |  |   | 2 | 2 | G | 4 |  |  |  |  |   |  |  |   | Dr. Tamás János |
| MTMVG7015A | Farm machines of the irrigation, irrigation technology |   |  |  |   | 1 | 2 | G | 3 |  |  |  |   |   |  |  |   | Dr. Hagymási Zoltán |
|   | *Total number of hours:* |   |   |   | 12 | 11 | 23 |   |   |   |   |   |   |   |
| MTMVG7016A | Precision agriculture |   |  |  |   |   |  |  |   | 1 | 2 | G | 3 |   |  |  |   | Dr. Riczu Péter |
| MTMVG7017A | Drought management |   |  |  |   |   |  |  |   | 2 | 2 | G | 4 |   |  |  |   | Dr. Nagy Attila |
| MTMVG7018A | Integrated water management and monitoring |   |  |  |   |   |  |  |   | 3 | 2 | K | 5 |   |  |  |   | Dr. Tamás János |
| MTMVG7019A | Water economics |   |  |  |   |   |  |  |   | 2 | 1 | K | 3 |   |  |  |   | Dr. Szőllősi Nikolett |
|   | *Total number of hours:* |   |   |   |   |   |   | 8 | 7 | 15 |   |   |   |   |
| MTMVG7020A | Excess water management |   |  |  |   |   |  |  |   |   |  |  |   | 2 | 2 | K | 4 | Dr. Zsembeli József |
| MTMVG7021A | Agricultural water supply systems |   |  |  |   |   |  |  |   |   |  |  |   | 2 | 2 | K | 4 | Dr. Juhász Csaba |
| MTMVG7022A | Agricultural water management planning and implementation |   |  |  |   |   |  |  |   |   |  |  |   | 1 | 2 | G | 3 | Dr. Nagy Attila |
| MTMVG7023A | Waterpolicy, water law and sectoral public administration |   |  |  |   |   |  |  |   |   |  |  |   | 2 | 1 | K | 3 | Dr. Szőllősi Nikolett |
|   | *Total number of hours:* |   |   |   |   |   |   |   |   |   | 7 | 7 | 14 |   |
|   | *Subjects of free choice* |   |   |   |   |   |
| MTMKG7013A | Environmental technologies I - Soil remediation, soil protection, biotechnology in agriculture |   |   |   |   | 2 | 1 | K | 3 |   |   |   |   |   |   |   |   | Dr. Nagy Attila |
| MTMKG7018A | Farm Business Management and Project Management  |   |   |   |   |   |   |   |   | 1 | 2 | G | 3 |   |   |   |   | Dr. Szőllősi Nikolett |
| MTMKG7025A | Remote sensing  |   |   |   |   |   |   |   |   | 0 | 3 | G | 3 |   |   |   |   | Dr. Nagy Attila |
| MTMVG24A | Urban hydrology | 1 | 2 | G | 3 |   |   |   |   |   |   |   |   |   |   |   |   | Dr. Riczu Péter |
| MTM7NY1 | Academic language skills (scientific language) | 0 | 2 | G | 3 |   |   |   |   |   |   |   |   |   |   |   |   | Dr. Czellér Mária |
| MTM7NY2 | Professional language skills (business language) |   |   |   |   | 0 | 2 | G | 3 |   |   |   |   |   |   |   |   | Dr. Czellér Mária |
|   | *Internship (4 weeks)* |   |   |   |   | 0 | 160 | A | 5 |   |   |   |   |   |   |   |   | Dr. Tamás János |
|   | *Thesis preparation I* |   |   |   |   |   |   |   |   | 0 | 3 | G | 15 |   |   |   |   | Dr. Tamás János |
|   | *Thesis preparation II* |   |   |   |   |   |   |   |   |   |   |   |   | 0 | 3 | G | 15 | Dr. Tamás János |
|   | *Physical excercise* | 0 | 2 | A | 0 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | *Total number of credits for compulsory subjects* | 26 | 23 | 16 | 14 | **79** |
|   | *Total number of credits for subjects of free choise* | 3 | 3 |   |   | **6** |
|   | *Professional practice (4 weeks)* |   | 5 |   |   | **5** |
|   | *Thesis* |   |   | 15 | 15 | **30** |
|   | Total credit: | 26/29 | 28/31 | 31 | 29 | 120 |
|   | Total number of hours alltogether (hour/week): | 16/17 | 10/12 | 26/29 | 12/14 | 11/12 | 28-31 | 8 | 7 | 31 | 7 | 7 | 29 |   |